LĪLĀVATI-1

(Contributions of Women Scientists-2008)

PROCEEDINGS

NATIONAL WOMEN'S SCIENCE CONGRESS

Rashtriya Mahila Vijnana Sammelana

7-9th November 2008, Bijapur

Organised by

MATRU VEDIKE (Women Scientists Forum)

SWADESHI VIJNANA ANDOLANA

(The Karnataka Unit of Vijnana Bharati)

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BANASTHALI WOMEN'S UNIVERSITY, Rajasthan

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PREFACE:

OUR VISION ON WOMEN'S SCIENCE CONGRESS

Throughout the world, there is an awakening amongst women. Many Women's "Liberation" Movements have come into existence. Most of these in the West have taken an "activist" role, often tending to aggressive postures in society and ending up in friction rather than reconciliation. All the activities of Swadeshi Vijnana Andolana-Karnataka (SVAK) on the other hand are essentially an attempt at social harmony. This has been possible because of the ambience of Bharatiya Culture and spritiuality. That approach gives a distinction to this National Women's Science Congress from so many women's conferences organized elsewhere.

This will become more apparent if we analyse the Bharatiya concept of "mukti" or "moksha" which are the Indic equivalent for the word "liberation".

The ultimate objective of life as per Bharatiya vision is mukti or moksha. This is not just liberation but harmonizing life in totality. This harmony may be at three levels:

(a) the individual level (Yogic life leads to harmony of the physical, the mental and the spiritual)
(b) the familial and the social level (the horizontal harmony of the individual with the rest in family and society, transcending all differentiations); or
(c) the national and the global levels, concerning the entire humanity (Vasudhaiva Kutumbakam, Vishvaneedam).

Liberation is applicable if life has "duality and conflict" while mukti connotes "unity and harmony". The Western philosophy is based on the existence of exclusive opposites, (duality and conflict), one perpetually antagonistic to the other; the proletariat vs the bourgeoisie, the workers vs the masters, the women vs the men etc. There is a continuous class struggle between these two groups of exclusive opposites. And there is a need for "liberation" of the "oppressed" class from the "oppressors". This has received currency the world over for the past one hundred years plus.

The equivalent Indic word is Mukti or Moksha and has been in use in Bharat for thousands of years. Its significance is related to the meaning of life or the aim of life. Life is fulfilled only on the attainment of moksha, mukti, salvation and ultimate liberation in totality more in spiritual sense than in secular material sense.

Moksha concerns each and every individual-the men and the women. It looks at the total emancipation of both men and women. Conflicts do exist in society, but these conflicts are transcended into cooperation. Future of humanity depends on the coexistence of women with men or men with women. Each should be elevated spiritually where the conflicts are eliminated totally and harmony is firmly established.

As it stands today, women in science are not receiving adequately what they truly deserve. Women have specific problems if they take up a serious career in science, and these are compounded if they retain their role in family. If these problems are identified by women themselves, it would be more realistic. The whole approach should be positive, universal, unbiased and unprejudiced. The issues should be identified through collective discussions and deliberations among women, and the solutions should also be proposed constructively. The sincerity and purity of purpose would give the necessary strength to overcome the impediments.

Matru Vedike (Women Scientists Forum) of Swadeshi Vijnana Andolana-Karnataka (SVAK) has taken up the noble task of enobling women to the motherhood of humanity and enabling them to take up successful and leading roles in science. We do have great and successful women in many other walks of life-as President of the Republic of India, as Prime Minister of the largest Democracy in the World, as Chief Ministers of States, as Judges, as Vice Chancellors, as Professors, as Journalists, as Creative artists, as Poets and writers-in fact, in every walks of life, except in science. Here we lag behind in numbers. We lag behind in leadership. We have to analyse the reasons for this impase. We have to remove the impediments bit by bit, one by one, and reach the road towards a smooth rise in numbers. Larger numbers of women in science will lead to a quicker rise to leadership roles in larger numbers. If this is achieved, we have the real success and nothing succeeds like success.

This is what we proposed as the purpose of this National Women's Science Congress.

"This National Women's Science Congress is planned essentially to bring women to the forefront of Science, Engineering, Technology, Industrial Entrepreneurship and Management which will automatically empower them to create a frontline of women scientists of the caliber of Marie and Irene Curies, Maria Mayer, Dorothy Hodgkin, Gerty Cori, Rosalyn Yalow, Barbara

Mc Clintock, Rita Montalcini, Gertrude Elion, Christiaene Volhard and Zind Buck of Modern Science or of the grandeur of Maitreyi, Gargi, and the Vedic Rishikas of ancient Bharat. Even though there were only a few well-known women leaders of science in India, those with outstanding scientific achievements are indeed very large in number in almost every field of science. This Women's Science Congress is planned to bring them all together and instil a sense of pride, confidence and camaraderie amongst them and guide them on to the positions of power and leadership".

"In addition to scientific themes, there would be a focal Theme on the Problems and Prospects of Women in Science".

"These are the means to attract and retain more women in the domain of science and bring about cohesive solidarity amongst them. With appropriate measures, these women scientists could be brought forward to the forefront of science & technology in all aspects of teaching, research and industrial practices, and even leadership in science administration".

Perhaps, this needs a little elaboration. Why a Women's Science Congress when we have the Indian Science Congress and a host of other Congress. All these Congresses are male-dominated while we have many women scientists in our universities and R&D Institutions. It is true that their number is not proportionate to their population and it is rare that they come to top positions. Their problems are many because of the dual role that they have to play viz. (i) as a serious scientist and (ii) as a dedicated family member. These problems are compounded by the absence of decision making powers in a tradition-bound family as well as society. This Science Congress is an attempt to bring all women scientists into a single platform from all areas and disciplines, and to establish the fact that women can handle any subject of science. The Congress is also to project an identity to women scientists and to identify areas where they can outshine or excel. All problems confronting the women scientists would be analysed threadbare in order to identify the remedial measures to reduce them, if not to eliminate them altogether. The success would depend on the possibility of developing an integrated personality of women as scientist as well as a householder. Ultimately, it is essential to transform women scientists into a mutually appreciating and mutually helpful fraternity with adequate toughness, boldness and stamina to face any sitnation in life. Women's identity should be fortified amongst the entire scientific community irrespective of the gender-Not only the gender bias but also the "mutual bias" (women against woman) should be squarelly met, and this Congress will explore all these issues in an impartial and impersonal atmosphere.

Rabble-rousing platform talk of the sufferings of women in science may receive some public applause, but will not change the situation unless the women themselves evolve the strategies for their emancipation in an atmosphere of mutual trust and concern with the rest of the scientific community-The actual scenario can be briefly presented as follows:

There is no doubt that the world has for long been male-dominated, and women face innumerable difficulties. Due to prolonged suppression, they lost confidence and developed an inferiority complex. There does not appear to be any genetic factor in the difference between males and females. The women in science are small in number, and for them the problems are aplenty. The greatest problem is the lack of unity and solidarity amongst them. Wherever there is an exposure to higher education, the people get enlightenment, and with unity and solidarity, they can acquire courage and confidence to overcome the impediments by being tough and bold to face the situation. Unity is strength; solidarity brings in the needed courage, and the camaraderie developes the feeling of pride. Mutual jealousies and "crab mentality" ought to be overcome. All these will create a new niche of identity and a sense of equality with men in science.

The Congress is expected to create an atmosphere of mutual understanding, mutual appreciation, and alove all, a drive for mutual help.

Do we have some role models to emulate in the sciences?. The Bharatiya world view of science is in the broader sense of holistic sciences. There are many in all the three facets of holistic sciences-the psychospiritual, the sociocultural and the physicosecular sciences.

In psychospiritual sciences, we have Mata Amrutanandamayi as an exemplary role model. In humanities and sociocultural sciences, we have the following Jnanapth Award winners: (i) Smt. Amrita Pritam and ; (ii) Mahasveta Devi. And there is a galaxy of artists and musicians like Dr. Gangubhai Hangal. We have Dr. Vandana Shiva in the Environmental crusade. These are in addition to the women in political leadership or in administrative field like Smt. Kiran Bedi. The women in Secular natural sciences have been collected in "Lilavati's Daughters"-a publication from Indian Academy of Sciences. Dr. Manju Sharma has done wonderful work as a science administrator. Dr. Kiran Mazundar Shaw is a great entrepreneur. And we have Dr. Sudha Murthy in Information Technology with an inimitable leadership in social engineering and an endearing fame as writer in Kannada and English.

If one were to examine the possible existence of an era where women and men were equal in all respects, it is found only in the Vedic period in Bharat. Rigveda alone mentions seventeen rishika equals of male rishis.

Succeeding the Vedic period, Bharat has produced such great women of erudition and eminences as Gargi and Maitreyi. Can we recapture the spirit of equality between women and men of the Vedic period? Can we attract a larger number of women to a scientific career-as teachers, as researchers, as entrepreneurs and as industrialists? Can we inspire them towards leadership in sciences, engineering, technology, industry and management? Yes, the motivation ought to come from within. This Congress is essentially meant to be a catalyst to accelerate this process of self-motivation.

Prof. K.I. VASU
Stapaka/ Poshaka/ Margadarshaka of Swadeshi Vijnana Andolana-Karnataka &
Coordinator, National Women's Science Congress 2008, Bijapur

SWADESHI VIJNANA ANDOLANA-KARNATAKA

and

SB ARTS & KCP SCIENCE COLLEGE, Bijapur

cordially invite you to the inauguration of

NATIONAL WOMEN'S SCIENCE CONGRESS

At 10:30 hrs on Friday, 7th November. 2008

(Birth Anniversary on Dr. C. V. Raman and Madame Marie Curie-Noble Laureates)

At **KCP SCIENCE COLLEGE AUDITORIUM, BLDEA's, BIJAPUR.**

Dr. MAHTAB S BAMJI, FNA, FNAAS, FNAMS

Chairperson, National Task Force for Women in Science, DST, Govt. of India

(Formerly National Institute of Nutrition, Hyderabad)

will Inaugurate the Science Congress

Prof. G. SAROJAMMA

Vice Chancellor, Sri Padmavati Mahila Visvavidyalayam., Tirupati

will preside over the function

HONOURS

Prof. VIJAYALAKSHMI RAVINDRANATH

Director, National Brain Research Center, Manesvar-122 050

will be honoured with **MARIE CURIE MAHILA VIJNANA PURASKARA**

Shri. M. B. PATIL, M.L.A

President & Chairman, BLDE Association, Bijapur

Chancellor, BLDEA University (D.U), Bijapur

will grace the function

PROGRAMME

08:30-10:00 a.m--Registration of Delegates

INAUGURAL SESSION	10:30 a.m, Friday, 7th November. 2008
INVOCATION	
WELCOME	Shri. M. B. PATIL, President & Chairman, BLDEA's, Bijapur
LIGHTING THE LAMP	
INAUGURAL ADDRESS	Dr. MAHTAB S BAMJI, Chairperson, N.T.F.W.S, DST, GOI
RELEASE OF SOUVENIR	
ABOUT SVAK & MATRU VEDIKE	Prof. P.K. SRIMANI, President, SVAK
PRESENTATION OF MARIE CURIE MAHILA VIJNANA PURASKARA TO	Prof. VIJAYALAKSHMI RAVINDRANATH, Director, N.B.R.C, Manesvar
ADDRESS BY PURASKARA RECEIPIENT	
PRESIDENTIAL ADDRESS	Prof. G. SAROJAMMA, V.C., Sri. P.M.V.V., Tirupati
FELICITATIONS	Ms. MEERA KAUSHAL, Scientist G, GTRE-DRDO, B'lore
	Dr.Mrs. PRAJNA J.JOSHI, Ahamedabad
	Prof. SAVITA SINGAL, Hisar, Haryana
VOTE OF THANKS	Dr. D.K. VENKATALAKSHMI, Chairperson, Matru Vedike,SVAK

Panel Discussion on the Problems & Prospects of Women in Science will follow the inaugural function.

Technical Programs in parallel sessions will continue on 8th Nov. & 9th Nov. 08

VALEDICTORY

2:30 p.m on Sunday, 9th November. 2008

INAUGURAL ADDRESS AT THE NATIONAL WOMEN'S SCIENCE CONGRESS, BIJAPUR, NOVEMBER, 7TH, 2008

GENDER DISPARITY IN SCIENCE AND HEALTH- NEED FOR ACTION

Dr. MAHTAB S BAMJI, FNA, FNAAS, FNAMS
Chairperson, National Task Force for Women in Science, DST, Govt. of India
(Formerly National Institute of Nutrition, Hyderabad)

At the outset I would like to congratulate the Swadeshi Vignana Andolana – Karnataka for organizing a National Women's Science Congress. However, I do hope that a day will come soon when separate conferences and congresses for women would not be needed and women will find visibility in gender neutral events. To day such special events are needed to showcase women's contributions top science and to discuss factors which prevent women from achieving academic heights on par with men.

In my today's address I wish to touch on **two important issues.** 1) Issues related to science career for Indian women, and 2) Women, health and nutrition- the adverse health and nutritional consequences of neglect of women.

SCIENCE CAREER FOR INDIAN WOMEN

Gender inequity in all walks of life is a global phenomenon. It tends to get worst in more demanding vocations like scientific and technological research.

Science a rational subject: Such discrimination in science and technology on the basis of un-rational biases is surprising since science by its very nature and ideology is supposed to be a rational subject and practitioners of this profession at least should be above such biases.

Human right and loss to society: Gender discrimination which **marginalizes females** from being equal partners in acquiring knowledge, particularly scientific knowledge and worst still – being sidelined after acquiring knowledge, has to be viewed from the point of view of – **1) denial of human right in terms of opportunities for full expression of abilities, to half the human kind, and 2) loss to the society by impeding growth and development in a more humane and environment- friendly way- the feminine way.**

Lawrence Howard Vs Stanley Hall: That gender bias **persists in the 21st century** which boasts of a knowledge society and developmental leap frog, is double speak and a matter of shame. Though the scientific world has moved away from the days when women scientists, even those who got Nobel Prize later, were made to do research stealthily in cellars; the **recent remarks of Lawrence Howard – president of Harvard University that women lack single minded dedication to work which employers demand and more women than men have average scientific ability,** are similar in tone and substance to those of **Prof. Stanley Hall in 1905.** Needless to say that there are many Howards, and the male centric mindset has not changed significantly.

Problems Unique to India: School drop out: While there are many common factors responsible for gender bias across the globe, there are some which are unique to India and a few developing countries. Unlike in developed countries and many developing countries where gender gap in education begins to appear only at the level of university education, in India fewer girls than boys enrol into primary school and many more girls than boys discontinue schooling after primary school. The proverbial leaky pipe leaks heavily from primary to secondary school. The reasons for this are many, one of them being, lack of high schools in most villages. While many villages do have primary school of some sort, children often have to travel to another village for high school studies. Parents hesitate to send girls out of the village for reasons of safety and the fact that most government schools do not have facilities like toilets - a matter of great inconvenience for young girls and women. Private schools, even if present in the village, charge fees. Resource- poor families would rather invest in education of sons than daughters. Needless to say that if the science base for the country has to be made robust, beginning will have to be made with school education to ensure that all children at least complete high school and gender disparity at school level disappears.

Cultural mind set: There are cultural mind sets and attitudes towards females which are also unique to India and some developing countries. Right from birth, females are perceived as a burden to the family, (thanks to the dowry system), and rejected. Skewed gender ratio, one of the lowest in the world, is a case in point. Being at the bottom of the Human Development Index, and having the highest incidence of malnutrition in women and children in the world despite a high macroeconomic growth, does not make the nation proud. Women are regarded to be child bearers and home makers, and men as bread winners. Yet women do contribute significantly to the economic well-being of the family by doing more drudgery- oriented, less- paying jobs, besides taking the full burden of house work and child care- the familiar double burden, the third burden being patriarchal mind set.

The INSA study: Few years ago INSA identified science career for Indian women as an issue to be examined since increasing numbers of women are studying science but not pursuing career in science. A committee constituted for the purpose examined 1) the status of study and practice of science by Indian women through secondary data and reports, and 2) factors influencing science career by Indian women. The latter

was based on a study conducted by the Research Centre for Women's Studies – SNDT university. Based on the findings a set of recommendations were made.

University enrolment: There has been a steady **growth** in women's enrolment in the university from **10.9% in 1950-51 to 39.4% in 2000-01**. However, there are marked regional differences. In states like Goa, Kerala, Punjab and Pondicherry women represent more than 50% university enrolment, whereas in states like Arunachal Pradesh, Bihar, Orissa and Rajasthan, university the number is less than 35%.

Fewer women tend to opt for subjects like engineering and technology as well as agriculture and veterinary science compared to subjects like basic sciences and medicine.

37% of PhDs in science are women. Yet the percentage of women scientists occupying faculty positions in research institutions and prestigious universities is less than 15% except in ICMR and DBT. Recognition of women by way of awards and fellowships of academies is very low (less than 4%). This suggests a glass ceiling at the level of practice of science, particularly research and recognition

Urban English medium bias: It was interesting to note that most respondents in the SNDT study had **studied in English-medium schools** in urban areas suggesting a vast untapped human resource living in rural areas and studying in vernacular language schools that can be drawn in to science.

Biological sciences followed by chemical sciences were the chosen subjects.

Factors influencing science career for women are complex, but the bottom line is **society's mind set**: society views women as child bearers and home makers and men as bread winners. Career women fight the **triple burden** of home, work and male centric mindset. No matter how brilliant or talented they are, their career path has to sub-serve that of her husband. Therefore if women have to blossom in scientific and technological or for that matter in any profession, two things are needed. 1) Change of mind set. Education of the society on gender equity, and this has to be done from school days and 2) support systems- infrastructural, and emotional that would lighten their burden. Programmes are needed to encourage more women in to study science and take up career in science.

As it is, with **globalisation, science education is becoming more and more expensive and parents** hesitate to invest in girls. To get more girls in to science, appropriate scholarships and coaching is needed, to enable them to compete on par with men.

What the women want is a **level playing field.** The INSA report has made two sets of recommendations: 1) Special programmes to encourage study and practice of science by women including programmes that would enable women to continue a career in science after a break for domestic reasons and 2) Steps to reduce the stress on women scientists and students that would facilitate study and practice of science by women.

Task force for women in science: In response to the INSA report, the SAC to prime minister of India constituted a National task force for women in science to examine the issues and advise the government. The task force was constituted in **December 2005** and its term will come to an end by March 2008. We have been meeting in various locations and having brain storming meetings with women scientists, technologists and students to understand the problems. A set of recommendations /demands have been put up to the government through the minister of Science and technology – Sri Kapil Sibal.

Recommendations made by the Task force to the minister-Science and technology: 1. Flexible employment opportunities for women, with full service benefits.

Increase fraction of scientific positions held by women: Desirable goal if not quota – 30% and gender audit to be put up on web sites

Provision of crèche + day-care facilities to be made compulsory

50% of proposed fellowships (Million Fellowship plan in the 11th Plan) to be allocated to girl students.

Formulate universal guidelines for issues of special concern to women scientists and students, with this information to be readily available: Gender cell, policy for hiring and firing, policy on hiring couples and so on.

Maternity and paternity leave

Re-entry programmes

On March 8th (2008) a conference on Showcasing cutting edge science by Indian Women was held in Delhi. Over 700 women participated. The president inaugurated the conference and, the minister for S&T presided.

Mr. Kapil Sibal took the lead to announce concrete measures that 1) all DST- Aided Institutions would be provided financial support to establish a state-of-art crèche facility in the institutions; 2) DST's scientific institutions would start flexible working hours for women scientists having children up to the age of 3 years with provision to work from home; these flexi-timings will be allowed for a total of 3 years;3) all women who are young associates of INSA will be provided a research grant of up to Rs.10 lakhs a year for a period of 5 years and 4) support will be provided by the government to build a residential block for women employees in all scientific institutions having more than 20 women scientists. Mr. Sibal also stressed that other Scientific Departments must ensure that these measures could be implemented in their departments.

Let's see how far the govt. walks the talk.

WOMEN, HEALTH AND NUTRITION

India has the highest incidence of malnutrition in the world. Almost 50% pre school children suffer from moderate to severe malnutrition as judged by anthropometric index. PM Manmohan Singh called it the **'curse that must be removed'.**

The Asian enigma: The incidence of malnutrition in South Asia higher than in Sub Saharan Africa. More than 30% infants in India are born with low birth weight (LBW). The percentage is half in SSA

LBW children have impaired development- mental and physical. They are more susceptible to morbidity and mortality. Malnutrition and infection is a vicious cycle.

Foetal origins of adult diseases. Of particular relevance to India which is a country in transition, is the finding that-those born with LBW are more susceptible to diseases like diabetes, hypertension and CVD in later life, particularly if there is a change in life style due to affluence. They have greater adiposity. Thus there are short and long- term consequences of LBW. Women who were born with LBW, tend to give birth to LBW babies. Thus it's a multigenerational insult.

The basic cause of this melody is cultural **rejection and neglect of women** as seen from other parameters as well, like – **Low sex ratio. Curse of dowry system is the major cause of rejection of girls from birth.**

Nutrition Security vs good security: Food security generally implies adequacy of cereals at national level.

Nutrition security is broadly defined as physical, economic and social access to and utilisation of an appropriate, balanced diet, safe drinking water, environmental hygiene and primary health care for all. Thus

Nutrition is not a stand alone subject

India's self sufficiency in food grains thanks to the green revolution is now threatened. Production of millets and pulses has languished, and though India is among the top two countries for production of vegetables and fruits, and milk, what is produced is not sufficient and it does not reach the vulnerable sections of the people who lack purchasing power. Many govt. programmes like ICDS, MDM are there but there is lack of convergence and governance. Improving nutrition is not the major goal of those programmes.

Indian diets are qualitatively very deficient in micronutrients (vitamins and minerals) rather than proteins and hence focus has to be on production to consumption of micronutrient-dense foods like vegetables and fruits, pulses, millets and foods of animal origin.

Health nutrition, education are treated as trickle down beneficiaries of economic development. Social indicators like health, nutrition and education, particularly of women should be regarded as important outcomes/indicators of development and should be leveraged as centre piece of nation's development strategy.

There has to be **nutrition awareness at all levels-** policy makers, administrators, professionals (medical, agriculture, social scientists, educationists) and community.

There has to be a leadership agenda from bottom to the top. Countries poorer than India, like Vietnam and Thailand have brought down the incidence of malnutrition through appropriate planning and leadership. There is no reason why a country that can launch a mission to moon cannot do this.

FOCAL THEME
PROBLEMS AND PROSPECTS OF WOMEN IN SCIENCE

SL NO	TITLE OF PAPER	AUTOR'S	PAGE NO
1.	AN ASSESSMENT OF PERSPECTIVES AND ATTITUDES TOWARDS SCIENCE EDUCATION: A STUDY ON URBAN INDIAN FEMALES	Dr. Jyoti D. Vora Ms. Vidhi J. Shah Ms. Selora Pereira	12-17
2.	Lady Engineers - Ready to Overcome The Obstacles	Ms Ashwini Anil Kulkarni	18-19
3.	Global Glass Ceiling against Women in science	Prof. B.Y.Khasnis	19-21
4.	ಮಹಿಳೆ ಮತ್ತು ಗೃಹರಂಗ (Woman and Homefront)	ಟಿ. ಇಂದಿರಾ	22-24

AN ASSESSMENT OF PERSPECTIVES AND ATTITUDES TOWARDS SCIENCE EDUCATION: A STUDY ON URBAN INDIAN FEMALES

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INTRODUCTION: The quality enhancement in education is an imperative and relative tool in evolution of society. This realization has resulted in the concerted study of requisites and measures that can address the same. Usage of resources to actualize these requirements has its detrimental effects, which are rather tangible. Hence, there should be, in principle, no gender bias in making opportunities available in academics; whatsoever may be the projected reasons.

An education in science, mainly due to analytical undertones, is coveted and much sought after option in most mindsets. The simulated connection between acquisition of such an education and lucrative job opportunities makes an education in science a necessary pre- requisite to be regarded as successful, eventually. However the above notions need to be reviewed for their truth and relevance, especially in the Indian context.

Policy makers, both in academic and scientific community, have repeatedly emphasized the empowerment of women, through education. A gender-based division of labour is a long existing conjecture, thus becoming a deterrent in the advancement of women and consequently the society. It is ironic however that very little structured effort has gone into this objective. With this in view, the present study has been undertaken to accurately understand the attitudes and mindsets of women subjects in an urban Indian context.

REVIEW OF RELATED LITERATURE: In India, even a cursory and casual look at technology-related enterprises and institutes of higher education in technology would reveal the dismally low representation of women. Given the male-dominated educational context of science education, technology education and employment, gender equity efforts need to be given more attention and support. This issue also needs to be taken up at societal forums because of iniquitous integration of females in families and society.

Though there have been successful examples of female students in male-dominated technology education and employment contexts, reason for such successes is attributed to the social network established at the personal level by such females rather than the educational practices and approach being followed (Overdijk 1996).

On the basis of the foregoing, there is a need to actively encourage more girls to study technology. Many girls are being lost from science and technology education beyond the school stage. Even the technology component in curriculum at the school level is very low and that too is presented in a traditionally male-dominated manner.

At the international level, the concern about lack of women in technology has been expressed for more than two decades. The gender and science and technology association (Gasat-8, 1996) held in India, deliberated on the current scenario of gender imbalance in science and technology and identified the issues, which are multi-level and many-fold in relation to gender, education and society. The situation is complex and requires actions at many levels and in many ways.

Recognizing the complexity of the problem, Department of Trade and Industry (DTI, 1997) scanned the literature and identified some successful strategies for attracting girls into science, engineering and technology at various levels. According to DTI, children learn in social context, therefore, parental and peer attitude, media representation and a host of other cultural influences play an important part in shaping the perceptions, attitudes and behaviors of girls and boys. Based on the findings of projects related to gender and science and technology over the last 15 years, it has come out with the lessons, which can be learned to initiate new action effectively to redress gender imbalance in science and technology.

It is necessary that through the teachers' education and training programs, the right kind of images and perceptions need to be built up that science and technology are neither neutral nor value-free activities. Research has shown that girls and boys begin at equal levels of performance in mathematics and science, but that during the middle school years differences have been observed, in both science achievement and science attitudes of males and females. It appears that once science becomes an option for females, they often do not select science experiences.

The purpose of this literature review was to analyze research dealing with the factors influencing female retention in the sciences. These factors were considered from personal, sociological, and educational perspectives, with the intention of making people more aware of the influences, which they may have on the future education of females.

Gender disparity at all levels and its adverse impact on women has become a fact of life. This is partly due to the biological role and responsibilities of women as mothers, but mostly due to the traditional mindsets, which visualize women as being child bearers and homemakers, and men as breadwinners. Yet in many invisible, unrewarded ways women contribute significantly to the economic well being of the family, and take on the double or triple burden of home making, work outside home and fighting male chauvinism.

Among the various professional spheres, women seem to miss out more in science and technology, particularly physical sciences, agriculture and engineering fields. Those who do study science, often end up in what are considered as less challenging teaching jobs. There is a growing realization that by not allowing the creative talent of women from being expressed through their involvement in research and development, society is missing out, and something needs to be done to make scientific research more gender friendly.

Last century has seen an explosion of knowledge in Science and Technology. Science and technology has permeated every sphere of life and has become a part of day-today living. Female sex represents half of humankind (unfortunately less than half in India due to deliberate elimination of females) and yet the status of women in society at all levels is inferior to that of men. Large-scale gender discrimination and inequity have denied females opportunities for education and employment on par with males. Though women contribute significantly to national development and well being their contribution to the family (child rearing and home keeping) lacks a monitory tag, and is taken for granted and worst still, viewed with cynicism.

In the developed world, school education is universal and educational opportunities at college level are more or less similar for both the sexes. However, traditional mindsets internalized over generations prevent women from opting for courses like science (particularly physical sciences and mathematics) and technology, which are perceived as being more in the male domain. Study of science and technology does not ensure further opportunities and smooth career path for women, thanks to the notorious 'glass ceiling'

The situation in the impoverished communities of developing countries like India is because education and health, particularly of females are issues of low priority, the primary concern being livelihood. Apart from child labour to augment family income, girls are often taken away from school to do house work and take care of younger siblings when both the parents go to work. There is also the fear of safety of girls. Denial of school education blocks the stream that would feed into higher education including science education. Those who overcome the hurdles against school education, come up with other obstacles of the kind described earlier for the women from developed countries. Thanks to the curse of dowry system, the first worry of parents is getting the daughters married. Often education is seen as a stepping-stone to marriage. Unfortunately, most girls feel obliged to yield to parental pressure.

In recent years the issue of marginalizing women from scientific career is being seen with concern all over the world. In India the problem is two fold: 1) getting more women to study science and technology and 2) ensuring that those who study are able to pursue a career in science and technology. Attrition after higher education, apart from other things, is a national waste and impoverishment of Indian science. The term 'study of science' means women who enroll in university to get a degree in science and pursue further studies to obtain post graduation and doctorate in science. The term 'practice of science' means those who after post graduation pursue a career in science.

Perusal of the annual reports from a few institutions showed that in most cases the presence of women in advisory committees was less than 15%. One very prestigious biological sciences institute, where 30% of faculty members were women, did not have a single woman in the advisory committee.

Recognition in science can be judged on the basis of variety of factors such as ability to secure permanent faculty position, attract research grants, and research scholars, publications and patents, invitations to speak in conferences, travel fellowships, invitations to be on various policy making, and review committees, awards, academy fellowships etc. Some of the criteria such as publications are objective but others depend on the scientists' visibility and recognition by peers. On the basis of publications in 38 high impact journals, 85.7% of the papers from India had men as the corresponding/senior authors and only 14.3% had women.

Very few women are elected as fellows of science academies Women seldom receive awards open to both the sexes. For instance, National Biosciences award, instituted by the DBT in 1999, has given 24 awards between 1999 and 2003. Only 2 awards (8%) have gone to women. Bhatnagar prize for young scientists was instituted in 1958, by CSIR. It is one of the most prestigious awards in natural sciences. Out of 333 awards given between 1958 to 1998, women received only 8 awards (2.4%). Maximum recognition for women was in medicine (7.5% awards), whereas in physics, earth science and engineering not a single woman got the Bhatnagar award. The greater visibility of women at the university level in the more progressive states of India is expected.

An interesting observation that differentiates India from other developed countries relates to the absence of attrition in women's percentage (if anything there is some improvement) as we move from graduation to post graduation in science. This phenomenon is seen even in biology where women's presence is more than in other fields. It would therefore appear that in India the phenomenon of 'leaky pipeline' in education, including science education, disfavoring women occurs mostly at school level and if school drop out can be plugged, the presence of women in higher education including science may increase.

Far fewer females seem to opt for engineering, agriculture and veterinary science. However, in agriculture and veterinary science, some southern universities show higher percentage of women. On the other hand, medicine does seem to attract women. In medicine, women tend to cluster in disciplines such as obstetrics/gynecology, pediatrics, and pathology.

Few women enter into more lucrative male dominated disciplines like surgery, or orthopaedics.

The general perception is: more Indian women, like women in other countries, tend to cluster in biological sciences than physical sciences. According to a recent report, however, 32% of enrolment in physics in India is of women. This is considered quite high in global context where the representation of women in physics ranges from 6% in Netherlands to 36% in Poland. There is a feeling all over the world that interest in science among students is declining, and more students opt for courses like commerce, management and computer science. It is possible that the brighter ones still opt for commerce, management computer science, engineering, medicine etc. where there is better employment potential. Women who qualify in science either take up teaching jobs or faculty positions in Universities or Institutions, which are engaged in research with or without teaching.

Recognition of women scientists as judged by awards and fellowships is meager compared to men even assuming their smaller numbers in academics. The fact that not a single woman in last 5 years has got the Bhatnagar award might imply that situation is getting worse, rather than improving. It is possible that fewer women get nominated, because of their lower visibility. They are not part of the networks, which give visibility to men. Within an organization, the career path for women tends to be slower as seen from the number of professors vs. assistant professors/ lecturers. Scientific productivity as judged by publication output tends to be proportional to the academic position, because ability to attract research grants, students etc. improves with position.

Clustering of women in the lower grades is obvious. Conscious or unconscious marginalisation of women from science job market is a worldwide phenomenon. According to the Greenfield report, 2002 (commissioned by UK government) fewer than 10% of senior scientific positions in any country are held by women. In UK even in a faculty like biology, where women's presence is substantial, the graph dipped from 50% women obtaining Ph.D. to less than 10% professors. Relatively more women tend to settle down in less challenging teaching jobs (Greenfield report, Peters et. al 2002).

The European Commission's ETAN Expert Working Group on Women and Science reported in 2002 that women make up less than seven percent of science professors, five percent of academy members and have a very small proportion of senior scientific positions in six member states. Another European Commission report this year points out that although women obtain nearly 40% of all PhDs (even more in life sciences), in the European Union, only 15% of industrial researchers in Europe are women

According to a report from Korea, women constituted only 3.8%, of full time faculty in natural sciences and engineering. A study from Sweden points out the shocking level of nepotism and sexism in this advanced country where women are believed to enjoy a high status in society. During selection of post-doctoral candidates by Medical Research Council, 62 men and 52 women applied. While the success rate for men was 26% that for women was only 7%.

When the scores given by the review committee based on publications quality etc. were analyzed there was mismatch between this objective parameter of scoring and the rank given to judge competence. According to the authors, the females had to be 2.5 times more productive to get the same competence score. While remedial suggestions can be made for problems related to support systems and encouragement, changing mindset is not going to be easy.

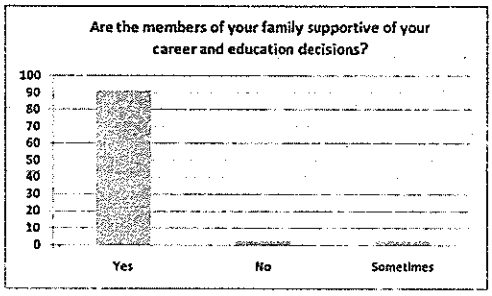
OBJECTIVES AND WORKING RATIONALE:

Recognizing the global concern for this significant aspect of the inter phase of education and gender, it was decided to actualize a research endeavor aimed at studying perspectives and attitudes of Urban Indian Women towards science education.

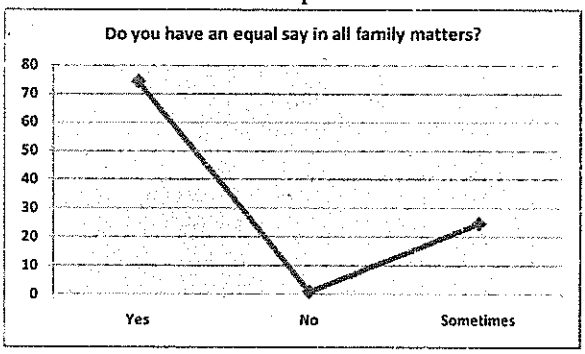
A carefully structured questionnaire was administered to female subjects of the representative groups of the society with the view of obtaining a holistic picture of their perspective towards science education. The questionnaire comprised of a series of questions regarding level of educational qualification, choice of subjects, career stances, personal preferences and logistics. The findings were statistically analyzed.

RESULTS AND DISCUSSION:

The results were collated and analysed and assessment of findings revealed certain path breaking truths relating to overall perspectives of female gender towards education and career at large and scientific pursuits in academics in particular.

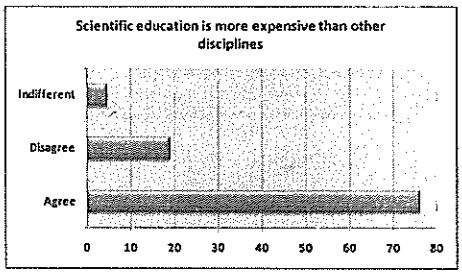


Graph 1

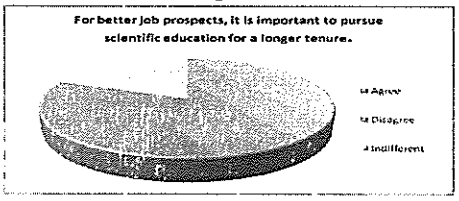


Graph 2

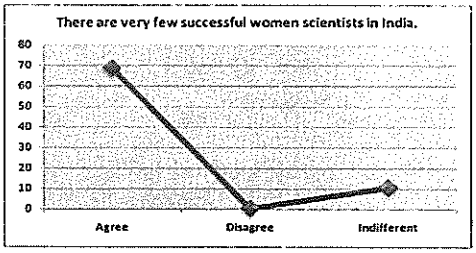
It was encouraging to find that most women agreed that members of their family were supportive to their career and education related decisions (Graph 1). It was also heartening to realize that women had an equal say in all family matters and perceived themselves as decision making machinery of their homes and families. However a reaction of panelist were indifferent to the role they play in this purview (Graph 2).



Graph 3

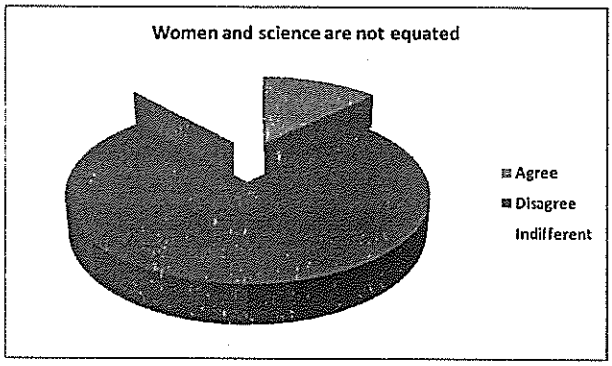


Graph 4

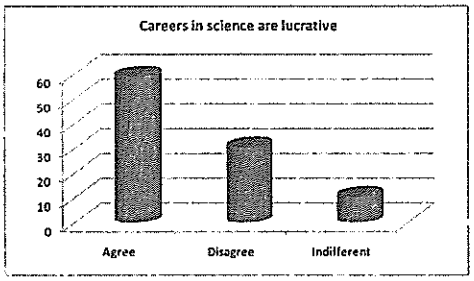


Graph 5

Approximately 80 % of female subjects felt that scientific education was more expensive than other disciplines (Graph 3) and agreed, in part, that for better job prospects it was important to pursue scientific education for a longer tenure (Graph 4). It is noteworthy that most women agreed on the paucity of successful women scientists in India (Graph 5).

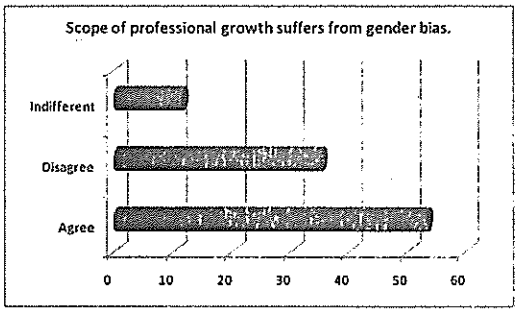


Graph6

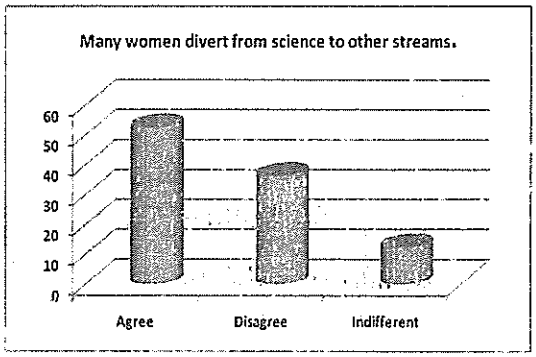


Graph 7

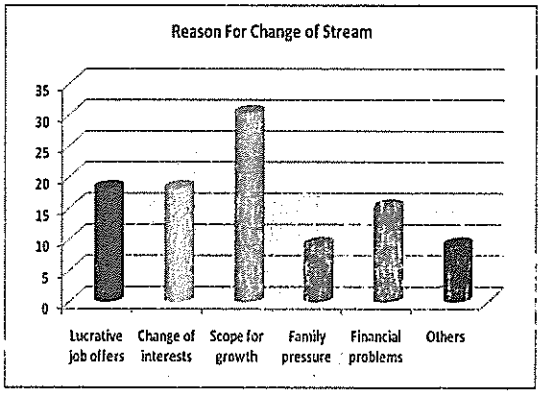
Most subjects realized that it was a fallacy that women and science do not synchronize (Graph 6) and they were of the belief that it was incorrect that careers in science are not lucrative (Graph 7). A surprising finding was that the panelists of subjects studied were in disparity that scope of professional growth suffers from gender bias (Graph 8).



Graph 8

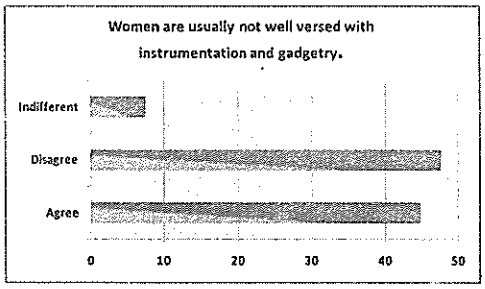


Graph 9

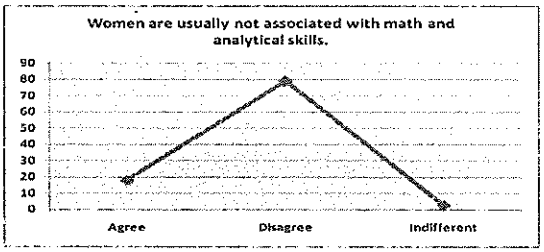


Graph 10

A substantial number agreed that for societal and personal reasons many women divert from science to other streams (Graph 9). The reasons cited were numerous; predominant among them was lack of scope for growth. Want of more lucrative job offers and parametric change in interest were cited as some other reasons. (Graph 10)

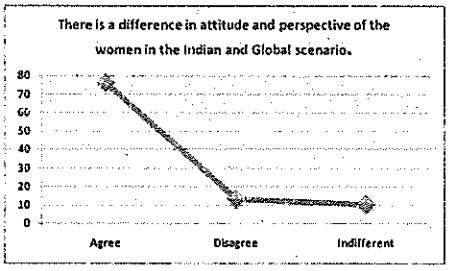


Graph 11

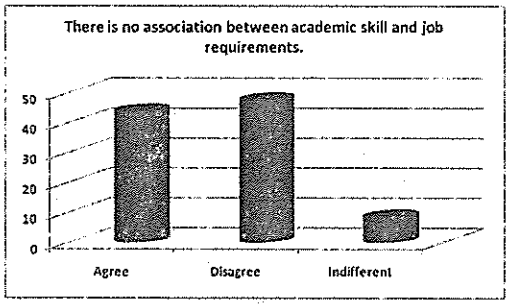


Graph 12

When issues of mindset, analytical ability and gender centric issues of proficiency were addressed, the findings belied the common assumptions related to the same. The opinion was divided that women are not well versed in instrumentation and gadgetry (Graph 11). However most panelists were emphatic that the dictum of disassociation between gender and mathematical or analytical skills is an anomaly (Graph 12).

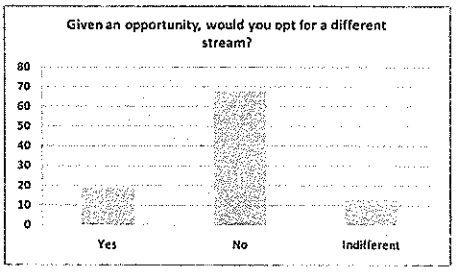


Graph 13

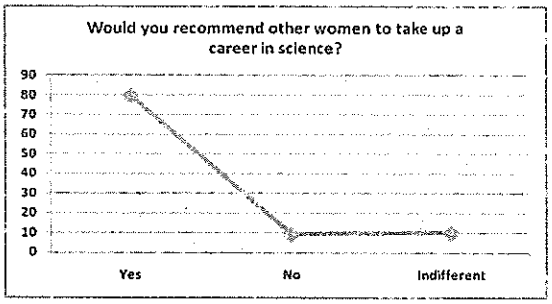


Graph 14

In keeping with emergence of India as an important component of global scenario, the women panelist believe that there is a significant difference in attitude and perspectives of women in the Indian and Global context (Graph 13). This observation is important because realization of this difference is infact the first step towards a corrective measure. . Interestingly, the opinion was divided as per whether the academic profile of a subject and job requirements had any association. This threw light on a significant area of the thought culture both of job seekers and job aspirants. (Graph 14)

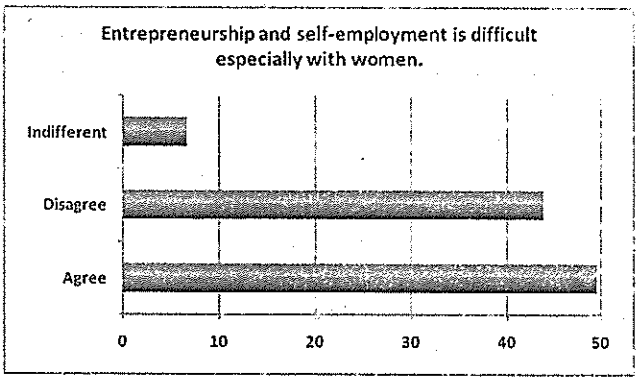


Graph 15



Graph 16

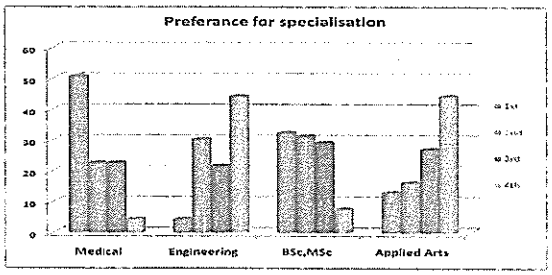
The female subjects who were pursuing science as an academic option did not wish to opt for different stream (Graph 15) and most of them were keen on recommending a career in science to other women (Graph 16). Some of them were also of belief that entrepreneurship and self-employment is difficult especially for women. A substantial number of group however disagreed with the same (Graph 17).



Graph 17

A critical analysis of personal abilities, assessment of the societal role and familial expectations seem to be some of the aspects which women contemplate on before they make a

choice of career as per graph 18, largest number of women cited medicine and pure sciences as their first preference when given a choice of careers. It was important to note that a profession in engineering sciences and applied arts was cited as the fourth and the last.



Graph 18

Of the total panelist analyzed, 27% were married. Of these, 50% of the panelist found it difficult, at times, to balance their professional and personal lives, along with 14 % who always found it difficult to balance the same. However 36% were able to manage (Graph 19)

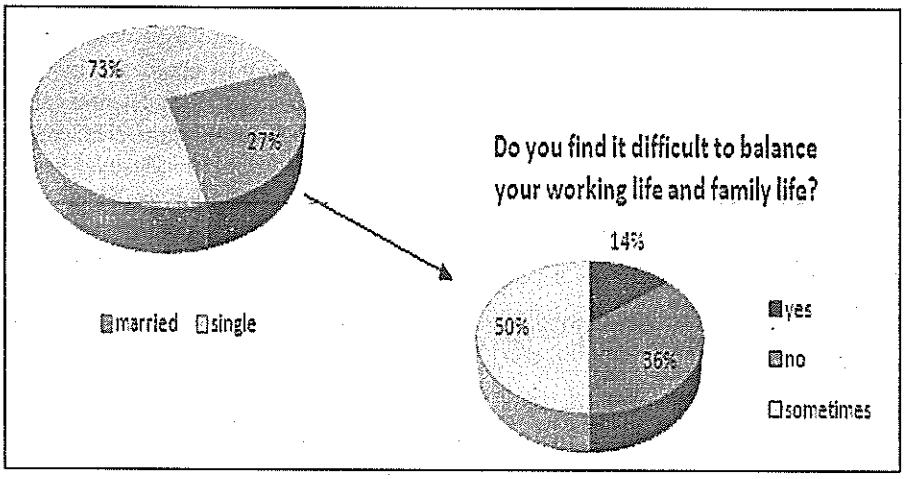
As a fall-out of this research endeavor, the authors have taken it on themselves to organize a workshop for women subjects of various cadres in order to create increased awareness among them as far as self-orientation is concerned. Encouraging responses from the panelist in question, lead us to believe that self-enhancement of those women subjects is a certainty as an outcome of the workshop.

We believe that the women subjects would view themselves in a newer light, they would be less rigid as far as their thought culture is concerned and this in turn would help them to percolate their philosophy among the genders.

Summing up, certain important realizations emerged from this study which has encouraged us to offer certain corrective and remedial suggestions which would be useful in improving the standpoint at which the ' Indian Woman' views the world at large and the way the world views her.

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Graph 19

LADY ENGINEERS - READY TO OVERCOME THE OBSTACLES

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Introduction

In the modern age world has become a global village but women , their problems and struggle to achieve the success are universal irrespective of their colour caste , creed ,religion , marital status and social as well as economic background. Though it is said proudly that India is the nation where women have dignity since ages;

is the motto of Indian culture ,still unfortunately we also have the tradition of problems faced by women. Earlier when home was the restricted work field of women , their problems were related to their personal life and their family members only; but in modern age women got equal status to men , they became self reliant and the rights were equally distributed . As rights and duties are the two sides of the same coin, equal distribution of duties was also expected. But in India, male dominated society always neglected this justifiable principle. Therefore though women got liberty, and the equal rights, they could not enjoy that because of the excess burden of duties. The principle of equality remains only on paper. It is the sorrow of all women in India. Researcher observed women from different classes of the society but was very curious about lady engineers because it is her own field.

This research paper is an opportunity for the researcher to communicate with lady engineers who are fighting with minor problems gradually becoming major obstacles in their career. Though they are working hard for the success, the problems are reducing their speed of development. Thus this paper is mere reflection of the world of lady engineers and also the story of their endeavor.

Because of the short span of time researcher has chosen select lady engineers from the field of computer and electronics and interviewed them. Though they belong to engineering field their work areas, designations are different such as researcher, entrepreneur, academicians, administrators, women working in industry.

Problems of Lady Engineers

Their few problems are similar while some are unique; but they cope up with the situation as tolerance is the inherent quality of women.

When the atmosphere of working place is good, efficiency increases. The concept of atmosphere not only includes the climate but behaviour of colleagues as well. Unfortunately all the chosen lady engineers are not happy with the behaviour of their colleagues and surprisingly non cooperative colleagues are ladies. Especially in industries where male colleagues are in majority, the internal conflicts of women reach to the height. In such cases there is good scope for unity but it is observed that ego problems become severe and male colleagues are getting the benefit of it. On the other hand where males are working under lady boss, they feel insulting. Sometimes they are neglecting her orders and if she is taking any action against her all the men unitedly raising voice against her, in one case taunting was the way to trouble her. Therefore by force she can not work efficiently and has to make another provision to complete the unfulfilled work.

It is very interesting to know the opinion of lady entrepreneur who is an engineer. She says she always prefers lady candidates in her unit because they are very sincere and honest. They stick to their work and never ask permission for tea or smoking. But at the same time she says with a great sigh that day by day sincerity of women is reducing. Young girls start crying directly if they fail in achieving a target and expecting sympathy from their boss. Still she says percentage of hard work is more in women.

Research scholars have different attitude. They want to devote number of hours for their research but because of unavoidable domestic duties, they could not spare extra time. If their guide considers it, the speed of their research may be slow but they can enjoy the satisfaction otherwise it becomes very difficult.

A lady principal of engineering college says women are very much sincere, but they are not ready to wait even few minutes after working hours. There are ego problems and even senior-junior category is the reason of conflict. Men only show off their work but they are ready to wait till late hours if required. Number of lady lecturers chooses the field of academics by their own wish but their male counterpart enter the field not by choice but by force.

Researcher asked lady lecturers about their work experience in academics and industries; and it was found that 70% ladies were working in industry when they were unmarried. After their marriage they could not balance their home and career. So it was the next best alternative for them which gives them job satisfaction and stable life. After marriage there is no proper division of work at their home. Though they are highly qualified their family members have lot of expectations like a full time housewife. If they are mothers they cannot concentrate on work as half of their mind is in their children. Few companies provide cradle home facility for their employees; but it is very rare in Nasik.

Even in academics male domination exists. Many of them always dominate their female counterparts in various ways.30% lecturers are deprived of promotions only because they are women. Reasons for denial were shown to be different but the hidden cause is their faminity.

60% women get conveyance but 20 % said they have to face lot of problems like traffic jam, bad roads and vehicular problems which are unavoidable and adversely affecting their

performance. Men are also facing the same problems but as they are free from domestic duties they can easily manage.

50% women got training which is required for the job. They have gained new skills and their performance is recognized as well. 40% women got 'Best Employee' award. But it is very painful to know that when good opportunities like going abroad for training or any project, are there males take initiative and grab the opportunity. Women are always hesitating .Before taking any decision they have to think twice. They can not decide individually without the permission of their family members.20% women have missed such opportunities.

40% Women especially working in industries find the burden of working hours but 60% feel that they are reasonable.

Findings-

1. Though Lady Engineers are facing lot of problems still their enthusiasm is appreciable.
2. Whatever work is assigned to them, they are doing it carefully.
3. They are maintaining the balance between their personal life and their career.
4. Their first priority is always home.

After the interaction with the lady Engineers researcher came to conclusion—

Conclusions

1. Attitude of the society towards women should be changed.
2. Lady Engineers should unite for their rights.
3. They should not be frustrated because of demotivating atmosphere around them on the other hand they should be firm and self-motivating.
4. Support should be given by their family members.
5. If they are determined no one can stop them from the success.

GLOBAL GLASS CEILING AGAINST WOMEN IN SCIENCE

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Women are the nucleus of our civilization she has different roles to play in the ever changing social set up. Women's development is directly related with the nation development. With the dawn of independence our constitution guaranteed gender quality and a large number of schemes and programmes have been initiated for women's development. But the Indian women have to survive in a complex area of social-cultural, historical, political economic realities.

Since women are considered the most oppressed section of the society, the term women's Empowerment has come to be associated with women's struggle, social justice and equality. Several programmes have been launched with the explicit objective of empowering women and money measures have been taken the betterment of women. Down the ages, the women's role in society has been constantly charging. The influence of western Education and the liberal ideas of great leaders and reformers brought about a change in the status of women in India.

Unlike in the west, in India, the educational pipeline leaks most heavily at the school level. There is a higher drop-out of girls compared to boys from the primary to secondary stage. (UGC 1995-96 to 2000-2001). The Sarva Shiksha Abhiyan launched in 2001-02 for achieving the goal of Universalisation of Elementary Education (UEE) has focused specific attention or promoting education for the girl child in order to equalize educational opportunities and to eliminate gender disparities in India. This has resulted in reduction of dropout rate at the primary level i.e.28.49% in 2004-05 from 30.03% (2001-02). The dropout rate for girls declines by 5.08% point.

Among various professional spheres, women seem to miss out more in science and technology, particularly physical sciences, agriculture ad engineering fields. Those who do study science, often end up in what are considered as less challenging teaching jobs.

Very few women receive recognition through awards and academy fellowships. Thus the percentage of women fellows in prestigious sciences academics is only 3-4 only 2 (out of 24) national bioscience awards have gone to women.

Out of 387 Bhat nagar awards given, since 1958; only eight women have received them and none in that past few years (Bal 2004)

It may be pointed out that these are very fortunate women; they managed to combine a career in science along with managing their homes many others would have fallen by the way side, being unable to cope with the triple burden of home work and societal prejudices, including gender-related nepotism. With increasing privatization of education, this kind of pressure will increase with greater marginalization of girls from science education.

A detailed study on science education and occupation among girl students in India that was conducted by Mukhopadhyay (2001) points to the reasons that prevents girls form opting for science, particularly physical sciences. Mathematics and engineering as disciplines of study were examined. The study found that gender did not determine aptitude or natural inclination for these subjects. Societal mind sets and pressures, particularly in patri focal families, determined the ultimate preference, the educational path that ultimately ended up in house hold assignments or in the job where their real knowledge or resources could not be utilized.

The Social advantages of a proportionate representation of women in the sciences cannot be over stressed women bring with them a more hum one and a more rooted perspective to

scientific research. Something that is so crucially necessary for sustainable development, the exclusion of women from scientific research and scientific assignments, despite their being qualified is a national loss and waste of source resources that can never be compensated something and the policy to ponder over.

Clearly we cannot allow the continuation of this denial of opportunities this policy of exclusion that in leading to a colossal loss of trained and equipped work force. Policies need to framed and implemented with all the urgency and with all the collective determination of all concerned agencies like the UGC, the NCERT, the science Funding agencies, and academies, INSA can be at the core of this effort, facilitating the process by initiating a dialogue between these agencies and organizations (Banji, 2005).

Numerous studies show that even in the advanced counties, women have to face many challenges beginning from early childhood and lasting their entire life span. Women who seek science as a career have to face the triple burden of professional work, domestic work and the life long biases of male chauvinism. If these are the burden that a women in the more enlightened and developed west has to face one cane easily imagine the situation in the impoverished communities of developing countries like India, where education and health, particularly of females are issues of low priority. Apart from child labour to augment family income girls are often taken away from school to do house work and take care of younger family members. Even at the parental front, marriage of the daughter, demands of dowry, and unending demands from in-laws even after the marriage leads to reinforcing the ideas of the girls being an unwelcome presence, the combination of all these leads to life long discriminations and abominable practices like aborting the female child and amniocenteses.

The INSA committee (Indian National science Academy 2004) on 'Science career for women's investigated the present status of women with regard to study and practice of science and on of curried in to the factors that influence women who wish to choose science as a career the committee came up three major recommendations

i) Steps to reduce the gender gap from school level upwards;
ii) Initiating special programmes for women to encourage study and practice of science by them and
iii) Special steps to reduce the stress on women scientists and students at work places. Implementation of these steps will certainly go long way in helping aspiring women scientists to step forward and make their rich deserved contribution in the science.

An examination of the situation in which women in higher education and related sectors are placed globally and its comparison with the Indian situation, will unerringly lead to the conclusion that it is the some decimal picture all over. If there are difference they are only of a quantitative nature, qualitatively the west is no different from the east, at least as for as treating women unfairly is concerned. Women have been usually marginalized not only in India but globally as well. The so called forward or developed nations have also not given women their due.

Wenneras and wold (1997) presented a study form sweden that exposed the shocking levels of nepotism and sexism in this advanced country where women are believed to enjoy a high status in society 62 men and 52 women had applied to the Medical Research council for the posts of post-doctoral candidates. While the success rate for men was that for women was only seven percent when the scorer given by the review committee based on publications quality etc. were analyzed there was a mismatch between the objective parameters of scoring and the rank given to judge compedence. According to the authors, the females had to be 2.5 times more productive to get the same competence score.

The marginalizations of women from the science job market appear to be a world wide phenomenon peters at (2002) come out with a report on women in science, engineering and technology commissioned by the government of UK. The report documented that less than 10% of senior scientific positions in any country are held by women. Even in the UK in a faculty like biology, where women' presence appears to be substantial the graph clipped from 50% women obtaining Ph.D to less than 10% professors.

Relatively more women tend to settle down in less challenging teaching jobs.

European Technology Assessment Network for women in science (ETANS) as expert working group in 2002 reported that women make up less than 7% of science professors, five percent of academy members and have a very small proportion of senior scientific positions in six member states. Another European commission reported that although women obtain nearly 40% of all Ph.D's, (even considerably more in life science) in the European Union, only 15% of industrial researchers in Europe are women.

The issue of marginalizing women form scientific careers in recent years is being seen with concern all over the world. In India, the problem is particularly money fold. Fighting this tendency in India would involve getting more women to study science and technology and further ensuring that those who steady are able to pursue a career in science and technology. It has to be recognized that the trend to drop out after higher education especially after studying sciences that involve a higher per capital cost in comparison to humanities is a national waste and contributes to impoverishment of Indian science.

Women scientist have never asked for any special personal privileges what they have asked for are enabling mechanisms crèches, day-care centers for elderly, flexible working hours, part-time jobs and campus housing, etc. Some organizations do not allow married couples to work in the same place. This has affected the career of many women. (Bambji.2005). A stra-

tegic approach has also been presented by Bamji (2005) to counter the issue of higher dropouts and their encouragement by the various functional and agencies.

Special programmes to encourage study and practice of science by women

SL. No	Recommendation	Implementing agency
1	Special merit scholarship for girls studying in Govt. schools to take up science, science education is becoming increasin gly expensive due to privatization; the axe will fall on girls.	NCERT
2	Travel Support to girls from poor families and once escort when they come to the city to write competitive exams.	NCERT
3	Opportunities for placement for girls, especially from small towns and Govt. schools to do summer projects in good labs.	DST, CSIR, ICMR, DBT etc
4	Opportunities for science teachers from colleges to do short-term research projects. Special leave with pay for Ph.D	UGC
5	Role model programme. Fellowship to eminent women scientists to visit, give lectures, and interact with students and teachers in Universities science academics	UGC, DST, etc
6	Website and directory of women scientists giving their professional profile. This can be used to return to science career.	DST, science academies.
7	Opportunity for women who suffered a break in career on achievement of women scientists	DST, science agencies, academies.
8	Articles on achievement of women scientists	Journals like current science.
9	Life histories of successful past and present women	
	scientists to be chronicled	Projects for a suitable organization like RCWS-SNDT
10	Gender sensitization programmes in all institutions and schools	Higher education institutions, schools.

Conclusion:

Thus the progress and all round development of a country depends upon harnessing the skills and abilities of all sections of society. The status of women could be the best indicator of a nation's progress. The position of women in the society in the true index of its cultural, spiritual attainments and science women's active role in regarded as an integral part of progressive social system. Today, there is a great awakening among women given and opportunity; they will deliver the best results with their strength.

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ಮಹಿಳೆ ಮತ್ತು ಗೃಹರಂಗ (Woman and Homefront)

ಟಿ. ಇಂದಿರಾ
ಹಿರಿಯ ಗ್ರಂಥಪಾಲಕರು, ಕೆನರಾ ಪ್ರಥಮ ದರ್ಜೆ ಕಾಲೇಜು, ಮಂಗಳೂರು-575 003

ಸಮಾಜದ ಮೂಲಘಟಕವಾಗಿ ಪುರುಷ ಹಾಗೂ ಸ್ತ್ರೀ ಇವರನ್ನು ಪರಿಗಣಿಸಿ ಅಂಗಭೇದದ ನೆಲೆಯಲ್ಲಿ ಮಾನವ ಜನಾಂಗವನ್ನು ಪುರುಷರು ಮತ್ತು ಸ್ತ್ರೀಯರು ಎಂದು ಎರಡು ಸಮೂಹಗಳನ್ನಾಗಿ ವರ್ಗೀಕರಿಸಿರುವುದು ಸಹಜ. ಪ್ರಕೃತಿದತ್ತವಾದ, ದೈಹಿಕವಾದ ಬೆಳವಣಿಗೆಯನ್ನು ಹೊಂದುತ್ತಾ ಇಂಥ ಗಂಡು ಹೆಣ್ಣು ಇವರ ಮಿಲನದ ಅವಸ್ಥೆಯಲ್ಲಿ ಸಾಂಸಾರಿಕ ಹಂತವನ್ನು ತಲುಪಿದಾಗ ಕುಮಾರಿ ಯಾಗಿದ್ದವಳು ಗೃಹಿಣಿ ಯಾಗುತ್ತಾಳೆ. ಕುಮಾರ ಆಗಿದ್ದವನು ಗೃಹಸ್ಥ ಅನ್ನಿಸಿಕೊಳ್ಳುತ್ತಾನೆ. ಸಹಜವಾದ ಈ ವರ್ಗಿಕರಣವೊಂದೇ ಅವರುಗಳ ನಡುವೆ ಸಾಕಷ್ಟು ವ್ಯತ್ಯಾಸಗಳನ್ನು ಹುಟ್ಟುಹಾಕುತ್ತದೆ. ಅವರವರ ವೈಶಿಷ್ಟ್ಯವೆ ಅವರವರ ಮಿತಿಯಾಗಿ ಪರಿಣಮಿಸುತ್ತದೆ. ಸ್ತ್ರೀ ಸಹಜವಾದ ಲಜ್ಜೆಯೇ ಆಕೆಗೆ ಆಭರಣ ಎಂಬುದಾಗಿ ಚಿತ್ರಣವಾಗುತ್ತದೆ. ಇದೊಂದು ಸಾಮಾಜಿಕ ಔಕಟ್ಟಾಗಿ ಅದಕ್ಕನುಗುಣವಾಗಿ ಅಕೆ ವರ್ತಿಸಬೇಕಾಗುತ್ತದೆ.

ದಾಂಪತ್ಯದ ಬದುಕಿನ ಉದ್ಯೋಗಸ್ಥ ಮಹಿಳೆಯ ಸಮಸ್ಯೆಗಳ ವಿವೇಚನೆ ಈ ಸಂಪ್ರಬಂಧದ ಉದ್ದೇಶ. ಮಧ್ಯಮ ವರ್ಗದ ಉದ್ಯೋಗಸ್ಥ ಮಹಿಳೆಯ ಬದುಕು ಹಾಗೂ ಗೃಹ ಸಮಸ್ಯೆಗಳ ವಿಶ್ಲೇಷಣೆಗಾಗಿ ಇದನ್ನು ಮಿತಗೊಳಿಸಲಾಗಿದೆ ಪೂರಕವಾಗಿ ಬಡ, ನಿಮ್ನವರ್ಗದ ಮಹಿಳೆಯ ಬದುಕನ್ನೂ ಕ್ವಚಿತ್ತಾಗಿ ಬಳಸಿಕೊಳ್ಳಲಾಗಿದೆ.

ಹುಟ್ಟಿದಾರಭ್ಯದಿಂದ, ಹೆತ್ತವರ ಮಮತೆಯ ಮಡಿಲಲ್ಲಿ ಬಾಲ್ಯ ಕಳೆದು, ಯೌವನಕ್ಕೆ ಕಾಲಿಟ್ಟು, ಪ್ರೌಢಳಾಗುವ ಹೆಣ್ಣಿಗೆ "ಅಂಜಿ ನಡೆಯುವುದೇ ಭೂಷಣ" ಎನ್ನುತ್ತದೆ. ನಮ್ಮ ಸಮಾಜ! ಅತ್ತೆ ಮಾವರಂಜಿ, ಸುತ್ತೇಳು ನೆರೆಗಂಜಿ, ಮತ್ತು ಅಳುವ ದೊರೆಗಂಜಿ ನಡೆದರೆ ಎಂಥ ಉತ್ತಮರ ಮಗಳಂದ_

ಇಲ್ಲಿ ವ್ಯಕ್ತಿತ್ವದ ನಿರಾವಣಕ್ಕಿಂತ ಆವರಣಬದ್ಧಗೊಳಿಸುವ ಪ್ರಕ್ರಿಯೆಯೇ ಜರಗುತ್ತದೆ. ಅತ್ಯಂತ ಜೀವ ವಿರೋಧಿಯಾದ ಸಮಾಜದ ನಿಲುವನ್ನು ಹೆಣ್ಣು ಪ್ರಥಮವಾಗಿ ಅನುಭವಿಸುತ್ತಾಳೆ. ಎಲ್ಲ ಸಂಸಾರಕ್ಕೆ ಇದು ಅನ್ವಯಿಸದಿದ್ದರೂ, ನನ್ನ ಸುತ್ತ ಇಂಥ ಅನೇಕ ಉದಾಹರಣೆಗಳನ್ನು ನೋಡುತ್ತಿರುತ್ತೇನೆ.

ಗಂಡು-ಹೆಣ್ಣಿನ ಸಂಬಂಧವನ್ನು ವಿವಾಹ ಸಂಸ್ಥೆಯ ಔಕಟ್ಟಿನೊಳಗೆ ಬಂಧಿಸುತ್ತ ಬರಲಾಗಿದೆ. ಗಂಡು ಹೆಣ್ಣಿನ ನಡುವಿನ ಬದ್ಧತೆಗಾಗಿ ಪರಸ್ಪರ ನಿಷ್ಠೆಯಲ್ಲಿರಬೇಕೆಂಬ ಕಾರಣಕ್ಕಾಗಿ ಇಂತಹ ವ್ಯವಸ್ಥೆಯೊಂದು ರೂಪುಗೊಂಡಿದ್ದರೂ ಇತಿಹಾಸದುದ್ದಕ್ಕೂ ಏಕಪತಿತ್ವದಂತೆ ಏಕಪತ್ನಿತ್ವವು ಒಂದು ಮೌಲ್ಯವಾಗಿ ಕಂಡು ಬರುವುದಿಲ್ಲ. ರಾಜಮಹಾರಾಜರುಗಳೆಲ್ಲ ಬಹುಪತ್ನೀವಲ್ಲಭರೇ. ಹೆಚ್ಚು ಜನ ಸ್ತ್ರೀಯರನ್ನು ಆಳುವುದು ಗಂಡಿನ ಪ್ರತಿಷ್ಠೆಯ ಸಂಕೇತವೇ ಆಗಿತ್ತು. ವಿವಾಹೇತರ ಸಂಬಂಧಕ್ಕೆ ಹೆಣ್ಣಿನ ವಿಷಯದಲ್ಲಿ ತೋರುವ ನಿಷ್ಠುರತೆಯನ್ನು ಗಂಡಿನ ವಿಷಯದಲಿ ತೋರುವುದಿಲ್ಲ. "ಶೀಲ" ಪಾತಿವ್ರತ್ಯದಂತಹ ಮೌಲ್ಯಗಳು ಹೆಂಗಸಿಗೆ ಇರಲೇಬೇಕೆಂದು ನಿರ್ಬಂಧಿಸುತ್ತ ಬಂದ ವ್ಯವಸ್ಥೆಯ ನಡುವೆಯೂ ಕೆಲವೊಮ್ಮೆ ಸ್ವಾರ್ಥಕ್ಕಾಗಿ ಲಾಭಕ್ಕಾಗಿ ವಿವಾಹಬಾಹಿರ ಸಂಬಂಧವನ್ನು ವ್ಯಕ್ತಿಗಳು ಒಪ್ಪಿಕೊಳ್ಳುವ ಕುರುಡಾಗಿ ವರ್ತಿಸುವ ಸಂಧರ್ಭಗಳೂ ಇವೆ.

ವೈವಾಹಿಕ ಜೀವನದಲ್ಲಿ ಗಂಡನ ಆಸೆ, ಆಕಾಂಕ್ಷಿಗಳು, ನಿರ್ಹಾರಗಳಿಗ

ನುಗುಣವಾಗಿ ತನ್ನದನ್ನು ಬೆಳೆಸಿಕೊಳ್ಳಬೇಕು, ಆತನ ನಿರ್ದೇಶನಕ್ಕನು

ಗುಣವಾಗಿ ತನ್ನ ವ್ಯಕ್ತಿತ್ವವನ್ನು ಅಳವಡಿಸಿಕೊಳ್ಳಬೇಕು, ತನ್ನ ಸ್ವಂತ ಅನಿಸಿಕೆಗಳನ್ನು ಹತ್ತಿಕ್ಕಿ ಬದುಕಬೇಕು ಎನ್ನುವುದು ಭಾರತೀಯ ಸಮಾಜದಲ್ಲಿ ಅಲಿಖಿತ ಶಾಸನ. ಇದನ್ನು ಒಪ್ಪದಿದ್ದಲ್ಲಿ, ಪ್ರತ್ಯಿಸಿದಲ್ಲಿ ಅವಳು ಗಂಡನೊಂದಿಗೆ ಬದಕಲು ನಾಲಾಯಕ್ಕು ಎಂದೇ ತಿಳಿಯಲಾಗುತ್ತದೆ. "ಧರ್ಮೇಚ ಅರ್ಥೇಚ ಕಾಮೇಚ ನಾತಿಚರಾಮಿ" ಎಂದು ಮದುವೆಯ ಕ್ರಿಯೆಯನು ಒಪ್ಪಿಕೊಳ್ಳುವ ಸಮಾಜದಲಿ ಗಂಡನ ಆಳ್ವಿಕೆ ಅನೇಕ ಸಂಧರ್ಭಗಳಲ್ಲಿ ಹೆಣ್ಣಿಗೆ ಉಸಿರು ಕಟ್ಟಿಸುವಂತಹದು. ಅತ್ತೆಯ, ಗಂಡನ ಮಾತಿಗೆದುರಾಡದೆ, ಅಸಮ್ಮತಿ ಸೂಚಿಸದೆ ತಣ್ಣಗೆ ಬದುಕಿದರೆ ಬಾಳು 'ನೆಮ್ಮದಿ' ಹೊಂದಾಣಿಕೆಯ ಮನೋಭಾವದ ಕೊರತೆ ಹೆಣ್ಣನ್ನು ನಲುಗಿಸುವಷ್ಟು ಗಂಡನು ನಲುಗಿಸುವುದಿಲ್ಲ. ವಿವಾಹ ಸಂಬಂಧದ ಎಳೆಯು ಬಹಳ ಸೂಕ್ಷ್ಮವಾದುದು. ಅರ್ಥಮಾಡಿಕೊಳ್ಳುವುದು ಕಷ್ಟಸಾಧ್ಯ. ಯಾವ ಕಡೆಯಿಂದ ಗಟ್ಟಿಯಾಗಿ ಎಳೆದರೂ ಕಡಿದು ಹೋಗುವಷ್ಟು, ಸೂಕ್ಷ್ಮತೆ ಆ ಸಂಬಂಧದ್ದು. ಪರಸ್ಪರ ಹೊಂದಾಣಿಕೆ ಹಾಗೂ ವಿವೇಚನೆಯಿಂದ ಅದನ್ನು ಉಳಿಸಿಕೊಳ್ಳಬೇಕಾಗುತ್ತದೆ. ಅಥವಾ ಒಬ್ಬರು (ಹೆಚ್ಚಾಗಿ ಹೆಂಡತಿ) ಎಲ್ಲ ಒತ್ತಡಗಳನ್ನು ಸಹಿಸಿ ದಾರ ಕೀಳದಂತೆ ನೋಡಿಕೊಳ್ಳಬೇಕು. ಸ್ವತಂತ್ರ ವಿಚಾರಧಾರೆಯನ್ನು ವೈಗೂಡಿಸಿಕೊಂಡ ಹೆಣ್ಣಿಗೆ ಗಂಡನ ಎಲ್ಲ ನಡವಳಿಕೆಗಳನ್ನೂ ಪ್ರಶ್ನಿಸದೆ ಒಪ್ಪಿಕೊಳ್ಳಲು ಸಾಧ್ಯವಾಗುವುದಿಲ್ಲ. ಗಂಡನ ವಿವಾಹೇತರ ಸಂಬಂಧಗಳನ್ನು ಮುಂಚಿನ ದಿನಗಳಂತೆ ಈಗ ಹೆಂಡತಿ ಸಹಿಸಲಾರಳು ಅದರಲ್ಲಿಯೂ ಆರ್ಥಿಕವಾಗಿ ಸ್ವಾವಲಂಬಿಯಾದ ಮಹಿಳೆ ಸಾಕಷ್ಟು ಯೋಚಿಸಿ ತೀರ್ಮಾನವನ್ನು ಕೈಗೊಳ್ಳುತ್ತಾಳೆ. ಉದ್ಯೋಗ ನಿಮಿತ್ತ ಬೇರೆ ಬೇರೆ ಊರುಗಳಲ್ಲಿ ಇರಬೇಕಾದಾಗಲಂತೂ ಗಂಡ ಹೆಂಡತಿಯರಲ್ಲಿ ಪರಸ್ಪರ ನಂಬಿಕೆ, ವಿಶ್ವಾಸಗಳು ಬಹಳ ಅಗತ್ಯ, ಆರ್ಥಿಕ ಭದ್ರತೆಯು ಹೆಣ್ಣಿಗೆ ಸ್ವಾವಲಂಬನೆಯ ಸ್ಥೈರ್ಯವನ್ನು ನೀಡುತ್ತದೆ. ಪುರುಷ ಕೇಂದ್ರಿತ ವ್ಯವಸ್ಥೆಯಲ್ಲಿ ಮಹಿಳೆಯು ಹೊರಗಿನ ದುಡಿಮೆಯನ್ನು ಸವಾಲಾಗಿ ಸ್ವೀಕರಿಸಬೇಕಾಗಿದೆ. ಮುಂದುವರಿದ ರಾಷ್ಟ್ರಗಳ ಪರಿಸ್ಥಿತಿಯೂ ಇದಕ್ಕೆ ತೀರ ಭಿನ್ನವಾಗಿಲ್ಲ. ಅಲ್ಲಿಯೂ ಸ್ತ್ರೀಯರ ದುಡಿಮೆಯ ಬಗ್ಗೆ ಒಂದು ಸಾಂಪ್ರತಿಕ ಹಿಂದೆಳೆತ ಇದ್ದೇ ಇದೆ. ಶಾಲೆಗಳಿರುವ ಜಾಗ, ಸಾರ್ವಜನಿಕ ಸಾರಿಗೆಯ ಅಸಾಮರ್ಥ್ಯ, ಚಿಕ್ಕ ಕುಟುಂಬಗಳು ಇವೆಲ್ಲವೂ ಹೆಂಗಸು ಮನೆಯಲ್ಲಿ ಉಳಿಯುವ ಸಂಧರ್ಭವನ್ನು ಹೆಚ್ಚಿಸುತ್ತವೆ. ಇದರರ್ಥ, ಹೊರಗಿನ ದುಡಿತ ಒಂದರಲ್ಲಿಯೇ ಆಕೆಯ ವಿಮೋಚನೆ ಇದೆಯೆಂದೋ, ಹೊರಗೆ ದುಡಿಯುತ್ತಿರುವ ಮಹಿಳೆಗೆ ಸಮಸ್ಯೆಗಳೇ ಇಲ್ಲವೆಂದಲ್ಲ, ಅದರೆ ಸ್ತ್ರೀ ವಿಮೋಚನೆಯ ಅತ್ಯಂತ ಮೂಲಭೂತ ಅಗತ್ಯ, ಹೊರಗಿನ ದುಡಿಮೆ, ದುಡಿಮೆಗೆ ತಕ್ಕ ಪ್ರತಿಫಲ, ಅವಳ ಹಕ್ಕು ಹಾಗೂ ಆರ್ಥಿಕ ಸ್ವಾವಲಂಬನೆ

ಯೆಂಬುದು ಸ್ಪಷ್ಟ ಸಂಗತಿ. ಹೊರಗೆ ದುಡಿಯುತ್ತಿರುವ ಮಹಿಳೆ ಹಲವು ಒತ್ತಡಗಳ ನಡುವೆ ಬಸವಳಿಯುತ್ತಿರುವುದನ್ನು ನಾವು ಕಾಣುತ್ತೇವೆ. ಆಕೆಗೆ ಒಳಗಿನ ದುಡಿತದಲ್ಲಿ ಯಾವುದೇ ಕಡಿತವಿರದು. ಹೊರಗಿನ ದುಡಿಮೆಯ ಅನಿವಾರ್ಯತೆ. ಇಂತಹ ಸಂಧರ್ಭದಲ್ಲಿ ಮನೆಗೇ ಮೊದಲ ಆಧ್ಯತೆ ಕೊಡಬೇಕಾದ ಒತ್ತಡವಿರುತ್ತದೆ. ಈ ಹೊರೆಗಳಲ್ಲಿ ಮಾನಸಿಕ ಸ್ವಾಸ್ಥ್ಯವನ್ನು ಉಳಿಸಿಕೊಳ್ಳಲು ಆಕೆ ಬಹಳಷ್ಟು ಶ್ರಮಿಸಬೇಕಾಗುತ್ತದೆ. ಇಲ್ಲವೇ ಸೃಜನಶೀಲತೆಯನ್ನು ಜಿಟ್ಟುಕೊಟ್ಟು ಜಡ್ಡಾಗುತ್ತಾಳೆ. ಆದರೆ ಇಂತಹ ಪರಿಸ್ಥಿತಿಯಲ್ಲಿ ಪ್ರವಾಹದ ವಿರುದ್ಧವೇ ಈಜ ತನ್ನ ವೃತ್ತಿಯಲ್ಲಿ. ತನ್ನ ಕ್ಷೇತ್ರದಲ್ಲಿ ವ್ಯಕ್ತಿತ್ವವನ್ನು ಸ್ಥಾಪಿಸಿಕೊಳ್ಳಲು ಸದೃಢ ಸಂಕಲ್ಪವೂ ಬೇಕಾಗಿದೆ. ಎಂಬುದೂ ನಿಜ. ಒಳ ಹೊರಗಿನ ಪ್ರಪಂಚ, ದುಡಿಮೆಗಳನ್ನು ಹೆಂಗಸು, ಗಂಡಸಲಿಬ್ಬರೂ ಹಂಚಿಕೊಳ್ಳಬೇಕಾದ ಪ್ರಸಂಗದಲ್ಲಿ ಈ ಹಂಚುವಿಕೆ ಪ್ರಶ್ನೆಗೀಡಾಗುವ ಸಂಧರ್ಭಗಳೇ ಹೆಚ್ಚು. ಅಪರೂಪಕ್ಕೆ ಅಲ್ಲೊಮ್ಮೆ ಇಲ್ಲೊಮ್ಮೆ ಸಮಾನತೆಯ ಸಂಕೇತಗಳು ಕಂಡು ಬರಬಹುದು. ಅಲ್ಲೂ ಅನೇಕ ವಿಷಯಗಳನ್ನು ಹೆಣ್ಣಾದವಳು ರೂಢಿಯಿಂದ ಅವುಗಳು ತನ್ನದೇ ಖಾತೆಗಳೆಂಬುದನ್ನು

ಒಪ್ಪಿಕೊಂಡಿರುತ್ತಾಳೆ. ಮನೆಯ ವಾತಾವರಣದ ಪರಿಣಾಮ ಅವಳ ಔದ್ಯೋಗಿಕ ಕ್ಷೇತ್ರದಲ್ಲೂ ಕಂಡುಬರುತ್ತದೆ. ಮನೆಯ ವಾತಾವರಣ ಎಷ್ಟೇ ಸಮೃದ್ಧವಾಗಿದ್ದರೂ, ಔದ್ಯೋಗಿಕ ಕ್ಷೇತ್ರದ ತೊಡಕುಗಳು ಮನೆಯ ಆಗುಹೋಗುಗಳ ಮೇಲೆ ಪರಿಣಾಮವನ್ನು ಬೀರುತ್ತದೆ.

ಮಧ್ಯಮ ವರ್ಗದಲ್ಲಿ ಕಂಡು ಬರುವ ಹೆಣ್ಣು ಗಂಡಿನ ತಾರತಮ್ಯ ಕೂಲಿಕಾರ್ಮಿಕ ವರ್ಗ, ಶ್ರಮಜೀವಿಗಳ ವರ್ಗದಲ್ಲಿ ಹೆಚ್ಚು ಢಾಳಾಗಿ ಕಾಣುವುದಿಲ್ಲ. ಏಕೆ? ಬಹಳ ಹಿಂದಿನಿಂದಲೂ ಶಿಕ್ಷಿತರಾದ ಮೇಲ್ಜಾತಿಯ ಸ್ತ್ರೀಯರಿಗಿಂತಲೂ, ಅಶಿಕ್ಷಿತರಾದ, ಬಡ, ನಿಮ್ನ ವರ್ಗದ ಸ್ತ್ರೀಯರೇ ಹೆಚ್ಚು ಸ್ವತಂತ್ರರಾಗಿದ್ದರು. ಜಾತಿಯ ಬಿಗಿ ಕಟ್ಟುಪಾಡುಗಳಿಂದ ಹೆಚ್ಚು ಮುಕ್ತರಿದ್ದರು. ಸ್ವತಂತ್ರರಿದ್ದರು. ವಿಧವಾ ವಿಚ್ಛೇದ, ವಿಧವಾ ಪುನರ್ವಿವಾಹದ ಹಕ್ಕುಗಳ ಅರ್ಹತೆಗಳಿಲ್ಲದೆ ನರಳಬೇಕಾದ ಸ್ಥಿತಿ ಶಿಕ್ಷಿತರಾದ, ನಗರದ ಮೇಲ್ಜಾತಿಯ ಸ್ತ್ರೀಯರಿಗಿತ್ತೇವಿನಾ ಶೇ ೮೦% ರಷ್ಟಿದ್ದ ಹಳ್ಳಿಗಳ ಅಶಿಕ್ಷಿತ ಸ್ತ್ರೀಯರಿಗಿರಲ್ಲ. ಬಾಲ್ಯ ವಿವಾಹ, ಬಹು ಪತ್ನಿತ್ವಗಳು ಹಳ್ಳಿಗಳಲ್ಲಿ ಆಚರಣೆಯಲ್ಲಿದ್ದು. ಅವರ ಸ್ವಾತಂತ್ರ್ಯಕ್ಕೆ ಸ್ವಲ್ಪ ಅಡಚಣೆಗಳುಂಟಾಗಿದ್ದರೂ, ಉಳಿದ ಎಷ್ಟೋ ವಿಚಾರಗಳಲ್ಲಿ ಮೇಲ್ಜಾತಿಯ ಸ್ತ್ರೀಯರಂತೆ ನಿಯಮಗಳ, ಕಟ್ಟುಪಾಡುಗಳ ಸಂಕೋಲೆಗಳಿಂದ ಬಂಧಿತರಾಗದೆ ತಮ್ಮ ಪುರುಷರೊಂದಿಗೆ ಸಮಾನ ಸ್ಕಂಧರಂತೆ ಜೀವಿಸುತ್ತಿದ್ದರು. ಇಲ್ಲಿಯೂ ಸಾಮಾನ್ಯವಾಗಿ ಪುರುಷರ ಪ್ರಧಾನ್ಯತೆಯನ್ನು ಒಪ್ಪಿಕೊಂಡು ನಡೆಯಲಾಗುತ್ತಿತ್ತು. ಆದರೆ ಸಂಪೂರ್ಣ ಶರಣಾಗತಿಯ ಜೀವನ ಇವರದಾಗಿರಲಿಲ್ಲ. ಆದರೆ ತಾರತಮ್ಯದ ಬಿಸಿ, ಮಧ್ಯಮ ವರ್ಗದ ಮಹಿಳೆಯನ್ನೆ ಸದಾ ತಟ್ಟುವುದು ಏಕೆ ಹೀಗೆ? ಕುಟುಂಬಕ್ಕೆ ಆರ್ಥಿಕ ಬಲವನ್ನೂ ಹೊಂದಿಸಿಕೊಡುತ್ತ. ಅನೇಕ ಸಂಧರ್ಭಗಳಲ್ಲಿ ಗಂಡಿಗಿಂತ ಹೆಚ್ಚಿಗೆ ಸಂಪಾದನೆಯನ್ನು ಮಾಡಿ, ನಿಭಾಯಿಸುವ ಮಧ್ಯಮ ವರ್ಗದ ಮಹಿಳೆ ಇಂತಹ ತಾರತಮ್ಯ ಹಾಗೂ ಶೋಷಣೆಗೆ ಒಳಗಾಗುತ್ತಾಳೆ. ಇದನ್ನು ಮೀರುವ ಪ್ರಯತ್ನ ಇಂದು ನಮ್ಮದಾಗಬೇಕು.

ಮಹಿಳೆಯ ಜಾಗೃತಿ ಒಂದೆಡೆ ಆಗುತ್ತಿದ್ದರೂ, ಇನ್ನೊಂದೆಡೆ ಅವರು ನಾನಾ ತರದ ಹಿಂಸೆಗೆ ಒಳಗಾಗುತ್ತಿರುವುದನ್ನು ನಾವು ದಿನನಿತ್ಯ ಪತ್ರಿಕೆ, ಟಿವಿ. ಮಾಧ್ಯಮಗಳಿಂದ ತಿಳಿಯುತ್ತೇವೆ. ವರದಕ್ಷಿಣೆಗೆ ಸಂಬಂಧಿಸಿದಂತೆ ಸ್ತ್ರೀಯರ ಕೊಲೆ, ಲೈಂಗಿಕ ಅತ್ಯಾಚಾರ, ಗೃಹಿಣಿಯರ ಮೇಲಿನ ಕ್ರೌರ್ಯ ಇಂಥವು ವರದಿಯಾಗುತ್ತಲೇ ಇವೆ. ಇವುಗಳನ್ನು ಸಾಮಾಜಿಕ ವ್ಯವಸ್ಥೆಯ ವ್ಯಕ್ತರೂಪಗಳೆಂದೇ ಪರಿಗಣಿಸಿ, ಅಪರಾಧಿಗಳನ್ನೂ ಬಯಲಿಗೆಳೆದು ಬುದ್ದಿ ಕಲಿಸುವ ಯತ್ನವನ್ನು ನಡೆಸುವುದಿದೆ.

ನಮ್ಮ ಧರ್ಮಶಾಸ್ತ್ರಗಳು ವೈವಿಹಿಕ ಜೀವನ ಹಾಗೂ ಪಾತಿವ್ರತ್ಯವನ್ನು ವೈಭವೀಕರಣ ಮಾಡಿ ಸ್ತ್ರೀಯರನ್ನು ಪುರುಷರಿಗೆ ಅಧೀನರನ್ನಾಗಿಸಿದುವು. ಧರ್ಮಶಾಸ್ತ್ರಗಳು ಸ್ತ್ರೀಯರ ಬಗೆಗೆ ಬಹಳ ಬಿಗುವಿನ ನಿಲುವನ್ನು ತಳೆದುದರಿಂದ ಕೆಲವು ಸಮಸ್ಯೆಗಳು ಹುಟ್ಟಿಕೊಂಡವು ಎಂದು ಪರಿಗಣಿಸಲಾಗಿದೆ. ಮಾಲೀಜ, ಯಾಜ್ಞವಲ್ಕ್ಯ, ಪರಾಶರ ಮುಂತಾದವರು ವಿಧಿಸಿದಂತೆ, ಸ್ತ್ರೀಯರಿಗೆ ಅವರು ರಜಸ್ವಲೆಯಾಗುವುದಕ್ಕಿಂತ ಮುಂಚೆಯೇ ವಿವಾಹ ಮಾಡಬೆಕೆಂಬ ಪದ್ಧತಿಯಿಂದಾಗಿ, ವೈಯಕ್ತಿಕವಾಗಿ ಸ್ತ್ರೀಯರಿಗೆ ಹೆಚ್ಚು ಅಪಾಯಕಾರಿಯಾದ ಬಾಲ್ಯ ವಿವಾಹದಂತಹ ಆಚರಣೆ ಅಸ್ತಿತ್ವಕ್ಕೆ ಬರುವುದು ಅನಿವಾರ್ಯವಾಯಿತು. ವಿವಾಹವು ಕಡ್ಡಾಯವಾಗಿ ಮತ್ತು ಬಾಲ್ಯ ವಿವಾಹವು ಅನಿವಾರ್ಯವಾಗಿ ಪರಿಣಮಿಸಿದ್ದರಿಂದ, ಹಣವನ್ನು ಕೊಟ್ಟು, ಅಮಿಷವೊಡ್ಡಿಯಾದರೂ ವಿವಾಹ ಮಾಡಬೇಕೆಂಬ ಒತ್ತಡವುಂಟಾಗಿ ವರದಕ್ಷಿಣೆಯ ಪಿಡುಗು ಆರಂಭವಾಯಿತು. ಪಾತಿವ್ರತ್ಯದ ವೈಭವೀಕರಣ ದಿಂದಾಗಿ ಪತಿಯೇ ಪರದೈವವೆಂಬ ನಂಬಿಕೆ ಮೂಡಿ ಪತಿಯು ತಮಗಿಂತ ಮುಂಚೆ ಸಾಯುವುದಾದಲ್ಲಿ ಅವರೊಂದಿಗೆ ತಾವು ಕೂಡ ಸಾಯುವುದರೊಂದಿಗೆ ತಮಗೆ ಶ್ರೇಯಸ್ಸು ಲಭಿಸುವುದೆಂದು ಮುಗ್ಧಸ್ತ್ರೀಯರು ಭಾವಿಸಿದ್ದರಿಂದ "ಸತೀ ಆಚರಣೆ " ಅಸ್ತಿತ್ವಕ್ಕೆ ಬಂತು. ಮುಸ್ಲಿಂ ಧಾರ್ಮಿಕಾಚಾರಗಳಿಂದ ರಕ್ಷಿಸಿಕೊಳ್ಳಲು ಕೂಡ ಸ್ತ್ರೀಯರು ಸತೀ ಆಚರಣೆಗೆ ಸಾಮೂಹಿಕ ಆತ್ಮ ಬಲಿದಾನದ ಜೋಹರ್ ಪದ್ಧತಿಗೆ (ಮುಖ್ಯವಾಗಿ ರಜಪೂತರು) ಒಳಗಾದುದಿದೆ. ಸತೀ ಹೋಗದ ವಿಧವೆಯರು ಎಲ್ಲರ ಅವಹೇಳನ, ಭರ್ತ್ಸನೆ, ಕ್ರೂರತೆಗಳಿಗೆ ಒಳಗಾಗಿ ವೈಧವ್ಯದ ಜೀವಚ್ಛವದ ಜೀವನವನ್ನು ನಡೆಸಬೇಕಾಯಿತು. ಬೃಹತ್ ದೇವಾಲಯಗಳ ಸ್ಥಾಪನೆಯೊಂದಿಗೆ ಭಕ್ತ ಜನರ ದೈವಿಕ ಭಾವನೆಯ ಪ್ರಕಟೀಕರಣಕ್ಕಾಗಿ, ಹಾಗೂ ದೇವ ದೇವತೆಗಳ ಸಂತೃಪ್ತಿಗಾಗಿ ನೃತ್ಯ ಸಂಗೀತಗಳ ವ್ಯಾಪಕ ಬಳಕೆ ಆರಂಭವಾದ ಮೇಲೆ ದೇವರ ಸೇವೆಗೆಂದು ದೇವಾಂಗನೆಯರು (ದೇವದಾಸಿಯರು) ಎಂಬ ಸ್ತ್ರೀಯರ ವಿಶಿಷ್ಟ ಸಮೂಹವೊಂದನ್ನು ನಿರ್ಮಿಸಲಾಯಿತು ಆರಂಭದಲ್ಲಿದ್ದ ಉದ್ದೇಶಗಳು ಮರೆಯಾಗಿ ಕ್ರಮೇಣ ಈ ಸಮೂಹವನ್ನು, ಶ್ರೀಮಂತರು ರಾಜರ ಅಮೋದ ಪ್ರಮೋದ ಮತ್ತು ಸುಖ ಭೋಗಗಳಿಗೆ ಒಂದು ಸಾಧನವಾಗಿ ಬಳಸಿಕೊಳ್ಳಲಾಯಿತು. ದೇವದಾಸಿಯರು ಎಂದರೆ ಹಣಕ್ಕಾಗಿ ತಮ್ಮನ್ನು ಮಾರಿಕೊಳ್ಳುವ 'ವೇಶ್ಯೆಯರು' ಎಂಬಂತೆ ಅವರನ್ನು ಕಾಣಲಾಯಿತು. ಈ ದೇವದಾಸೀ ಪದ್ಧತಿಯು, ಸ್ತ್ರೀ ಶೋಷಣೆಯ ಇನ್ನೊಂದು ಮಾದರಿಯಾಯಿತು. ಬ್ರಿಟಿಷರ ಕಾಲದವರೆಗೂ ಈ ಪದ್ಧತಿ ವ್ಯಾಪಕವಾಗಿ ಮುಂದುವರಿದಿತ್ತು.

ಇಂತಹ ಸಾಮಾಜಿಕ ವ್ಯತೀರಿಕ್ತ ಪರಿಸರದ ಈ ಅವಧಿಯಲ್ಲೂ ಕೆಲವು ಸ್ತ್ರೀಯರು ತಮ್ಮ ಪ್ರತಿಭೆ ಹಾಗೂ ಸಾಮರ್ಥ್ಯಗಳನ್ನು ಮೆರೆದಿದ್ದಾರೆ. ಭಕ್ತಿಪಂಥದ ಮೀರಾ, ತಾರಾಬಾಯಿ, ಜಿಜಾ ಬಾಯಿ, ರಾಣಿ ಚನ್ನಮ್ಮ, ಸಂಬಿಯ ಹೊನ್ನಮ್ಮ, ಅಕ್ಕಮಹಾದೇವಿ, ರಾಣಿ ಚಾಂದ್ ಬೀಬಿ, ಜಹಾಂಗೀರನ ಪತ್ನಿ ನೂರ್ ಜಹಾನ್, ರಾಣಿ ಮಮ್ ತಾಜ್, ಮುಂತಾದ ಸ್ತ್ರೀಯರು ಸಂಧರ್ಭದ ಮಹತ್ವದಿಂದ ಹಾಗೂ ಪರಿಸ್ಥಿತಿಯ ಅನಿವಾರ್ಯತೆಯಿಂದ ಬಹಳ ಉನ್ನತ ಮಟ್ಟಕ್ಕೆ ಏರಿದ್ದೂ ಅಲ್ಲದೆ ಪುರುಷರಿಗೆ ಏನೂ ಕಡಿಮೆ ಇಲ್ಲದಂತೆ ಸಾಹಿತ್ಯ, ಕಲೆ, ರಾಜ್ಯಾಡಳಿತ, ಯುದ್ಧ ಮುಂತಾದ ಕ್ಷೇತ್ರಗಳಲ್ಲಿ ಸಾಧನೆಯನ್ನು ಮಾಡಿದ್ದಾರೆ. ಆದರೆ ಈ ಸಂಖ್ಯೆ ಕೇವಲ ಬೆರಳೆಣಿಕೆಯಷ್ಟೆ. ಬಹುಪಾಲು ಸ್ತ್ರೀಯರು ಸಾಂಪ್ರದಾಯಿಕ ಕಟ್ಟುಪಾಡುಗಳು ಮತ್ತು ರೂಢಿ ಪದ್ಧತಿಗಳ ಬಿಗಿಮುಷ್ಟಿಯಲ್ಲಿಯೇ ಸಿಲುಕಿಕೊಂಡು ಪುರುಷರ ಅಧೀನತೆಯಲ್ಲಿಯೇ ಜೀವಿಸಬೇಕಾಗಿತ್ತು.

ಬ್ರಿಟಿಷ್ ಕಾಲಾವಧಿಯಲ್ಲಿ ಸ್ತ್ರೀಯರ ಸ್ಥಾನಮಾನಗಳಲ್ಲಿ ಹಲವಾರು ವಿಧಾಯಕ ಸ್ವರೂಪದ ಪರಿವರ್ತನೆಗಳಾದುವು ಸ್ತ್ರೀಯರ ವಿಮೋಚನೆಗೆ ಸಮಾಜ ಸುಧಾರಕರು ಪಟ್ಟ ಶ್ರಮ, ಸಾಮಾಜಿಕ ಶಾಸನಗಳ ಪಾತ್ರ, ಮಹಿಳಾ ಶಿಕ್ಷಣಕ್ಕೆ ಒತ್ತು, ಮಹಿಳಾ ನೇತಾರರು ಮತ್ತು ಮಹಿಳಾ ಸಂಘಗಳ ಪಾತ್ರ, ಉದ್ಯೋಗ ಕ್ಷೇತ್ರದಲ್ಲಿ ಸ್ತ್ರೀಯರು, ಸ್ವಾತಂತ್ರ್ಯ ಸಂಗ್ರಾಮದಲ್ಲಿ ಮಹಿಳೆಯರ ಪಾತ್ರ ಮುಂತಾದ ಬೆಳವಣಿಗೆಗಳು ಮಹಿಳೆ ತನ್ನ ಅವರಣವನ್ನು ಕಳಚಿ ಹೊರಬಂದ ನಿದರ್ಶನಗಳನ್ನು ನೀಡುತ್ತವೆ. ಅವರ ಹಿಂದಿನ ಅದೆಷ್ಟೋ ಸಮಸ್ಯೆಗಳು ಈಗ ಇಲ್ಲವಾಗಿದೆ. ಅಮಾನುಷವಾದ ಸತೀ ಆಚರಣೆ, ಬಾಲ ವಿವಾಹ, ವಿಧವಾ ಪುನರ್ವಿವಾಹ ನಿಷೇಧ, ವಿಧವೆಯರ ಶೋಷಣೆ, ದೇವದಾಸಿ ಪದ್ಧತಿ ಮುಂತಾದ ಸಮಸ್ಯೆಗಳು ಈಗ ಬಹುತೇಕ ಕಣ್ಮರೆಯಾದಂತಾಗಿ ಆರ್ಥಿಕ, ವೈಜ್ಞಾನಿಕ ಬೆಳವಣಿಗೆ, ಶಿಕ್ಷಣದ ವ್ಯಾಪಕತೆ, ರಾಜಕೀಯ, ಸಾಮಾಜಿಕ ಆಂದೋಲನಗಳು, ನಗರೀಕರಣ, ಪಾಶ್ಚಾತ್ತೀಕರಣ, ಆಧುನಿಕೀರಣ ಮುಂತಾದ ಬೆಳವಣಿಗೆಗಳಿಂದಾಗಿ ಸ್ತ್ರೀಯರು ತಮಗೂ ವ್ಯಕ್ತಿತ್ವವಿದೆ, ಪ್ರತಿಭೆಯಿದೆ, ಸ್ವಸಾಮರ್ಥ್ಯವಿದೆ ಎಂಬುದನ್ನು ಸಾಬೀತುಪಡಿಸಿ ತೋರಿಸಲು ಸಾಧ್ಯವಾಯಿತು ಸ್ವತಂತ್ರ ಭಾರತದಲ್ಲಿ ಸ್ತ್ರೀಯರ ಸ್ಥಾನಮಾನವನ್ನು ಹೆಚ್ಚಿಸುವ ಹಾಗೂ ಕಲ್ಯಾಣವನ್ನು ಸಾಧಿಸುವ ದೃಷ್ಟಿಯಿಂದ ಹಲವಾರು ಶಾಸನಾತ್ಮಕ, ಶೈಕ್ಷಣಿಕ, ಆರ್ಥಿಕ ಮತ್ತಿತರ ಕ್ರಮಗಳನ್ನು ಕೈಗೊಂಡ ಪರಿಣಾಮವಾಗಿ ಹಿಂದೂ ವಿವಾಹ

ಕಾಯ್ದೆ (1955), ಹಿಂದೂ ಉತ್ತರಾಧಿಕಾರ ಕಾಯ್ದೆ (1956), ಹಿಂದೂ ದತ್ತು ಮತ್ತು ಜೀವನಾಂಶ ಕಾಯ್ದೆ (1956) ಕ್ರಿಮಿನಲ್ ಕಾನೂನು ತಿದ್ದುಪಡಿ ಕಾಯ್ದೆ (1983), ಹೀಗೆ ಅನೇಕ ಕಾಯ್ದೆಗಳು ಸ್ತ್ರೀ ವಿಮೋಚನೆಯನ್ನು ಸಬಲಗೊಳಿಸುದುವು.

ಆಧುನಿಕಯುಗದಲ್ಲಿ ಸ್ತ್ರೀಯರಿಗೆ ಉತ್ತಮ ಸ್ಥಾನಮಾನಗಳನ್ನು ನೀಡಲಾಗಿದೆ ಎಂದ ಮಾತ್ರಕ್ಕೆ ಅವರು ಸಮಸ್ಯೆಗಳಿಂದ ಮುಕ್ತರು ಎನ್ನುವಂತಿಲ್ಲ. ಬದಲದ ಪರಿಸ್ಥಿತಿಯಲ್ಲಿ ಅವರ ಅಂತಸ್ತಿನ ಸುಧಾರಣೆಯಾಗುತಿದ್ದಂತೆ ಅವರು ಹೊಸ ಹೊಸ ಸಮಸ್ಯೆಗಳನ್ನು ಎದುರಿಸಬೇಕಾಗಿ ಬಂದಿದೆ.

ಲೈಂಗಿಕ ಅತ್ಯಾಚಾರ, ದೌರ್ಜನ್ಯ, ವರದಕ್ಷಿಣೆ ಕಾರಣಕ್ಕಾಗಿ ನವವಿವಾಹಿತ ವಧುವಿನ ದಹನ, ಹೆಂಡತಿಗೆ ಹೊಡೆಯುವುದು, ಹೆಣ್ಣು ಮಕ್ಕಳ ಅಪಹರಣ, ಬಲವಂತವಾಗಿ ಜುಂಬಿಸುವುದು, ಅಲಂಗಿಸುವುದು, ಮತ್ತಿತರ ರೀತಿಯಲ್ಲಿ ಪೀಡನೆಗೆ ಒಳಪಡಿಸುವುದು, ಆರ್ಥಿಕ ಲೈಂಗಿಕ ಶೋಷಣೆಗೆ ಒಳಪಡಿಸವುದು, ಆಸೆ ಆಮಿಷ ತೋರಿಸಿ, ಮದುವೆಯಾಗುವ ಭರವಸೆನೀಡಿ, ಬೇರೆ ಮತಕ್ಕೆ ಮತಾಂತರ ಮಾಡುವುದು ಮತ್ತಿತರ ರೀತಿಯ ಅಪರಾಧಗಳು ಸ್ತ್ರೀಯರ ವಿರುದ್ಧ ನಡೆಯುತ್ತಲೇ ಇವೆ. ಅಸಂಘಾಟಿತ ಕ್ಷೇತ್ರದಲ್ಲಿ ಸ್ತ್ರೀಯರನ್ನು ಎಲ್ಲಾ ದೃಷ್ಟಿಯಿಂದ ಶೋಷಿಸಲಗುತ್ತಿದ್ದರೆ ಸಂಘಟಿತ ಕ್ಷೇತ್ರದಲ್ಲಿ ಸ್ತ್ರೀಯರಿಗೆ ಕಿರುಕುಳ ಕೊಡುವ ಪ್ರವೃತ್ತಿ ಕಾಣಿಸುತ್ತದೆ. ಜಲನಚ್ರಗಳಲ್ಲಿ, ಪತ್ರಿಕೆಗಳಲ್ಲಿ ಸ್ತ್ರೀಯರನ್ನು ಕೇವಲ ಕಾಮನೆಯ ವಸ್ತು ಎಂಬಂತೆ ಚಿತ್ರೀಕರಿಸಲಾಗಿರುವುದರಿಂದ ಸ್ತ್ರೀಯರ ಅಸಮೌಲ್ಯ ನಡೆದಿದೆ. ಹರಿಜನ ಸ್ತ್ರೀಯರು ದುರಾಚಾರಕ್ಕೆ ಒಳಗಾಗಿದ್ದರೆ ಆದಿವಾಸಿ ಕನೆಯರನ್ನು ಅಂತಾರಾಷ್ಟ್ರೀಯ ಮಾರುಕಟ್ಟೆಗಳಲ್ಲಿ ಮಾರಾಟ ಮಾಡುವ ದುಷ್ಟ ವ್ಯವಹಾರವೂ ನಡೆದಿದೆ. ಆರ್ಥಿಕ ಅನುಕೂಲತೆಗಳನ್ನು ಹೆಚ್ಚಿಸುತ್ತಿರುವುದರ ಹೊರತಾಗಿಯೂ ಸ್ತ್ರೀಯರು ಬಡತನದಿಂದಾಗಿಯೇ ಇಂದಿಗೂ ಹೆಚ್ಚು ಹೆಚ್ಚು ವೇಶ್ಯಾವಾಟಿಕೆಗಳಿಗೆ ನೂಕಲ್ಪಡುತ್ತಿದ್ದಾರೆ. ಆರೋಗ್ಯ, ಶಿಕ್ಷಣ, ಉದ್ಯೋಗ ಹಾಗೂ ಕೌಟುಂಬಿಕ ಕ್ಷೇತ್ರಗಳಲ್ಲಿಯೂ ಈ ಹಿಂದಿಗಿಂತಲೂ ಭಿನ್ನವಾದ ಕೆಲವು ಸಮಸ್ಯೆಗಳನ್ನು ಅವರಿಂದು ಎದುರಿಸುತ್ತಿದ್ದಾರೆ.

ಇದುವರೆಗೆ ನಡೆದುಕೊಂಡು ಬಂದಿರುವಂತೆ ಈಗಲೂ ಮಾನವನ ನಾಗರಿಕತೆಯು ಪುರುಷ ಪ್ರಧಾನವಾದುದೇ ಆಗಿದೆ. ಸ್ತ್ರೀಯರು ವಹಿಸುತ್ತಿರುವ ಪಾತ್ರದ ಬಗ್ಗೆ ಈಗ ಮೊದಲಿಗಿಂತಲೂ ಹೆಚ್ಚಿನ ಅರಿವು ಮೂಡಿರಬಹುದಾದರೂ, ಆದರಿಂದಾಗಿ ಸಮಾನತೆಯ ಅವಶ್ಯಕತೆ ಇದೆ ಎಂಬ ತಿಳಿವು ಮೂಡಿದೆ ಎನ್ನುವಂತಿಲ್ಲ. ಸ್ತ್ರೀಯರು ತಮ್ಮ ಸ್ತ್ರೀ ಪಾತ್ರವನ್ನು ಪುರುಷರಿಗೆ ಸಮಾನವಾಗಿ ಎನ್ನುವುದಕ್ಕಿಂತ ಅರ್ಥಪೂರ್ಣವಾಗಿ ಹಾಗು ಗೌರವಯುತವಾಗಿ ನಿರ್ವಹಿಸಲು ಬಯಸುವರು ಭಾರತದ ಸ್ತ್ರೀಯರ ವಿಷಯದಲ್ಲಂತೂ ಈ ಮಾತು ನಿಜ. ಭಾರತೀಯ ಮಹಿಳೆಯರು ಇಂದು ಬಯಸುವುದು ಸಮಾನತೆಯ ಜತೆಜತೆಗೆ ಸಾಮಾಜಿಕ ಸ್ವಾತಂತ್ರ್ಯ ಸ್ವಾವಲಂಬನೆ ಮತ್ತು ಶೋಷಣೆಯಿಂದ ಮುಕ್ತವಾದ ಸಾಮಾಜಿಕ ಮತ್ತು ಆರ್ಥಿಕ ಪರಿಸರ.

ಸಮಾಜದ ಮನಸ್ಥಿತಿ ಬದಲಾಗಬೇಕು, ಆಗುತ್ತ ಇದೆ. ಎಲ್ಲ ಋಣಾತ್ಮಕ ಅಂಶಗಳೆದುರೂ ಇಂದು, ಅಲ್ಲೊಂದು, ಇಲ್ಲೊಂದು ಧನಾತ್ಮಕ ನಿದರ್ಶನಗಳು ಕಂಡು ಬರುತ್ತಿವೆ. ಅವಸರದ ವಿವಾಹಗಳು ಅನೇಕ ಸಲ ವಿಫಲವಾಗಿ ಪಶ್ಚಾತ್ತಾಪಕ್ಕೆ ಒಳಪಡುವ ಕುಟುಂಬಗಳ ನಿದರ್ಶನಗಳು ನಮ್ಮ ಮುಂದಿವೆ. ಆದರೆ ಬದಲಾದ ಪರಿಸ್ಥಿತಿಯಲ್ಲಿ ಜೀವನ ಪರ್ಯಂತ ಹೆಣ್ಣು ಪತಿಯೇ ಪರದೈವವೆಂದು ರೋಧಿಸುತ್ತ ಕಾಲಹರಣ ಮಾಡಾಬೇಕಾಗಿಲ್ಲ. ಅಕೆಯ ಮುಂದಿರುವ ವಿಶಾಲ ಜಗತ್ತು ಅವಳನ್ನು ಶೈಕ್ಷಣಿಕವಾಗಿ ಮುಂದುವರಿಯಲು ಪ್ರೇರೇಪಿಸುತ್ತದೆ. ಆರ್ಥಿಕ ಸ್ವಾವಲಂಬನೆಯನ್ನು ಹೊಂದಲು ಬಲ ನೀಡುತ್ತದೆ.

ಭಾರತೀಯ ಸಮಾಜದ ಮಧ್ಯಮ ವರ್ಗದ ದುಡಿಯುವ ಮಹಿಳೆಯನ್ನು ಉದ್ದೇಶಿಸಿ ನಡೆಸಿದ ಈ ವರೆಗಿನ ಸಮೀಕ್ಷೆಯಿಂದ ಕೆಳಗಿನ ಫಲಿತವನ್ನು ಪಡೆಯಬಹುದು.

1. ದುಡಿಯುವ ಮಹಿಳೆಗೆ ದುಡಿಯುವ ಕ್ಷೇತ್ರಗಳು ಎರಡು. ಅಕೆ ದುಡಿಯುವ ಕಚೇರಿ ಒಂದು ಕೇಂದ್ರವಾದರೆ, ಹಗಲೆನ್ನದೆ ಇರುಳೆನ್ನದೆ ದುಡಿಯುವ ಗೃಹ ಎರಡನೇ ಕೇಂದ್ರ.

2. ಸಾಮಾನ್ಯವಾಗಿ ಭಾವಿಸುವಂತೆ ಹೆಣ್ಣಿನ ಶೋಷಣೆಯಲ್ಲಿ ಲೈಂಗಿಕತೆ ಒಂದೇ ಮಾಪಕವಲ್ಲ. ಲೈಂಗಿಕವಾಗಿ ಹೆಣ್ಣನ್ನು ಶೋಷಿಸುವ ವಿವಿಧ ಆಯಾಮಗಳನ್ನು (Plane) ಕುರಿತಾಗಿ ವಿಶೇಷವಾದ ಚರ್ಚೆ ಸಾಮಾನ್ಯವಾಗಿ ನಡೆಯುತ್ತದೆ ಮತ್ತು ಅದು ಸತ್ಯವಾದದ್ದು ಕೂಡಾ ಈ ಸಂಪ್ರಬಂಧವು ಹೆಣ್ಣಿನ ಲೈಂಗಿಕ ಶೋಷಣೆಯ ಜೊತೆಗೆ ಅವಳನ್ನು ಬವಣೆಗೊಳಿಸುವ ಇತರ ಶೋಷಣೆಯ ಅಂಶಗಳನ್ನು ಪರಿಗಣಿಸುತ್ತದೆ. ಭಾವನಾತ್ಮಕ ಶೋಷಣೆಗೆ ಇಲ್ಲಿ ಸಿಂಹಪಾಲು.

3. ಹೆಣ್ಣಿನ ಧಾರಣಾ ಶಕ್ತಿಗೆ ಗಂಡಿನ ಧಾರಣಾ ಶಕ್ತಿಗಿಂತ ಹೆಚ್ಚಿನ ಕಸುವು ಇರುವುದು ವ್ಯಕ್ತವಾಗಿದೆ. ಗಂಡು ಹೆಣ್ಣಿನ ಜೈತನ್ಯದ ಮೂಲಸೆಲೆಯೇ ಹೆಣ್ಣು. ಆದುದರಿಂದಲೇ ಅಕೆ ತನಗೆದುರಾದ ಸವಾಲುಗಳನ್ನು ನಿಭಾಯಿಸಲು ಹೆಣಗಾಡುತ್ತಾಳೆ. ಇದರಲ್ಲೂ ಎಷ್ಟೋ ಬಾರಿ ಸೋಲು ಸನ್ನಿಹಿತವಾಗುವ ಸಂಧರ್ಭಗಳನ್ನು ಕಾಣುತ್ತೇವೆ.

4. ಕೌಟಂಬಿಕ ನೆಲೆಯಲ್ಲಿ ಮಧ್ಯಮ ವರ್ಗದ ಮಹಿಳೆಗೆ ಮಾತ್ರವೇ ಈ ಬಗೆಯ ತಾರತಮ್ಯದ ಬಿಸಿ ತಟ್ಟುವುದನ್ನು ಕಾಣುತ್ತೇವೆ. ಮಕ್ಕಳ ಲಾಲನೆ. ಮಕ್ಕಳ ಮೇಲಿನ ಪ್ರಭಾವದಲ್ಲಿ ಅಮ್ಮನದೇ ಹೆಚ್ಚು ಪಾತ್ರ. ಕೊಳ್ಳುಬಾಕ ಸಂಸ್ಕೃತಿಯ ಹಿನ್ನಲೆಯಲ್ಲಿ ಮಕ್ಕಳ ಮತ್ತು ಇತರರ ಬೇಕುಗಳಿಗೆ ಸ್ಪಂದಿಸಲು ಅಕೆ ಹೈರಾಣ ಪಡುತ್ತಾಳೆ.

5. ಮಹಿಳೆಯ ತಲ್ಲಣಗಳು ಎರಡು ವಿಧವಾದವು: ದೈಹಿಕ ಹಾಗೂ ಮಾನಸಿಕ, ದೈಹಿಕ ತಲ್ಲಣಗಳಿಗೆ ಮೂಲವಾಗುವ ಜೀವನ ಪದ್ಧತಿ, ಋತುಸ್ಥಂಬದ ಸಮಯದಲ್ಲಿ ತಲ್ಲಣಗಳಿಗೆ ಸಮಾಧಾನದ ಸಾಂತ್ವನದ, ಸಮನ್ವಯದ ಅವಶ್ಯಕತೆ ಆಕೆಗೆ ಇರುತ್ತದೆ. ಆ ಸಂಧರ್ಭದಲ್ಲಿ ಸಮಾಧಾನ ಚಿತ್ತವನ್ನೂ ನೀಡಲು ಜೀವನ ಸಂಗಾತಿಗೆ ಸಾಧ್ಯವಿದೆ. ಭಾವನಾತ್ಮಕ ಸುರಕ್ಷತೆಯು ಗಂಡಿಗೆ ಹೆಣ್ಣಿನಿಂದ ಸಿಗುತ್ತದೆ. ಆದರೆ ಅದೇ ಗಂಡಿನಿಂದ ಹೆಣ್ಣಿಗೆ ಸಿಗುತ್ತದೆಯೇ? ಸಿಕ್ಕಾಗ ಮಾತ್ರ ಅವರವರ ಅಸ್ತಿತ್ವಕ್ಕೆ ಬೆಲೆ ಬರುತ್ತದೆ. 'ನೀನು ನನಗೆ ಅನಿವಾರ್ಯ' ಎಂಬ ಭಾವನೆ ಅಕೆಗೆ ಬರುವಂತಾಗಬೇಕು. ಗಂಡು ಹೆಣ್ಣಿನ ಪರಸ್ಪರರ ಅವಶ್ಯಕತೆ ಲೈಂಗಿಕ ಅವಶ್ಯಕತೆಯ ವಯಸ್ಸನ್ನು ಮೀರಿದ ನಂತರವು ಬೇಕು. ಜೈವಿಕ ವ್ಯತ್ಯಾಸಗಳಿಂದಿಗೆ (Biological differences) ಮಾನಸಿಕ ವೈರುಧ್ಯಗಳುಂಟಾಗುತ್ತವೆ. ಅಂತಹ ಹಂತದಲ್ಲಿ ನಡವಳಿಕೆಯ ಸಾಂತ್ವನವು ಆಕೆಗೆ ಸದಾ ಬೇಕಾಗುತ್ತದೆ. ವರಿಸಿದ ಪತಿ ಆಕೆಯ ಮನಸ್ಥಿತಿಯನ್ನು ನಿಭಾಯಿಸುವ ಕೌಶಲ್ಯವನ್ನು ತೋರಿದಾಗ ಸಮಸ್ಯೆಗಳು ಸುರಳೀತವಾಗಿ ನಿವಾರಣೆಗೊಳ್ಳುತ್ತವೆ. ಇಲ್ಲವಾದಲ್ಲಿ ಅವೇ ಉಲ್ಬಣಿಸುತ್ತವೆ.

ಈ ಹಿನ್ನಲೆಯೊಂದಿಗೆ ದುಡಿಯುವ ಮಹಿಳೆಯ ಬದುಕು ಕೇವಲ "ಪುಣ್ಯಕೋಣಿಯ ಮಾದರಿ" ಯನ್ನು ಪೋಷಿಸುವುದಕ್ಕೆ ಉತ್ಸುಕವಾಗಿರುವ ಸಮಾಜ ನಮ್ಮದು, ಈ ದೃಷ್ಟಿಧೋರಣೆಗಳು ಬದಲಾದಾಗ ಅವಳ ಬಾಳು ಸಹನೀಯವಾಗಿ ಅವಳಲ್ಲಿರುವ ಎಲ್ಲಾ ಕೃತುಶಕ್ತಿಗಳು ವಿಕಾಸಗೊಳ್ಳಬಹುದೆಂಬುದು ಇಲ್ಲಿಯ ಒಟ್ಟು ಮಥಿತ ಅರ್ಥ.

ಆಕಾರ ಸೂಚಿ:

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CHEMICAL, BIOLOGICAL AND MATERIALS SCIENCES

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"TRATAMIENTO DEL AGUA EN ATAJADOS DEL CHACO BOLIVIANO, MEDIANTE TECNOLOGIA BIOLOGICA Y SU VALORACIÓN ECONÓMICA"

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Introducción.-Las comunidades de El Chaco boliviano, dentro de sus actividades socioeconómicas presentan una agricultura de subsistencia, sumadas a las adversidades climatológicas efectuados por la sequía, los agricultores no tienen las condiciones favorables, capaces de generar ingresos económicos, que posteriormente repercuten en los altos niveles de pobreza que presenta la región. Las frecuentes sequías que viene soportando el agricultor afecta en forma considerable la situación socioeconómica.

Las construcciones de atajados de tipo precarias sin ningún servicio básico generan con el tiempo una serie de problemas sociales, sumados a enfermedades que se dan en la mayoría de las comunidades indígenas, cada vez más acentuadas por las constantes epidemias en la región.Una de las principales causas de mortalidad son las enfermedades gastrointestinales (EDA), las causa principales son las aguas contaminadas, faltas de higiene y la poca resistencia por la mala nutrición. En la época de estiaje en toda la región de la provincia Cordillera la mortandad es alta debido fundamentalmente a la falta del liquido elemento (agua), lo que hace que tanto pequeños productores como grandes, que carecen de infraestructura adecuada (atajados) registren perdidas económicas. La falta de agua en el sector pecuario se traduce o se refleja en los índices zootécnicos que en la mayoría de los casos son bajos.

Objetivos.-Mejorar las condiciones de vida de 295 familias indígenas de dos comunidades, Rancho Nuevo (Yarumbairú) y Rancho Viejo ((Guirapembi) en la jurisdicción municipal de Charagua, beneficiando a una población de 1.477 personas entre hombres, mujeres y niños, disminuyendo en 70% las enfermedades gastrointestinales en el área rural a partir del consumo de agua limpia, en menos de un año, mediante:

La construcción de dos atajados implementando una Planta de Tratamiento con Tecnología biológica para la obtención de agua potable para un mejor aprovechamiento en el consumo humano y animal en épocas de sequía, asegurando la provisión del agua durante la época de estiaje a dos comunidades rurales de la de la Provincia de Charagua, en época de sequía y la apropiación de la tecnología por los comunarios indígenas, mediante el diseño y cobro de una tasa de agua para el mantenimiento de la planta

Adicionalmente, los objetivos colaterales de esta investigación fueron los siguientes:

- Estimar el valor económico directo del agua limpia en la Tierra Comunitaria de Origen (TCO) Bajo Isoso, Jurisdicción Municipal de Charagua, Región Cordillera – Santa Cruz, para las poblaciones Indígenas que se encuentran asentadas en ese lugar. Se considera como valor de uso directo el agua tratada/potable. Con esta estimación podrá evaluarse la posibilidad y/o pertinencia económica de instalar plantas de tratamiento de agua en atajados mediante tecnología biológica para la obtención de agua potable para consumo humano y animal, en otras comunidades rurales de esta cuenca.
- Evaluar los factores determinantes para la disposición a pagar por agua tratada
  o limpia.
- Determinar tarifas de cobro por servicio de agua tratada en las comunidades rurales beneficiadas por el proyecto piloto.

Población beneficiada. (Ver Anexo Nro.1)

Distrito	Comunidad	Nº de Familias	Hombres	Mujeres	Total
Bajo Isoso	Rancho Nuevo	200	440	550	990
	Rancho Viejo	95	248	239	487
TOTAL		295	688	789	1.477

Fuente : PDM, Municipio de Charagua, Ciudad de Santa Cruz de la Sierra/ Bolivia

Geográficamente, el Municipio de Charagua, se encuentra ubicado en Latitud Sur 18º56'07", Longitud Oeste 58º45' y Latitud Sur 20º30'17" y Longitud Oeste 63º20

ALTERNATIVAS DE TRATAMIENTO Y CRITERIOS DE DISEÑO

Primero existió un tratamiento preliminar que tuvo el objetivo de acondicionar el agua, para su ingreso a la planta, por los caudales de diseño tan pequeños que se presentan en el proyecto; el tratamiento preliminar consta únicamente de una reja.

El tratamiento biológico propuesto tuvo como finalidad remover la cantidad de Coliformes fecales y Coliformes Totales, así también el contenido de fosfatos.Finalmente

se obtuvo un tratamiento químico básico, basado únicamente en desinfección, con el objetivo de lograr la calidad deseada, y cumplir con el criterio mínimo de salubridad.

Lagunas de lentejas de agua (LEMNAS).

Elección y justificación de la alternativa:

Las plantas acuáticas han sido utilizadas para el tratamiento de aguas residuales en pantanos naturales o artificiales, donde dichas plantas proliferan considerablemente (REEd et al.,1995). En el ámbito internacional estos sistemas de tratamiento han tenido considerable atención, dada la posibilidad de la eficiente remoción de los contaminantes de la agua y la producción de biomasa reutilizable en otras actividades económicas, como producción de alimentos para animales o fertilizantes del suelo.

Tal es el caso de las lagunas con lenteja de agua (lemna), en las cuales, las plantas en asociación con las bacterias degradan la materia orgánica y acumulan minerales y nutrientes presentes en las aguas residuales, para convertirlos en biomasa vegetal rica en proteínas de alta calidad (Culley & Epps,1973).

Los sistemas con lenteja de agua presentan las siguientes ventajas:

- Comparativamente con los sistemas convencionales ofrecen la posibilidad no solo de remover eficientemente yabajocostola materia orgánica ylos sólidos suspendidos, sino también los nutrientes y las sales que enforma disuelta se encuentran en el agua, produciendo enuna o dos etapas - si se tiene pretratamiento- efluentes de calidad terciaria.
- Recuperación de los nutrientes presentes en las aguas residuales en forma de biomasa vegetal.
- El tamaño y estructura de la planta permite una fácil remoción por medio de implementos muy sencillos.
- El contenido alto de proteína y bajo en fibra le da a la lenteja de agua un valor nutricional y digestivo alto en ganado.
- El cubrimiento total de la superficie del agua proporciona condiciones de aquietamiento que facilitan la sedimentación y evita el crecimiento de algas, a diferencia de las lagunas convencionales en donde la presencia de algas aumenta las concentraciones de sólidos suspendidos en el efluente.
- Así mismo, el cubrimiento total de la superficie evita el crecimiento de mosquitos (Skillicorn, 1993).
- La capa formada por las plantas previene la salida de gases que pueden producir malos olores. En el caso del acido sulfhídrico, se considera que este es oxidado en las capas de agua cercanas a la superficie, que tienden a ser aérobicas por efecto de la cercanía a las plantas.
- Se reducen las perdidas por evaporación, puesto que la superficie del agua está cubierta. Esto es particularmente importante en zonas muy secas.
- La utilización de la lenteja de agua es altamente competitiva con respecto a otros métodos de tratamiento secundario existentes, ya que pueden reducir significativamente los gastos de todo el tratamiento además de los subproductos que se obtienen (Oron,1998).

Entre las desventajas de estos sistemas se tienen:

- Altos requerimientos de área. El manto de plantas reduce la capacidad natural de oxigenación del agua y dependiendo de la cantidad de materia orgánica presente, se pueden generar condiciones anoxicas o anaeróbias. Esto puede limitar la degradación de la materia orgánica, aumentándose los tiempos de retención y por lo tanto las áreas requeridas; para evitar este exceso debe existir un encargado de la planta que vaya retirando la excesiva cantidad de planta producida en los tanques, para dar como alimento a los animales.
- Altas cargas orgánicas pueden inhibir el crecimiento amoniacal pueden llegar a ser tóxicas dependiendo del pH.
- La lenteja de agua puede acumular metales pesado y otras sustancias tóxicas, por lo cual, debe establecerse el nivel de estas sustancias en el agua residual si la biomasa va a ser utilizada en alimentación animal.
- La lenteja de agua puede contener altas cantidades de oxalato de calcio, que limita su uso para la alimentación de animales.
- Con los conocimientos que se tienen hasta ahora las lagunas con lenteja de agua remueven patógenos pero no a los niveles requeridos por los estándares de salud pública.(Caicedo Bejarano,2002)

Por todo lo anteriormente expuesto, tomando en cuenta las características de calidad del agua a tratar, en correspondencia con factores que afectan al crecimiento de la lenteja de agua, como son: Temperatura, Iluminación, pH, Nitrógeno, Fosforo, Materia orgánica, Sustancias gaseosas; se concluye que la utilización de lagunas con lentejas de agua fue una alternativa de tratamiento integral y económica para el agua que se almacenó en el atajado.

En el presente proyecto de investigación, si bien no se ha tratando agua de calidad residual, si no por el contrario agua que podría ser clasificada como efluente tipo A, es decir agua que únicamente necesita desinfección.

Dimensionamiento de Las Lagunas para lentejas de Agua (genero (LEMNAS)

1° Laguna de lentejas de agua:

Profundidad	H = 0.7 – 1 m
Tiempo de retención	t = 2 – 5 días
L/B	= 2 – 4
Eficiencia respecto a la DBO	60-80%

Dimensionamiento de las unidades:
El caudal de diseño que consideramos es el caudal medio para el año 2027.
Temperatura de diseño = Temperatura Mínima del agua
Tagua = Temperatura ambiente + 2°C
Tagua = 12 + 2 = 14°C
Temperatura de diseño = 14°C
Qdiseño = Qmed (2027) = 49.321 (m^3/d)
Tiempo de retención tr=2 días.
Diseño Laguna 1:

$$V = Q_{med} * tr$$

$$V = 49.321 \left[\frac{m^3}{dia}\right] x 2 [dias]$$

$$V = 98.642\ m^3$$

$$A = \frac{V}{H} = \frac{98.642}{0.80}$$

$$A = 123.30\ m^2$$

Adoptamos una relación L/B = 2

$$L = 2B$$

$$A = 2B^2$$

$$B = \sqrt{\frac{A}{2}} = \sqrt{\frac{123.3}{2}} = 7.85 \text{ o } 7.90\ [m]$$

$$L = 2 * (7.90) = 15.80\ [m]$$

MACROFITAS DESCONTAMINADORAS DE AGUA

• Son vegetales que por sus características fisiológicas son capaces de remover de forma muy rápida nutrientes.
• Por esta característica, las especies más utilizadas para el tratamiento de aguas domésticas son:
– ***Eichornia crassipes*** (camalote, buchón lirio de agua).
– ***Azolla*** sp (helecho de agua).
– ***Lemna minor*** (lenteja de agua).

Infraestructura

Se ha ensayado el proceso en cuatro estanques.
La propuesta se basa en que el agua a tratar es menos contaminada.
Algunos parámetros (caudal, producción de Lemna, tiempo de remoción y otros) se han de determinar para la región, permitiendo su posterior extensión

Eficiencias del tratamiento con lentejas de agua (LEMNAS) elegido:

Característica	Porcentaje de remoción	Fuente
Amoniaco	70%	Osorio y Apaza 2005; Garcia,2000 Henriksson,1994;
Nitrito	90%	
Fosfato	71%	
Sulfato	50%	
Ntotal	65%	
Coliformes totales	85%	
Coliformes Fecales	87%	

Desinfección.
Se trata de una desinfección mediante lejía, también llamada lavandina, el hipoclorito de sodio debe dosificarse entre 0.5-3mg/l , concentraciones mas altas contienen sabor y olor.
La concentración de cloro residual aconsejable es de minimo 0.2 mg/l.La dosificación en peso de hipoclorito de Sodio se calcula de la siguiente manera:

$$Pv = \frac{V * D}{\%C * 10} [gr \text{ o } cc]$$

Donde:
Pv= Peso o volumen del desinfectante.
Volumen de agua a desinfectar.
Dosis aplicada(mg/l) que como minimo deje 0.2mg/l
%C=Porcentaje activo del desinfectante.
Cada toma de muestras está conformada por una muestra en la superficie, una media y una inferior, para análisis fisicoquímico; y una muestra para análisis bacteriológico.

RESULTADOS

La temperatura de las aguas en los estanques presentan una amplia variación entre la época de estiaje (8° a 12°C) y de lluvias 13° a 20°C). Existe una ligera disminución de la temperatura en la salida con respecto a la entrada, que es de aproximadamente de 1°C, esta variación se debe al escaso calentamiento de las aguas por la presencia de una capa considerable de lemnaceae, que alcanza alrededor de 2 a 3 cm. de espesor. El pH es básico, con pequeñas variaciones, debido probablemente a las mezclas de las aguas residuales con las aguas frescas en los estanques. Los valores de conductividad obtenidos en los estanques presentan pequeñas variaciones, los datos encontrados en la entrada con respecto a la salida tienden a disminuir o aumentar ligeramente, debido principalmente a la precipitación de las sales disueltas. Las aguas presentan una turbidez en todos los estanques además de un olor fuerte debido a la elevada carga orgánica, se observa una disminución importante hacia la salida de los estanques, debido principalmente a la sedimentación que sufren los sólidos suspendidos a lo largo y ancho de los estanques. El color verdadero disminuye en los estanques 1 y 2, mientras que en los estanques 3 y 4 sucede lo contrario estas variaciones se deben a la elevada productividad primaria que se da en los estanques.

Remoción de nutrientes

La remoción que se puede observar es elevada en los estanques 2 y 3, que alcanzan desde 92% hasta 93% respectivamente y un poco inferior 79% en el estanque 4 y la más baja remoción es de 64% en el estanque 1 . La remoción de fosfatos es buena en el estanque 3 (87%) y 4 (69%), en el estanque 1 el 51% y una remoción muy

baja en el estanque 4, que es unicamente del 4%.En el canal abierto la concentración de sulfatos es elevada alcanzando 92 mg/l. En la entrada a los estanques disminuye un poco y en la salida disminuye mucho mas, por lo tanto no se puede observar una mayor diferencia

Remoción de Nitrógeno total

En el canal abierto la concentración de N_{total} es de 240 mg/l. En los estanques los valores de N_{total} son inferiores, estos disminuyen significativamente hacia la salida de los estanques.

La remoción de N_{total} varia en los cuatro estanques, pero el estanque que presenta una mejor remoción es el 3; alcanzando a 74% , el estanque 2 alcanza a 55%, y una remoción relativamente baja en el 1, que es alrededor del 20% y el estanque 4 alcanza alrededor de un 5% .

Remoción de la Demanda Biológica de Oxígeno

La D.B.O. en el canal abierto alcanza valores altos alrededor de 300 mg/l.

La remoción de la D.B.O. en los estanques 2 y 3 alcanzan alrededor del 70% y 73% respectivamente, en el estanque 1 el 64% y una baja remoción en el estanque 4 que es el 53%.

Remoción bacteriológica Las evaluaciones de coliformes totales y coliformes fecales en el tratamiento de aguas residuales mediante la producción de **lemnaceae** nos demuestra, que en los cuatro estanques existe una disminución de la concentración de bacterias en la entrada respecto a la salida. Esta disminución expresada en porcentaje de remoción indica que el estanque 1 es el más efectivo, presentando una remoción del 83% para coliformes totales y 86% para coliformes fecales.

Porcentaje de remoción de Coliformes totales y fecales

De forma comparativa los gráficos demuestran el comportamiento los estanques 1 y 3, tal como se puede observar el estanque 1 presenta una eficiencia correlativa de los dos parámetros bacteriológicos evaluados, en el caso del estanque 3 también se observa una disminución de coliformes, pero con la misma eficiencia que el estanque 1.

Producción de lemnaceae

El desarrollo de las lemnaceae ha sido muy interesante, puesto que estas plantas en el estanque 1 presentan las mismas características cuando fueron sembradas, es decir, el tamaño de las frondas se mantiene pequeña, mientras que en el resto de los estanques se incrementa, debido posiblemente a las condiciones de cada estanque. Es casi siempre asi el comportamiento de esta planta cuando las concentraciones de DBO disminuyen (Gillman cm. per.).

El primer estanque presenta una uniformidad en cuanto al tamaño de las frondas como al tamaño de las raíces con ligeras variaciones durante el período de estudio. El estanque 2 presenta un máximo de 7,9 cm en el crecimiento de las raices al igual que en el estanque 3, que es del orden de 10,9 cm, bajando las dimensiones en época seca, debido posiblemente a las temperaturas bajas en los estanques.Se realizaron varias cosechas cada 7 días durante el tiempo que duro el experimento, esto ha permitido la buena remoción de nutrientes en los estanques.

Composición química y valor nutritivo de la Lemnaceae

Como la mayoría de las plantas acuáticas, las **lemnaceae** tienen un contenido alto de agua, pero su fracción solida tiene aproximadamente, en algunas especies la misma cantidad y calidad de proteína que la torta de soya (CULEY, et al, 1981).

CUADRO : Análisis bromatológico de la Lemna

PARAMETROS	HUMEDA	SECA	HUMEDA	SECA
Materia Humeda	93,63	6,35	94,07	7,00
Proteinas	1,48	22,65	2,32	23,15
Grasa	0,29	4,48	2,20	3,52
Ceniza	0,89	14,00	0,51	13,75
Fibra	1,48	23,48	0,84	22,54
Carbohidratos	2,17	35,07	1,70	34,08
Calcio	141,51	2137,12		
Fosforo	38,23	592,84		
Hierro	1,94	30,09		

Los análisis bromatológicos de las diferentes plantas acuáticas, demuestran un bajo contenido de proteinas y un alto contenido de carbohidratos, además de un alto contenido de fibra que el algunos casos hace menos digestible para los animales (PALACIOS & LAGUNA, 1991).

Como se puede observar en el cuadro 2 la Lemna fresca tiene alrededor del 94% de agua, pero la materia seca presenta valores bajos de agua (7%) y valores altos en proteinas (23%) y carbohidratos (34%) y un menor contenido de fibra (22,5%). Estos resultados probablemente se deban a las condiciones en las que se ha llevado adelante el proyecto.

CONCLUSIONES DE LA IMPLEMENTACION DE LA TECNOLOGIA BIOLOGICA EN ATAJADOS EXISTENTES.

La implementación de la planta piloto de tratamiento de aguas residuales mediante plantas acuáticas flotantes nos ha permitido conocer el funcionamiento y la eficiencia de la remoción de nutrientes, Demanda biológica de oxígeno y bacterias.

El presente trabajo nos permite tener una nueva alternativa de tratamiento de aguas residuales, además del uso de las plantas acuáticas como alimento

complementario para los animales, por las características bioquímicas de que se asemejan bastante a la soya en su contenido de proteínas.

VALORACION ECONOMICA DEL RECURSO AGUA LIMPIA EN LOS ATAJADOS

La realización de esta investigación permitió establecer pagos o tarifas para el mantenimiento y renovación de estos sistemas, por el servicio de abastecimiento de agua tratada o limpia.

Así mismo, como recurso el agua dulce en el mundo es un recurso cada vez más escaso, asumiéndose que su tendencia per cápita tiende a disminuir de manera sostenida, por lo que como bien económico el agua tratada tiene un precio.

Conceptualmente, el *valor económico total* (VET) de un recurso cualquiera, entre ellos el agua, está dado por el *valor de uso* (VU) y el *valor de no uso* (VNU). El *valor de uso* puede dividirse en *valor de uso directo* (VUD), *valor de uso indirecto* (VUI) y *valor de opción* (VO) o valor de uso potencial. Por otro lado, las categorías del *valor de no uso* (VNU) son el *valor de existencia* (VE) y *valor de legado* (VL),por lo tanto podemos representar la ecuación siguiente:

VET = VU + VNU ó
VET = (VUD + VUI + VO) + (VE + VL)

Estos valores fueron reflejados de distinta manera para cada individuo o colectivo
dependiendo de la intensidad de uso del recurso, su bagaje cultural, sus creencias,
las posibilidades de uso futuro o alternativo, entre otros. Una estimación del Valor
económico total requirió, por tanto, evaluar todos estos tipos de valor de uso.

El trabajo de investigación estimó sólo el valor de uso directo del agua en la TCO mencionada. Concretamente, dado que el agua que se consume trae consigo consecuencias colaterales en la salud de las familias que habitan en la zona rural, se pudo medir el valor subjetivo que los pobladores asignaron en promedio, al agua limpia.

Este valor de uso directo fue estimado mediante la aplicación del método de Valoración Contingente definiendo por niveles de ingreso la Disponibilidad a pagar (DAP) por agua potable o limpia.

El propósito de la valoración contingente (Hanemann, 1994) es "derivar" las preferencias del consumidor. Normalmente el procedimiento seguido en la práctica consistió en analizar la conducta de la persona (en el estudio con la aplicación de las encuestas) con respecto a algún bien privado, que tiene por tanto un mercado, y que guarda relación con el disfrute del bien individual (Azqueta,1994).

Entre los factores que influyen en las preferencias por el uso de agua tratada en el
estudio, asumimos: el número de miembros de la familia, edad, educación, etnicidad, ingreso, organización del centro poblado, entre otros.

La hipótesis de trabajo que se planteó para la investigación fue:

"No hay diferencia significativa en la disposición a pagar (DAP) por agua potable entre las poblaciones indígenas".

El método de valuación contingente (MVC) es una técnica analítica basada en la aplicación de una encuesta a los agentes involucrados en el uso (directo o indirecto) o participación en algún beneficio o perjuicio de un activo ambiental. En la encuesta se establecen situaciones hipotéticas o experimentales que permiten asignar un valor monetario a los bienes y servicios que no tienen un valor en el mercado (Schmis, 1989).

Al valorar los recursos naturales, el objetivo es obtener información directa de las preferencias individuales de los usuarios, manifestada a través de la cantidad máxima que estarían dispuestos a pagar DAP (WTP, en inglés), o la cantidad mínima de compensación a aceptar DAA (WTA, en ingles) por un aumento o disminución los beneficios recibidos a partir del uso o conservación de estos recursos o de sus componentes cuyos valores no tiene un precio explícito en el mercado.

La aplicación de este método se basa en los siguientes supuestos: el individuo o agente involucrado en el recurso, dado su ingreso disponible, maximiza su utilidad; el comportamiento del individuo en el mercado hipotético es equivalente a su comportamiento en un mercado real; el individuo tiene completa información sobre los beneficios del activo ambiental, el cual fue incluido en el cuestionario

Para la investigación se aplicó el Método de Valoración Contingente (MVC), mediante una encuesta a una muestra conformada por los centros poblados y número de familias que habitan.

La muestra fue elegida de manera aleatoria entre dos comunidades Rancho Nuevo con 200 familias beneficiadas y Rancho Viejo con 95 familias, en base a la experiencia de implementación de agua potable en las comunidades rurales (Ej. Caritas). La encuesta que

se aplicó, se adjunta en anexo.

Se estimó un modelo econométrico lineal múltiple mediante Mínimo Cuadrado Ordinario (MCO). La variable dependiente es la disponibilidad a pagar y las que se indican en el cuadro son las variables independientes

La función de demanda fue:

Qw = Qw (pw, pa, p; y; z)
Donde:
Qw : nivel individual de consumo de agua en un determinado tiempo y período
pw : precio del agua
pa : precio del agua de una fuente alternativa
p : precio índice promedio que representa todos los otros bienes y servicios
y : ingreso del consumidor
z : otros factores como clima y preferencias
Los entrevistados se agruparon en submuestras y a cada miembro de una submuestra, se les presentó un mismo precio, preguntándole si o no pagarían dicho precio. A cada submuestra se le asignó aleatoriamente un precio. El método fue familiar para la mayoría de entrevistados debido a que sus decisiones en el mercado, cuando compran algo la hacen similarmente. Elimina el sesgo estratégico pues los entrevistados no tienen incentivo para sesgar su respuesta. El modelo estadístico usado fue el Logit, el cual predijo la probabilidad de aceptar una oferta en función del valor requerido y otras variables (socioeconómicas, actitudes y creencias). El método Logit es más complejo y menos familiar que el usado para la pregunta abierta y subasta (se calcula más fácil el valor de la media o la mediana).
También existió una combinación del método de referéndum con uno de seguimiento. Si la respuesta es no, se le proporciona un nuevo valor más pequeño, seleccionado aleatoriamente. Si es si, se proporciona un nuevo valor más grande, seleccionado aleatoriamente. Con este proceso se ganó en información y se redujo el número de muestra que requiere el método de contingencia mediante encuestas. Ver anexo Valoración económica, diseño de encuesta.

Se consideraron los siguientes datos para la valoración, una vez realizada la encuesta y sistematizados los datos:

Población por comunidad, Polígono 2 TCO ISOSO

Municipio Charagua por Familia	Comunidad	Mujeres	Hombres	Total	Nº Familia	Miembros
Bajo Isoso	Rancho Nuevo	550	440	990	200	4,9
	Rancho Viejo	239	248	487	95	5,0
	Aguaraiga	164	168	332	64	5,0
	Iyovi	311	364	675	149	4,5
	Mini Yuki	38	37	75	25	3,0
	Koropo	271	231	502	64	7,8
	San Silvestre	69	71	140	35	4,0
	Piquirenda	37	37	74	15	5,2
	Aguarati	159	195	354	69	5,0
	Paraboca	44	41	85	15	5,7
	Kuarirenda	347	395	742	154	4,8
	Guandare	20	24	44	9	4,8
	Tentarembei	52	42	94	26	3,4
	Joseravi	126	132	258	45	5,7

Municipio	Comunidad	0-15		16-30		31-45		46-60		61 y más años		Total
Bajo Isoso	Rancho Nuevo	150	210	85	100	75	95	85	95	45	50	990
	Rancho Viejo	118	127	70	73	26	25	19	17	6	6	487

Acceso a los Recursos

El acceso a los recursos en el espacio territorial del distrito del Isoso tiene dos variantes: Acceso a nivel familiar y a nivel comunal, dependiendo de la organización

productiva y actividad a realizar en cada comunidad; mayormente el acceso a los recursos con fines agrícolas es familiar; pero existen algunas otras actividades o proyectos desarrollados bajo propiedad comunal. El acceso a los recursos por los comunarios es irrestricto, todos tienen el mismo derecho de acceder a ellos, más aun si el aprovechamiento es con fines de uso doméstico.

La comercialización es una actividad poco desarrollada por ser un tiempo de economía basada en el convite y la reciprocidad, donde las relaciones comerciales con fines acumulativos (ahorro-inversión) son mínimas. De igual manera considerando que la producción está destinada fundamentalmente, al consumo familiar, los márgenes para comercializar son mínimos, con esto no se puede considerar que lo comercializado sean excedentes de la producción, sino debido a la necesidad de las familias lo que se comercializa son parte de los productos necesarios para la reproducción familiar, provocando la migración temporal hacia otros lugares con la finalidad de obtener algún tipo de ingresos

Existen en algunas comunidades familias con mayor poder económico que acceden a los recursos de manera más ventajosa, principalmente con fines comerciales, caso de los recursos forestales, como la venta de postes, se pudo notar que la familia es mas aventajada en el acceso a éstos recursos cuando dispone de una motosierra, situación que le permite tener mayor cobertura de aprovechamiento y fácil acceso a la explotación de dicho recurso

The cattle production so much at level of more livestock as of smaller livestock and corral birds, it is fundamentally extensive without handling and with the possible (zero investment) smallest investment, that is to say we can assure that they don't exist practical that cooperate to the preservation of the environment, just the opposite, this activity is the one that is causing the gradual deterioration of the vegetable covering and of the fertility of the floor, for the sobrepastoreo of animals, especially of the bovine livestock and caprino; the negative impact that you/they cause is bigger in comparison to the rest of the breeding animals.

El desarrollo de la actividad pecuaria en general se caracteriza por el uso irracional del monte mediante el ramoneo y la trashumancia, en la cría de bovinos, caprinos y ovinos En casos especiales, algunas comunidades con proyectos ganaderos han realizado actividades orientadas al enriquecimiento del monte, construyendo divisiones e implantando sistemas de silvopasturas.

Nivel de Ingresos por familia (compuesto por 5 miembros) mensual por Área Productiva

Los sesgos en el MVC se dividieron en conducta estratégica, sesgo de complacencia, punto de inicio, sesgo relacional, sesgo de importancia y posición, mala interpretación del escenario, entre otros.

SESGOS

Los sesgos identificados a través de los resultados sistematizados por la encuesta y la aplicación de la metodología de Valoración Contingente fueron los siguientes:

Sesgo de complacencia se refiere a que el entrevistado por querer complacer al entrevistador que hace el estudio, contesta sin tomar en cuenta su criterio propio. Para reducir el sesgo se seleccionó entrevistadores profesionales que no afecten las respuestas del entrevistado.

El sesgo del punto de inicio fue ya discutido en el formato de subasta

Sesgo relacional ocurre cuando el recurso a ser valorado es relacionado por el entrevistado con otro recurso.

Sesgo de posición e importancia ocurre donde se mencionan varios atributos a valorar y la gente piensa que por estar de primero o mayormente mencionado es muy importante. Asimismo, porque cree que se le pregunta un valor extra, este debe ser debido a que si existe este valor, lo que se valora es muy importante.

La mala interpretación del escenario, Ocurrió cuando el entrevistado no entendió la situación dada presentada por el entrevistador. Para reducir este resultado se tuvo que diseñar cuidadosamente, las pruebas pilotos y de

Polígono 2	Ingresos	Prom. Ingreso familiar en Bs.	Prom. Ingreso por persona	Ingreso por Comunidad
Rancho Nuevo	Área 1 Bs. 2.500 Área 2 Bs. 1.800 Área 3 Bs. 800	Bs. 1.700.-	Bs.340.-	BS.24.035
Rancho Viejo	Área 1 Bs. 1.800 Área 2 Bs. 1.500 Área 3 Bs. 500 Bs.253	Bs. 1267,0 Bs. 50.600		

convergencia hasta estar seguros de que se comprende por las familias indígenas encuestadas lo presentado.

Also by means of the method Cost Benefit the minimum price was calculated the one that the water will be sold, analyzing the investment and the cost of maintenance of the treatment plant, obtaining to it valued monthly minimum ace to result for family of Bs./m3:

INVERSION: " CONSTRUCCION DE ATAJADOS Y PLANTAS DE TRATAMIENTO"			
ITEM	COSTO ITEM	DETALLE [$]	
REMODELADO Y ACONDICIONAMIENTO	15574,04	licencia ambiental	7030,2
		muestras	8543,84
CONSTRUCCION	194113,8	Construcción atajado Rancho Viejo	89425,56
		Construcción atajado Rancho Nuevo	91513,12
		Construcción Tanque de purificación Rancho viejo	6813,72
		Construcción Tanque de purificación Rancho Nuevo	6361,40
		INVERSIÓN TOTAL Bs.	209687,84

COSTOS DE MANTENIMIENTO en Bs.

CONCEPTO	Sueldo y salario encargado/mes	Gasto mensual de materiales de limpieza incluyendo el cloro	COSTO DE MANTENIMIENTO mensual	COSTO DE MANTENIMIENTO anual
Mantenimiento				
y limpieza de la				
planta Rancho				
Nuevo	1.800,00	500,00	2300	27.600,00
Mantenimiento				
y limpieza de la				
planta Rancho				
Viejo	1.000,00	400	1.400,00	16.800,00
			COSTO TOTAL DE MANTENIMIENTO	44.400,00

COMUNIDAD RANCHO NUEVO

agua requerida de la comunidad en mltrs.	18000,00
Capacidad atajado mlitrs.	18286,50
ingreso por persona	340,00
ingreso promedio por familia	1700,00
ingreso de la comunidad	68000
número de familias	200
consumo agua por persona	1,5
consumo agua por FAMILIA	7,5
COSTO DEL AGUA	226,67
Método B/C m3 AGUA (Bs)	2,00
PAGO TASA MENSUAL POR CADA FAMILIA PROMEDIO	15
MONTO MENSUAL RECAUDADO POR LA COMUNIDAD	3.000
PARA MANTENIMIENTO DE LA PLANTA DE TRATAMIENTO	

COMUNIDAD RANCHO VIEJO

agua requerida de la comunidad en mlitrs.	9000,00
capacidad atajado en mltrs.	18286,50
ingreso por persona mensual	253,00
ingreso promedio por familia mes	1265,00
ingreso total mensual de la comunidad	24035

número de familias	95
consumo agua por persona día	1,5
consumo agua por FAMILIA día	7,5
COSTO DELAGUA	168,67
Método B/C m3 AGUA (Bs)	2,00
PAGO TASA MENSUAL POR CADA FAMILIA PROMEDIO	15
MONTO MENSUAL RECAUDADO POR LA COMUNIDAD	1.425
PARA MANTENIMIENTO DE LA PLANTA DE TRATAMIENTO	

CONCLUSION SOBRE LA VALORACION ECONOMICA

Cuando se inició el proceso de llenado de encuestas con las poblaciones beneficiadas se percibió emoción al recibir agua potable y tuvo una valoración extrema de hasta $100 a $us.150 pagar el litro mes por familia lo que para muchas familias representaba un salario por mes; pero llegando a realizar ajustes sobre los sesgos de opinión y considerando los niveles bajos de ingreso de muchas familias debido a la escasez de agua en la Región, se obtuvo una tasa de Bs.15 ó $us. 2 de pago mensual por familia, destinado a la limpieza y mantenimiento de la planta de tratamiento con tecnología biológica, representando para esta investigación una tasa simbólica de valoración del recurso agua en la Región del Chaco Boliviano, en relación al beneficio de mejora de la calidad de vida que se proporcionó a los comunarios.

FUNGAL DIVERSITY IN THE BURROW WALL OF *PONTOSCOLEX CORETHRURUS*

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Introduction

Earthworms are a major component of many terrestrial ecosystems. By modifying decomposition processes and soil structure, they function as driving factors of the soil microbial community. It has been documented that they affect the density and distribution of other soil invertebrates and modify microbial activity (Brown 1995; Tiunov and Scheu 1999; Tiunov et al. 2001). They are also 'ecosystem engineers' as they actively redesign the physical structure of the soil environment by their activities of ingesting litter and soil particles, depositing casts on the soil surface and translocating soil particles. The activities of earthworms in soils have been shown to have profound impact on the soil ecosystem functioning as well as on the types and numbers of micro-flora and micro-fauna (Pederson *et al.* 1993).

Earthworms are important to plant litter decomposition and fertility of soil and their role is complex, which involves the assistance of microorganisms. Earthworm deposits have a localized effect on microbial behavior modifying the biological activity of soils (Daniel, O. and J.M. Anderson. 1992, Edwards and Bohlen 1996). This phenomenon is observed in casts and/or burrows, which are lined with mucus and other deposits. In particular, they induce a population increase in the main functional groups (Loquet et al. 1977). The burrow wall zone, which is directly or indirectly influenced by the earthworm burrowing activity, has been called zoosphere (Joffe, 1936), vermisphere (Hamilton and Dindal, 1983) or drilosphere (Bouché, 1975). Earthworm burrow systems can be very extensive especially in the case of endogeic species. Consequently, the burrow walls can represent an important area in the soil. Burrow walls which are enriched with polysaccharides (Zhang and Schrader, 1993) become buffered to neutral pH in acid and alkaline substrate through cutaneous mucus secretion (Schrader, 1994) and form stable microhabitats for specific active microbial communities (Tiunov and Scheu, 1999). Microbial activity is generally enhanced in the burrow wall as compared to bulk soil. Nitrogenous waste excreted through the body surface of an earthworm accumulates in the burrow wall and affects the soil microbial community in those areas. Earthworms, in the process of burrowing, accelerate litter decomposition, change pore structure, increase aeration and water infiltration, and accelerate C and N mineralization. They may also change microbial community composition during gut transit and following excretion in casts and burrow walls (Parle, 1963b; Pedersen and Hendriksen, 1993). Earthworms enhance microbial activities by providing in their gut a mucus consisting of energetic and easily metabolizable compounds (Martin *et al.*, 1987) and favourable physico-chemical conditions: neutral pH, high moisture and temperature conditions (Barois and Lavelle, 1986).

There are about 3000 species of earthworms distributed all over world and about 384 species are reported in India (Julka, 1986). *Lampito mauritii* is the widely distributed earthworm in India, reported from different agro-ecosystems. Next to *Lampito mauritii, Pontoscolex corethrurus Polypheretima elongata, Perionyx excavatus,* and *Dichogaster bolaui* are the other earthworms having wider distribution in the country *(Lee*, 1985, Bano & Kale,1991, Kale 1997). Although seven species of earthworm are found distributed in Bangalore only three species viz: *Lampito mauritii, Pontoscolex corethrurus* and *Perionyx excavatus* occur in abundance in most area (Kale 1981). *Pontoscolex corethrurus* is a tropical geophagous

endogeic earthworm species. They are medium-sized pale earthworms that colonize the upper mineral soil and ingest organic matter together with large amounts of mineral soil. Due to permanent horizontal burrowing and the ingestion of large amounts of mineral soil, endogeic species have been shown to be major soil-forming agents (Shaw and Pawluk 1986; Scheu 1987; Scheu and Parkinson 1994). Endogeic worms reside in extensive burrows in the mineral soil horizons. They consume more soil than epigeic and anecic worms.

P. corethrurus reproduce only at temperatures between 23 and 27 °C, being of low activity in soils with low field capacity of water retention (pF 2.5). However, they have great capacity to adapt to soils of different pH values, texture and organic matter content (Bernardes et al, 1997) and have a short reproduction cycle, therefore being able to multiply themselves faster than the other types of earthworms. The interactions between the micro-organisms and the *P. corethrurus* during the transit of the soil inside their gut is known (Barois and Lavelle, 1986). The microflora of the soil is also favored by the presence of the earthworm, for it induces the increase of the microbial activity of the original soil (Guerra, 1981). Therefore, it is quite probable that there is an existence of a correlation between the population density and the activity of the *P. corethrurus* with the activity of micro-organisms in the soil.

Much of the work regarding earthworm effects on organisms has focused on the functional significance of microbial-earthworm interactions. Virtually nothing is known about the possible effect of burrow wall on the taxonomic composition of communities of soil microorganisms, filamentous fungi in particular. Microfungi in the casts of earthworms, *Perionyx millardi, Eudrilus eugeniae, Lampito mauritii* and certain other earthworm species are available. But, the scientific knowledge available on the fungal flora in the burrow wall of the earthworm, *Pontoscolex corethrurus* is scanty and hence the present study has been carried out.

Material and Methods

Collection of Earthworms

A natural plot was identified for collection of earthworms. About one square meter plot was cleared off surface plant growth and the area sprayed with 1% jaggery solution to attract the underlying earthworm population. After 48 hours the spot was dug and the earthworms were collected for use in the laboratory. *Pontescolex corethrurus* was identified by the calciferous glands. Collected earthworms were released into glass troughs having a layer of garden soil and a top layer of humus prepared by mixing garden soil and leaf litter for a period of two months. This was carried out to adapt them to laboratory conditions.

Experimental set up

The sample material was generated in the laboratory by maintaining earthworms in chambers with a dimension of 30 cm x 40 cm and width of 10 cm in two sets. The chambers were filled with air dried soil and moistened to maintain 60% level before releasing earthworms. About three fourth of the chamber was filled with this soil. The top one third of the chamber was filled with humus. Ten adult earthworms were released.

Sample collection

Soil sample was collected by destructive method with sterile spatula by carving the inside lining of the burrows. Sampling was carried out at 30 days and 45 days interval. Control sample was collected from a region away from the burrows.

Analysis of soil samples

Samples collected were analyzed for total count of bacteria, fungi and actinomycetes. Serial dilutions were carried out and plated on soil extract agar, potato dextrose agar and glucose aspergine agar. The total count was estimated for the samples. The frequency of occurrence of fungal taxa (as percentages) was calculated as the number of particles with fungal growth per total number of isolates. The community of filamentous microscopic fungi was analyzed.

Results Total count

The percent of the total microflora in the sample after 30 days was as follows – fungi 44.41%, bacteria 49.46% and actinomycetes 5.97% as compared to the control soil where the fungi was 36.82%, Bacteria 57.64% and actinomycetes 5.54% (Table 1). The colony forming units of fungi isolated in the burrow wall sample after 30 and 45 days was 4.44 $x10^6$ and 5.88 $x10^6$ respectively where as in the control soil the cfu after 30 and 45 days were almost similar (3.68$x10^6$ and 3.89 $x10^6$ respectively). There was an increase in the fungi number in the burrow wall sample and a decrease in the bacterial count. The actinomycete count remained the same (Graph 1). A 19% increase of fungi between control soil and burrow wall soil after 30 days was observed.

After 45 days the percent of the total microflora in the sample was as follows – fungi 58.8%, bacteria 27.36% and actinomycetes -13.84% as compared to the control soil where the fungi was 38.09%, bacteria 52.98% and actinomycetes -8.93%. Here too an increase in the fungal number was observed in the burrow wall sample compared to control sample so also an increase in the actinomycete number was observed. Bacterial count decreased after 45 days (Graph 2). The increase in fungal number between control soil and burrow wall soil after 45 days was observed to be 55% as against 19% after 30 days. The increase in fungi in burrow wall sample between 30 and 45 days fungi was 34%.

Fungi isolated

A total of 35 species of fungi were recorded of which 8 species were isolated only from burrow wall samples, and 5 only from control soils. 22 species were isolated from both control and burrow wall soil. The dominant fungal community in burrow wall differed from that in the control soil.(Table 1)

Table 1- Percentage of Fungi at 30 and 45 days interval

		30 days		45 days		
S.No.	Fungi isolated	Control soil	Burrow wall soil	Control soil soil	Burrow wall soil	Species Identified
1	*Aspergillus niger*	04.64%	06.74%	06.25%	1.94%	1
2	Zygomycetous fungi	07.79%	03.68%	00.59%	——	2
3	*Aspergillus flavus*	02.69%	05.83%	04.76%	03.74%	1
6	*Alternaria alternata*	02.39%	02.90%	01.19%	01.30%	1
7	*Curvularia spp*	00.29%	01.53%	01.19%	———	2
8	*Chaetomium spp*	———	———	02.98%	———	1
9	*Fusarium spp*	01.35%	01.53%	05.95%	00.32%	4
10	*Cladosporium spp.*	02.39%	01.99%	02.98%	01.30%	2
11	*Nigrospora oryzae*	——	———	04.76%	——	1
12	*Acremonium spp*	——	———	02.98%	———	3
13	*Rhizopus oryzae*	——	01.85%	04.46%	———	1
14	White colony	——	———	——	00.49%	2
15	*Saccharomyces* spp	13.93%	13.78%	——	09.44%	1
16	*Aspergillus oryzae*	00.46	00.91%	——	01.30%	1
17	*Volutella* spp	——	———	——	32.88%	1
18	*Aspergillus albus*	——	00.61%	——	00.65.%	1
19	*Penicillium* spp	00.59	01.22%	——	03.58%	3
20	*Verticillium* spp	———	———	——	00.65%	2
21	*Trichoderma* spp	00.29%	01.84%	——	00.65%	3
22	*Paecilomyces* spp	———	———	——	00.65%	2
					Total	**35**

Species isolated only form burrow wall soil include- *Paecilomyces* spp.(2), *Verticillium* spp. (2), *Aspergillus albus* (1), *Volutella* spp.(1) and unidentified(2).

The difference between burrow wall and control soil fungal communities was less pronounced in 30 days of sampling as compared to 45 days. Nine new fungi were observed in 45 days burrow wall sample as compared to control soil. The percentage occurrence and diversity of fungi in 30 days and 45 days sample is shown in Fig 1 and 2

Discussion

The results of total count of microflora obtained from burrow wall soils indicated that total numbers of fungi and actinomycetes were higher in burrow wall soil that in surrounding soils. The total bacterial numbers showed a decrease. There was a change in the diversity of the fungal population too in the burrow wall soil. Idowa *et al* (2006) in a related study also reported that the total aerobic and anaerobic counts of microflora were higher in casts that in surrounding soil. Another study by Polyanskaya and Tiunov [1996] showed that fungal hyphae were less dense and bacteria were more abundant in the drilosphere than bulk soil.

Earthworm burrow wall creates a favorable microhabitat for the soil microflora. Tropical geophagous earthworms seem to exploit soil organic resources by a mutualist earthworm/microflora digestion system (Lavelle *et al.*, 1983). There is a great deal of information suggesting that earthworm activity changes the microbial community structure of soil. High microbial biomass and activity in earthworm burrow walls were recorded in a range of field and laboratory studies (Tiunov & Scheu 1999). Moreover, earthworm burrow walls and other zoogenous soil structures harbour distinctive communities of soil animals, e.g. protozoa, nematodes and microarthropods, which presumably control microbial activity in these microhabitats (Hamilton & Sillman 1989; Anderson & Bohlen 1998; Maraun et al. 1999; Tiunov & Kuznetsova 2000; Tiunov et al. 2001a). Thus, earthworm- associated microhabitats may contribute to the maintenance of soil faunal diversity.

Burrowing activity of *P. corythurus* creates distinctive microhabitats, which differs considerably from surrounding soil. Effects of earthworms on the microbial community depend, in part, on the timing of the measurement. Some effects of earthworms may become apparent only after an extended period of time because changes that affect microbial community composition and trophic interactions, such as diffusion of nutrients beyond the burrow walls and development of pore structure in the burrow walls, may occur gradually. There have been contrasting effects on microbial biomass, with microbial biomass increasing, decreasing, or showing no net change relative to soil unaffected by earthworms (Brown, 1995). Clegg et al. (1995) found that total bacterial counts in burrow and bulk soil were initially no different, but increased through time in casts and remained elevated compared with bulk soil. The present study shows a similar result with an increase in fungal numbers from 30 to 45 days interval. It is significant here that the number of fungi in the control at both intervals

did not show much difference. The burrow wall soil also displayed more diverse fungal flora than that of the surrounding soil. A total of 35 species were recorded in the present study. Another study of casts recorded a total of 27 species (Tiwari 1993). Experiments with burrow walls of *Lumbricus terrestris* in forest soils show 2.5 times larger microbial biomass compared to surrounding soil. Both bacterial and fungal communities differed significantly from the control soil. Generally, a substantial part of the fungal community in "lined" burrow walls were typical "litter" species, mainly *Trichoderma* and *Mucor* (Tiunov, A and Dobrovolskaya 2002).

The results of the present laboratory experiment suggest that there is no particular "burrow wall specific" fungal community. However there was found an increase in the number of *Penicillium*, *Volutella* and *Trichoderma* spp. in the burrow wall compared to control soil.

Pontoscolex is one of the few tropical earthworms capable of persisting under agricultural tillage conditions, it may be of some importance in creating soil properties favorable to plant growth and the present study reinforces the general concept that the burrow wall soil tends to be more microbiologically active than surrounding soil and might be a specialized microhabitat of enhanced microbial activity in soils.

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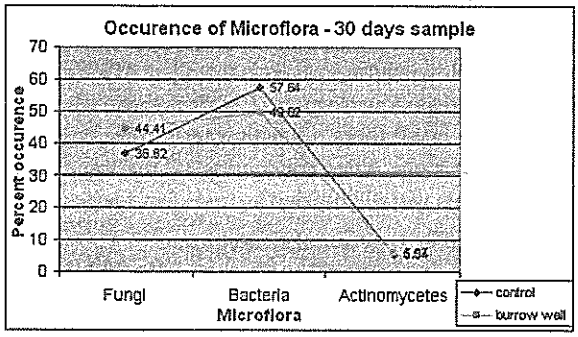
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Population of fungi, bacteria and actinomycetes in the burrow wall of *Pontoscolex corethrurus* at 30 days interval



Population of fungi, bacteria and actinomycetes in the burrow wall of *Pontoscolex corethrurus* at 45 days interval

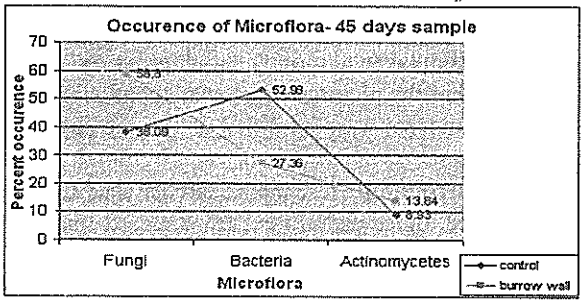
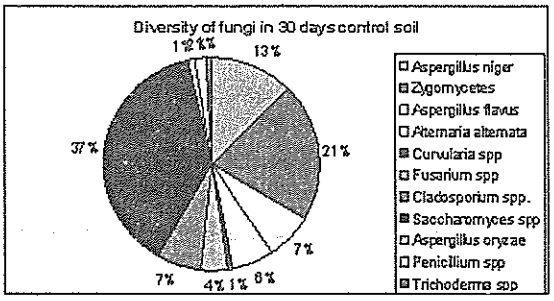


Fig 1 Diversity of fungi in the burrow wall of *Pontoscolex corethrurus* at 30 days interval



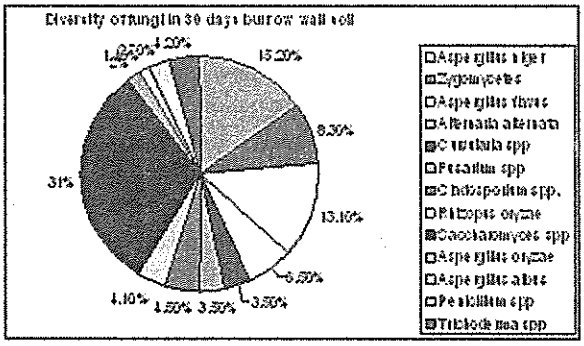
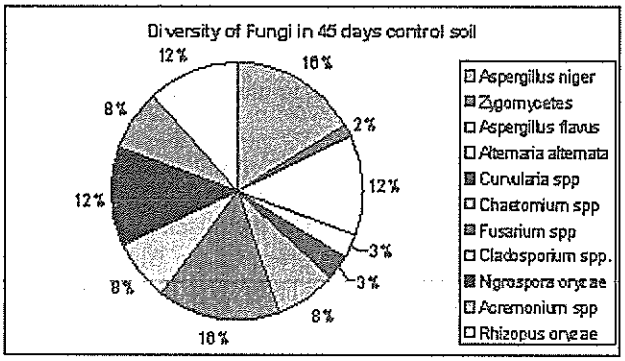
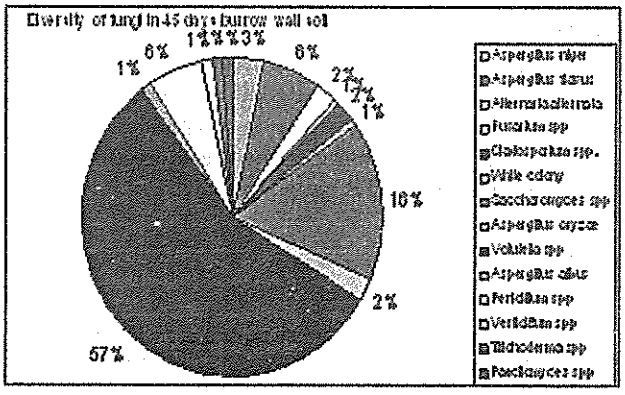


Fig 2 Diversity of fungi in the burrow wall of *Pontoscolex corethrurus* at 45 days interval





STRATEGIES TO ACCELERATE SCIENCE LEARNING AMONG SLOW LEARNERS

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Inroduction:

Children, the most precious asset of any nation deserve the best care that mankind can offer. They are like seeds whether they go waste or shape up as a huge tree depends on how they are nurtured. Parents and teachers should understand what a child is good at and encourage the same. Opportunities are needed to foster fullest development of the inherent potentialities. No doubt, every nation is investing in the education of its young but strategies have not been developed to the fullest extent to identify the slow learners and strengthen them in order to develop strong nation.

The identification of slow learners is a difficult task as children show potentialities in one or the other areas but may be poor in school performance. If one child is poor in some of the subjects like music, drawing, painting and other extracurricular subjects, though they are part of the school curriculum , the performance in these subjects do not severely affect their achievement in life but if the child is poor in academic subjects like science, maths and other compulsory subjects, it matters a lot for parents as well as teachers. They worry and bother very much as children cannot escape studying these subjects till they pass their basic education (SSLC) and moreover achievement in these academic subjects is considered as the yardstick for further education and career. To learn the new technologies, knowledge of science is a must. Thus the present study was carried out to identify strategies to accelerate science learning.

A preliminary survey was carried out to collect information regarding the total number of Government and private schools prevailing in Dharwad city. The list of schools in Dharwad city was obtained from the office of the Block Education Officer(BEO) of Dharwad city. There were 38 Government and 25 private schools in Dharwad taluk at the time of survey. It was decided to take schools located within 10 kms radius and the postal addresses of these schools were taken from the BEO office. Further an introductory letter along with the self-addressed envelope was sent to all the heads of the schools. The timely reply was received only from four schools. Later the investigator personally visited all the heads of the four schools for taking prior permission to conduct the experiment. The willing cooperation of the teachers of the schools, timings of the school and strength of the

students in the IVth standard were considered while selecting schools. Though there was willing co-operation of the head of the institution as well as class teachers from all the four schools, two schools were dropped because the timings of the school overlapped with the other which were selected for the study. Finally, two schools were selected for the study. Further, the list of students studying in the IVth standard was taken from the concerned class teachers and also the list of marks scored by the students in the previous two monthly tests and half yearly examination in all the subjects was obtained from both the schools. The real slow learners were identified using four screening methods.

1. Teacher's assessment: Teacher assessed the overall intelligence and skill of pupil during question and answer session, playing puzzles, solving simple problems, sports, games and other extra curricular activities. The teacher tested the memory power, attention span, reasoning ability, abstract thinking, leadership qualities etc in day to day activities.

2. Academic performance: Based on the previous formal examinations like monthly, mid-term and annual examinations, the level of academic achievement was assessed. Those who scored continuously low marks were considered as slow learners.

3. Intelligence tests: There are many standardized and validated tools to assess intelligence of children. Some of the simple and reliable tools like Raven's standard and colored progressive matrices was used to assess intelligence. The children who scored continuously 'below-average' even in this form of informal test were considered as slow learners.

4. Achievement tests: sometimes, children due to exam fear and nervousness, score less informal examinations. Informally, some simple tests were conducted based on the previous portion they had studied in relaxed atmosphere. Those who scored 'below-average' even in this form of informal test were considered as slow learners. Children those who scored below average in all these screening tests were considered as real slow learners. After conducting all the four tests, finally 96 students were identified as real slow learners.

Development of instructional strategies:

I. Models: This instructional strategy consisted of models of animals, birds, fruits, flowers, nature and other naturally available seeds of fruits, vegetables, cereals, pulses and oilseeds.

II. Picture book: The subject matter were illustrated with the help of different pictures and designs. The help of the drawing teachers was taken to color the pictures. Suggestions of the teachers were taken to modify and improve the clarity of pictures. Further the pictures which were confusing and not clear to the students were modified as per the suggestions after the pre-test.

III. Video instruction: Here the researcher used CD's containing science topics useful for IVth standard students for teaching of science subject.

IV. Peer tutoring: Here students taught the other students.

The student who received the instruction is called tutee and the one who taught the subject is the tutor. The tutors who had aptitude for teaching were selected by the teachers.

V. **Individualized instruction:** Here the researcher taught the portion according to the needs of each slow learner. The portion was taught repeatedly using all the instructional strategies developed.

Results and Discussion

In order to improve the capacity and speed of learning, students intervention was carried out using the five strategies developed. In the beginning of the academic year when school reopened, teachers of the particular class highlighted the important basic points of the portion covered in previous year (class) for two weeks. After 15 days investigator conducted knowledge test (pre test) with the help of teacher using the question paper which covered the portion of the previous class. Further out of 96 slow learning students identified 11 were treated as control group and the other 5 groups of 17 students each were treated as experimental groups to each science subject using 5 different strategies (1-Models, 2-Picture book, 3-Video instruction, 4-Peer tutoring and 5- Individualized instruction).

The intervention program was initiated separately during science class hours . All the experimental groups received one hour instruction daily for 6 months using the respective instructional strategies. The results revealed significant difference between pre-test and post - test scores of control and experimental group students taught using different strategies it is clear that performance of the students taught by video instruction(14.14) was better followed by instructional method i.e models (11.30), picture book (10.30), individualized instruction (9,06) and peer tutoring (8.39) (Table-1).

It is also observed that there is significant difference between the post – test scores of students in the control group taught through the normal teaching method in the room and the students from the experimental group taught using the different instructional strategies. The science achievement of experimental group students was higher that that of the control group students (Table -2)

Further from table-3 the values of 't' test revealed that the different strategies i.e , video instruction, Picture book , models , peer tutoring and individualized instruction were significantly effective in improving the ability of learning science of slow learners. Students of the experimental groups performed significantly better in science that the students from the control group after the intervention program(Table-3)

Among the five instructional strategies, video instruction was found to be an excellent and effective teaching strategy. This result is in line with the study carried out by Soundaraja and Rajaguru (1985). Video instruction provides for considerable visualization of objects and processes which is very essential for better perception of concepts. It provides unique experience to the slow learners in the presentation of instructional content. Concrete presentation of instructional content ensured in video instruction is very conducive for the slow learner for making a better perception of the concept. The concept if not understand at the first attempt can be made to understand thoroughly by making use of the provisions such as 'pause' and 'play back'. Not only that , they can also take the video cassettes to their houses and view the instructional programme according to their convenience. This enables the slow learners to learn the subject matter better at their own speed.

Secondly it was observed that the picturisation of the subject matter developed interest among children and increased concentration and curiosity which enabled students to grasp the subject matter easily. Pictures having different colours help imprint the subject matter in the mind of the students. Usually children enjoy pictures and more over visual aids are better than only verbal explanation.

Further, the instructional strategy which consisted of models is also found to be an effective device that fosters concrete learning . It is a kind of play way method of self learning. Models along with verbal instruction certainly increases the speed of comprehension, improves the capacity of retention of knowledge, enhances the power of understanding and also arouses the sensations for self activity as almost all the sensory organs are involved in the learning process. The main principle behind is the importance of sense of touch as emphasized by Montessori in the curriculum for teaching young children. Young children have a very strong desire to touch everything that they see. Learning by using various sensory stimuli, too difficult task or problem can be made easy, increases thinking power, fosters mental activity and helps in exploration (Bhadwal and Sood, 1991).

Another strategy used was individualized instruction. Instruction was given by the researcher according to the individual needs of the student. Repetition as well as emphasis was given on the topics in which the students were weak. However some children need much guidance in developing each new concept and the teaching of the concepts must be explicit and detailed.

Peer tutoring is also found to be an effective measure in learning. In peer-tutoring the learner is generally more relaxed and stress free atmosphere help to grasp more in learning. Though peer tutoring increased the rate of learning however, the result was found to be non-significant. Overall the strategies were found to be interesting and useful than mere verbal teaching.

Conclusion:

From the above results, the fact is revealed that all the instructional strategies motivate students and develops interest for learning. Repeated information of the subject matter with visual aids and informative pictures helps in imprinting the subject matter permanently in the mind of students.

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Table-1: Impact of teaching on science through different strategies

Type of instruction	Mean scores		Gain scores
	Pre-test	Post- test	
Normal teaching method	10.70	18.20	7.50
Picture book	12.62	22.92	10.30
Models	11.95	23.33	11.38
Video instruction	11.54	25.68	14.14
Peer tutoring	10.92	19.31	8.39
Individualized instruction	11.00	20.06	9.06

Table-2: Comparison of Pre-test and post-test mean scores of control and experimental group slow learners in science

	Pre –test		Post-test	
	Control	Experimental	Control	Experimental
Mean	11.25	11.34	18.20	25.27
SD	3.41	3.58	5.04	7.62
't'	0.171ns	4.25*		

Table-3: Comparison of mean scores in science of control and different experimental groups after the intervention program

Group	Mean scores of experimental group	Mean scores of control group	SD-1	SD-2	't' value
Models – control	22.92	18.20	7.53	4.21	3.12
Picture book- Control	23.33	18.20	7.14	4.21	6.54**
Video instruction- Control	25.68	18.20	8.02	4.21	7.53**
Peer tutoring- Control	19.31	18.20	6.12	4.21	4.27*
Individualized instruction – Control	20.06	18.20	6.59	4.21	4.12*

वैदिक वाङ्मय में गर्भविज्ञान

डॉ. प्रज्ञा जोगेश जोशी
व्याख्यात्री, महर्षि वेदविज्ञान - अकादमी, अमदावाद, गुजरात

सुसन्तति निर्माण का शुभारम्भ सन्तान गर्भ में आये उससे पूर्वे ही माता-पिता को अपनी शारीरिक और मानसिक तैयारी प्रारम्भ कर देनी चाहिए । सन्तान के रूप में जीवात्मा का अवतरण और उसकी विकास यात्रा में योगदान देना माता-पिता की समझदारी सांझीदारी तथा उत्तरदायित्व है । सुयोग्य बालक ही राष्ट्र के सुयोग्य नागरिक बनते हैं । अच्छे बीजों से उत्पन्न खेती अच्छी होती है । सुयोग्य सन्तान होना बहुत कुछ इस बात पर अवलम्बित है कि माता - पिता सुयोग्य हों । सुयोग्यता का आधार पवित्रता और आध्यात्मिकता से ही है ।

उपनिषदों में कोषों के आधार पर व्यक्तित्व विकास सङ्कल्पना को साकार करने के लिए हमारे महर्षियों ने संस्कारों का सांचा तैयार किया था और फलस्वरूप उस सांचे में से निकलने वाला बालक शारीरिक दृष्टि से सबल, प्राणिक दृष्टि से सन्तुलित, मानसिक दृष्टि से सद्विचारी, बौद्धिक दृष्टि से सत्यान्वेशी तथा आत्मिक दृष्टि से सेवाभावी था ।

वैदिक वाङ्मय में सुसन्तति की उत्पत्ति के बारे में सविस्तर चर्चा की गई है । प्रस्तुत शोधलेख मे सन्ततिजनन शास्त्र (सुसन्तति के जन्म के साथ जुड़े हुए शास्त्र) अर्थात् गर्भ विज्ञान के बारे में शास्त्रीय एवं वैज्ञानिक दृष्टिकोण से प्रस्तुति करने का विनम्र प्रयास किया गया है ।

वैदिक युग में समाज के प्रत्येक नागरिक के मन पर पहले से ही से भाव अङ्कित कर दिये जाते थे कि पैदा होते ही उस पर कितना ही उत्तरदायित्त्व आ जाता है, वह स्वतंत्र व निःश्रृङ्खल नहीं है । उसे अपने जीवन में तीन ऋण चुकाने पड़ते थे । तैत्तिरीयसंहिता[1] में कहा है कि "ब्राह्मण उत्पन्न होते ही तीन प्रकार के ऋणों से ऋणवान् होता है । ब्रह्मचर्याश्रम में वेदाध्ययन, विद्यादि प्राप्ति द्वारा ऋषिऋण, यज्ञों द्वारा देवऋण तथा सन्तानोत्पत्ति द्वारा पितृऋण चुकाया जा सकता है ।" मनुस्मृति[2] और अथर्ववेद[3]-संहिता में भी दर्शाया गया है कि तीनों ऋणों से उऋण हुए बिना मोक्ष की प्राप्ति नहीं होती है ।

प्राणी मात्र का शरीर उसके माता-पिता की देन है । केवल उनकी सेवा करने से पितृऋण से उऋण नहीं हुआ जा सकता है । इसके लिए वंश परम्परा बनाए रखना अत्यावश्यक है । इसके पीछे एक कारण यह भी है कि मनुष्य के जीवित रहते वंश परम्परा आवश्यक है इसके अतिरिक्त मृत्यु पश्चात् भी वंश आवश्यक है जिसके माध्यम से पिण्डदान, दाह, श्रद्धादि, कर्म करने होते हैं । इनको किए बिना मृतात्मा की सद्गति नहीं होती ऐसा हमारे शास्त्रकारों का कथन है । यह अधिकार भी पुत्र को ही होता है । अत : हमारा यह धर्म है कि हम अच्छे कुल, गोत्र, शील संस्कार की कन्या से शुद्ध विवाह करें और उससे पुत्र उत्पन्न करें अर्थात् गृहस्थाश्रम का पालन करें ।

प्राचीन काल में सुसन्तान उत्पन्न करना पवित्र कर्तव्य समझा जाता था । वैदिक ऋषि देवताओं से प्रार्थना किया करते थे कि उन्हें अच्छी सन्तान प्राप्त हो व वह चिरञ्जीवी तथा समृद्धिशाली बने ।[4] आदर्श पुत्र वह समझा जाता था जो देवताओं का भक्त रहता था तथा प्रार्थना द्वारा उनको प्रसन्न कर सकता था, तथा जो बुद्धिशाली, शत्रुहन्ता तथा विद्वान् रहता था ।[5] अत्रिपुत्र द्युम्नने एक ऐसे पुत्र की प्राप्ति के लिये प्रार्थना की थी जो शत्रुओं को युद्ध में हरा सके ।[6] एक अन्य ऋषि ने सशक्त, आह्लादक, यज्ञकर्ता, दानदाता, व शत्रुओं के विजेता पुत्र की प्राप्ति के लिए प्रार्थना की थी ।[7] इन उल्लेखों से स्पष्ट हो जाता है कि वैदिक युग में पुत्रों को विद्वान्, धार्मिक, स्वावलम्बी, वीर व युध्धकला रत बनाया जाता था । इस प्रकार माता-पिता अपनी सन्तान को सुयोग्य बनाने में कोइ कसर बाकी नहीं रखते थे । यही पितृऋण का तात्पर्य है। इस प्रकार पितृऋण के कारण समाज का वातावरण पवित्र रहता था, तथा प्रत्येक व्यक्ति अपने उत्तरदायित्व को समझता था ।

वास्तव में सत्पुत्र प्राप्त करने के लिए ही धार्मिक संस्कारों का आविर्भाव हुआ । अन्यथा मनुष्योत्पत्ति तो विवाह संस्कार किए बिना ही हो सकती है । समाज को सदृढ, सुसंस्कृत, सुसंगठित बनाए रखने के लिए ही यह सब हुआ है । यदि कल्पना से भी इस विहित संस्कारों से अलग होकर समाज निर्माण सोचा जाए तो सब तरह अमर्यादित, भ्रष्ट समाज दृष्टिगोचर होगा । गर्भाधानादि प्राग्-जन्म संस्कार तथा नामकरण, आदि जन्म पश्चात् संस्कार सुपुत्रोत्पत्ति के लिए ही बताए गए हैं । आज हम संस्कारों के ह्रास के कारण समाज की मर्यादाओं को ह्रास के साक्षात् द्रष्टा है । अतः यह कहा जा सकता है कि अपनी वंश परम्परा को निरन्तर बनाये रखने के लिए एवं सत्पुत्र प्राप्ति द्वारा पितृऋण से उऋण होने के लिए गार्हस्थ्याश्रम में प्रवेश करना अत्यावश्यक है ।

स्थिर आदर्श समाज के गठन के लिए विवाह को सर्व संस्कृतियों ने अनिवार्य संस्कार माना है । भारतीय परम्परा में विवाह संस्कार के तीन मुख्य उद्देश्य हैं । मनु ने कहा है कि - "सन्तति, अग्निहोत्रादि कार्य, पति की सेवा, उत्कृष्ट रति, पितरों का और अपना स्वर्ग साधन, ये सब पत्नी के हाथ हैं ।[८] विवाह के तीन मुख्य उद्देश्य धर्म, प्रजा एवं रति में से धर्म को प्रथम, और रति को अन्तिम स्थान प्राप्त हुआ है । इससे पता चलता है कि विवाह द्वारा जातीय आकर्षण को बुद्धिपूर्वक नियन्त्रित किया फलस्वरूप नियन्त्रित सहजीवन की सुवास से महेंकता समाज निर्माण हुआ ।

सगोत्र, सप्रवर विवाह निषेध :-

गृहस्थाश्रम में प्रवेश विवाह से होता है । प्राचीन ऋषि-मुनि शास्त्रकारों ने विवाह संबंध अगोत्रीय एवं अप्रवरीय करने का सिद्धान्त विहित किया है । अर्थात् सगोत्र सप्रवर विवाह का निषेध किया है । गोत्र का अर्थ है "आपस में सम्बन्धित मनुष्यों का एक दल[९] या समूह ।" बृहदारण्यकोपनिषद् में गौतम, भारद्वाज, विश्वामित्र, जमदग्नि, वसिष्ठ एवं कश्यप आदि का गोत्रोल्लेख किया है ।[१०] शब्द कल्पद्रुम[११] के अनुसार गोत्र अर्थात् पूर्व पुरुष । अष्टाध्यायी[१२] में पाणिनी ने गोत्र की व्याख्या वंश या कुल के अर्थ में की है । गोत्र की व्युत्पत्ति कई प्रकार से बताई गई है । पूर्व पुरुषों का यह उद्घोष करता है, इसलिए गोत्र कहलाता है । इसके पर्याय है सन्तति, कुल, जनन अभिजन, अन्वय, वंश, सन्तान आदि । वास्तविक अथवा कल्पित आदि पुरुष से वंश परम्परा प्रारम्भ होती है ।

मनु के मत अनुसार जमदग्नि, भरद्वाज, विश्वामित्र, गौतम, वसिष्ठ, कश्यप, अगस्त्य मूल गोत्र ऋषि थे । यद्यपि अन्यत्र मनुने चौबीस गोत्रों का उल्लेख किया है । गोत्रों के आदि पुरुष ब्राह्मण ऋषि थे । इसलिए ब्राह्मण के जो गोत्र हैं वे ही पौरोहित्य परम्परा से क्षत्रिय, वैश्य और शूद्रों के भी गोत्र हैं । जिनकी पौरोहित्य परम्परा छिन्न हो गयी है और जिनके गोत्र का पता नहीं लगता उनकी गणना काश्यप गोत्र में की जाती है, क्योंकि काश्यप सबके पूर्वज माने जाते है ।[१३] श्रौत साहित्य, स्मृतियों आदि में गोत्रों के बारेमें स्पष्ट उल्लेख हैं । मुख्य रूप से विश्वामित्र, जमदग्नि, भारद्वाज, गौतम, अत्रि, वसिष्ठ और काश्यप ऋषियों की सन्तान को भी गोत्र कहा गया है। पहले तो ये गोत्र सात ही थे, बाद में इनकी संख्या हजारों लाखों में पहुँच गई ।[१४] गोत्र के संबंध में याज्ञवल्क्य तथा बौधायन का कथन है कि इनकी संख्या आठ न होकर हजारों हैं, परन्तु वंश-परम्परा में वंश का जो कोई प्रसिद्ध पुरुष हुआ, चाहे वह आदिम काल में हुआ अथवा बीच के काल में हुआ, उसके नाम से गोत्र चल पड़ा ।[१५]

इस दृष्टि से यह कहा जा सकता है कि आज जो गोत्र परम्परा प्रचलित है वह उन उन परिवारों में इन परिवारों के आदि प्रवर्तकों, जिनसे परिवार प्रारंभ हुआ था, के नाम से ही प्रचलित हुई है । ये गोत्र वंश के आदि पुरुष के द्योतक समझे जा सकते हैं । इन गोत्रों का सम्बन्ध आदि ऋषियों, महापुरुषों से रहा है । जिन परिवारों के आदिपुरुष एक ही रहे है, उन्हें आपस में भाई बहन समझा जाता है अतः सगोत्र (समानगोत्र)में विवाह निषिद्ध किया गया है ।

गोत्र और वंश के प्रवर्तक ऋषियों के व्यावर्तक ऋषि विशेष को प्रवर कहते हैं ।[१६] प्र विशिष्ट रूप एवं 'वर वरणे' धातु से वर चुन लेना अर्थात् विशेष रूप से जिसे यज्ञादि के लिए चुन लिया जाए उसे 'प्रवर' कहते

है । अथवा वरण करने योग्य, आवाहनीय (प्रार्थनीय) । गोत्र की भाँति प्रवर भी ऋषियों के ही नाम हैं और वह प्राचीनकाल से ही गोत्रों से जुड़े हुए हैं । प्रत्येक गोत्र के साथ एक, दो, तीन या पाँच (किन्तु चार नहीं और न पाँच से अधिक)ऋषि होते हैं जो उस गोत्र के प्रवर कहलाते हैं । गोत्रों को दलों (गणों)में गठित किया गया है । बौधायन के अनुसार प्रमुख आठ गोत्र कई पक्षों में विभाजित हुए । उपमन्यु का प्रवर है वसिष्ठ, भारद्वाज, इन्द्रप्रमद; पराशर गोत्र का प्रवर है वसिष्ठ, शाक्त्य, पराशर्य; कुण्डित एवं वसिष्ठों का प्रवर है केवल वसिष्ठ । अत:कुछ लोगों के मत से प्रवर का तात्पर्य है ऋषिगण जो एक गोत्र के संस्थापक को अन्य गोत्र संस्थापकों से पृथक् करते हैं ।[१७] आश्वलायन श्रौतसूत्र[१८] एवं बौधायन श्रौतसूत्र[१९] के मत से क्षत्रियों एवं वैश्यों के प्रवर के उनके पुराहित के प्रवर होते है । बौधायन ने सहस्रों गोत्र बताएँ हैं और उनके प्रवराध्याय में ५०० गोत्रों एवं प्रवर ऋषियों के नाम हैं ।

यद्यपि अधिकांश गोत्रों के तीन ऋषि हैं किन्तु सब प्रवर एक ऋषि वाले, दो ऋषि वाले या पाँच ऋषि वाले होते हैं । यथा प्रवर वाघ्रवश्य, वसिष्ठों में एक प्रवर ऋषि वासिष्ठ है, शुनकों में एक प्रवर ऋषि गृत्समद या शौनक या गात्समद है, अगस्तियों में एक प्रवर ऋषि आगस्त्य है ।[२०]

क्षत्रियों एवं वैश्यों के कोई प्रवर नहीं होते । अत: विवाहादि में उनके पुरोहित के गोत्र और प्रवर की गणना होती है ।[२१] गोत्र एवं प्रवर में जो सम्बन्ध है उसके विषय में यों कहा जा सकता है - "गोत्र प्राचीनतम पूर्वज है या किसी व्यक्ति के प्राचीनतम पूर्वजों में से एक है, जिनके नाम से युगों से कुल विख्यात रहा है, किन्तु प्रवर उस ऋषि या उन ऋषियों से बनता है, जो अति प्राचीनतम रहे हैं, अत्यन्त यशस्वी रहे हैं और जो गोत्र ऋषि के पूर्वज या कुछ दशाओं में अत्यन्त प्रख्यात ऋषि रहे हैं ।"[२२]

सगोत्र और सप्रवर लोग आपस में भाई बहन कहलाते हैं अत: सभी शास्त्रकारों ने सगोत्र सप्रवर विवाह का निषेध किया है ।

सपिण्ड विवाह निषेध :-

विवाह, अशौच एवं वसीयत में सपिण्डता का विशेष महत्त्व है । जिसका एक साथ पिण्डदान हो अथवा मूल पुरुष एक हो वह सपिण्ड कहलाती है । उससे भिन्न असपिण्डा हुई ।[२३] पिण्डभागी पिता आदि से होते हैं । इनमें सप्तम, पिण्ड देनेवाला होता है । अत: सप्त पौरुष सापिण्ड्य होता है । इसमें स्त्रियों को भी पतियों के साथ कर्तृत्व होने से सपिण्ड्य की सिद्धि होती है ।[२४]

दूसरा मत है कि मूल पुरुष के एक शरीरावयव से अन्वय होने पर अवयव सपिण्ड्य होता है । यद्यपि भाई की स्त्रियों का आपस में यह सापिण्ड्य संभव नहीं है फिर भी आधानत्व से एक शरीर का अन्वय होता है क्योंकि उनमें मूल पुरुष पृथक् पृथक् है फिर भी मूल पुरुषों में अवयवों का पुत्र द्वारा उन स्त्रियों में आधान होता है ।[२५] यदि इसी प्रकार सपिण्डता को बनाए रखा जाय तो सम्पूर्ण विश्व में कहीं न कहीं सभी व्यक्ति सापिण्ड्य सम्बन्धी हो सकते हैं । अत: याज्ञवल्क्य ने सीमा निर्धारित की इस सम्बन्ध में सातवी पीढ़ी तक पिता की तथा पाँचवी पीढ़ी तक माता की सपिण्डता में अविवाह्य सम्बन्ध होंगे ।[२६] कहने का तात्पर्य यही है कि पिता की सातवी और माता की पाँचवी पीढ़ी तक विवाह सम्बन्ध निषेध है । उसके अनुसार पिता के कुल से आठवे और माते के कुल से छठे कुल में विवाह सम्बन्ध ग्राह्य हैं।

देश-धर्मानुसार और कुल परम्परा के अनुसार विवाह के सम्बन्ध में एक प्रश्न यह भी है कि किसी-किसी स्थान पर मामा की कन्या या बुआ आदि की कन्या से भी विवाह होता है, तो क्या वह उचित है? सपिण्ड के आलौड़न से तो ये दोनों सम्बन्ध सपिण्ड सिद्ध होते हैं । आपस्तम्ब धर्मसूत्र[२७] के अनुसार अपने माता-पिता एवं सन्तानों के समानोदर सम्बन्धियों अर्थात् माताओं एवं बहिनों से सम्भोग को महान् पातकीय क्रियाओं में माना गया है । अत: मामा की अथवा बुआ की लड़की से सम्बन्ध वर्ज्य हुए । मनु किसी भी स्थिति में

फुफेरी बहिन, मौसेरी बहिन और ममेरी बहिन के साथ गमन निषेध माना है, इतना ही नहीं विवाह करता है तो यह नरक गामी होता है[२८] इस प्रकार अधिकांश स्मृतिकार मातुल कन्या तथा बुआ की दुहिता से विवाह सम्बन्ध को वर्ज्य ठहराते हैं ।

इस प्रकार से सगोत्र, सप्रवर और सपिण्ड विवाह को वर्ज्य माना गया है । धर्म-सिन्धु में विरुद्ध सम्बन्ध विवाह का निषेध किया है, पति-पत्नी का आपस में माता-पिता के साम्य होने पर विरुद्ध सम्बन्ध होता है जैसे कि स्त्री की बहिन की लडकी पुत्री के समान और चाचा की पत्नी की बहिन इन दोनों का सम्बन्ध एक पक्ष में स्त्री का पति, पिता तुल्य और दूसरे पक्ष में स्त्री का पति पुत्र सदृश होता है यही विरुद्ध सम्बन्ध है । बौधायन ने कहा है कि माता की सौत की बहिन और उसकी लड़की का भी त्याग उचित है । यह विरुद्ध सम्बन्ध है । कुछ लोग कहते है कि ज्येष्ठ भाई पिता के समान है इस आशय के वचन से ज्येष्ठ भाई की स्त्री की बहिन मौसी तुल्य होने से विवाह के योग्य नहीं है ।

सगोत्र, सप्रवर, सपिण्ड विवाह निषेध के वैज्ञानिक कारण :-

पुत्रि के लिए प्रयुक्त दुहिता शब्द की सृष्टि हुई इसलिए है चूँकि वह दूर सम्बन्ध अथवा देश में विवाहित की जाती है । निरुक्त[२९] 'दुहिता दुर्हिता दूरे भवति' - कन्या का हित उसके दूर विवाह करने में ही है । यह बात की प्रजनन - विज्ञान (सायन्स ऑफ युजनिक्स) द्वारा भी पुष्टि पाई गई है । भारत में सपिण्ड विवाह का प्रतिबन्ध संभवतः दो कारणों से था - (१) यदि सन्निकट सम्बन्धी आपस में विवाह सम्बन्ध स्थापित करें तो उनके दोष कई गुने रूप में उनकी सन्तों में बढ़ जायेंगें तथा (२) यदि सन्निकट लोगों में विवाह - सम्बन्ध स्थापित होंगे तो गुप्त प्रेम की परम्पराएँ गूंज उठेगी और समाज में अनैतिकता का राज्य बढ जाएगा और उन कन्याओं के लिए, जो एक ही घर में सन्निकट एवं दूर के सम्बन्धियों के साथ रहती है, वर पाना कठिन हो जाएगा ।[३०]

इस सम्बन्ध में वैदिक विवाहदर्श[३१] नामक पुस्तक में मास्टर आत्माराम ने पश्चिमी विद्वानों के अनेक उद्धरण प्रस्तुत किए हैं ।

डॉ. बेलफोर महाशयने अपनी पुस्तक के ७० से ७८ पृष्ठ तक अपने इस कथन की पुष्टि की है रोगी माता-पिता के बच्चे कभी हृष्ट-पुष्ट नहीं हो सकते प्रत्युत असाध्य रोगों से ग्रस्त रहते हैं, फिर मदिरापान करने वाले की सन्तान किस प्रकार मन्द-पागल -दुष्ट और घृणित स्वभाव की दास होती है और इस बात की पुष्टि में उमत्तता से पृष्ठ ७८ से ८७ तक लेख लिखा है - फिर एक अन्य आवश्यकीय वैद्यक सिद्धान्त की ओर ध्यान दिया है, वह वैद्यक सिद्धान्त यह है कि सगोत्र विवाह करने में लाभ है या हानि ?

सगोत्र विवाह से प्रयोजन समीपी सम्बधियों अथवा एक परिवार के लडके लडकियों का परस्पर विवाह करने से है, इस सिद्धान्त के प्रत्येक अंग पर तर्क करते हुए उन्होंने समीक्षकों की अनुमति बतलाकर यह निर्णय किया है कि सगोत्र विवाह शारीरिक रोगों की उत्पत्ति और सन्तान के नाश का भारी कारण है ।

डॉ. बेलफोर ने अपने ग्रन्थ में डॉ. फाल्ज का पता देकर वर्णन किया है कि यह बात निश्चित है कि माता-पिता का प्रभाव सन्तान में अवश्य आ जाता है और समीपी सम्बन्धियों की सन्तान या तो अपने माता-पिता से बुरी अथवा अंगहीन (कुष्टि इत्यादि)अथवा पागल होती है । आगे लिखते है कि स्विट्जरलैण्ड की घाटियों में रक्त सम्बन्धियों में परस्पर विवाह का प्रचार है और वहाँ ठिंगनी और पागल सन्तान अधिकता से पैदा होती है ।

बस्ती के विचार से समीपी सम्बन्धियों में विवाहों का मध्यभाग फ्रांस देश में प्रति सैकड़ा दो है परन्तु जो इस प्रकार से विवाहों से सन्तान उत्पन्न होती है वह २८ प्रति सैकड़ा ठिंगनी और आलसी होती है ।

डॉ. हुई की सूचना का सार यह है कि - पागलों की संख्या का $\frac{1}{20}$ भाग अपने मातुल (मामा) और चाचा की सन्तान के परस्पर विवाह का प्रतिफल था । रक्त सम्बन्धी इस प्रकार १७ विवाह हुए जिनके बालकों

की संख्या ९५ थी । इन बच्चों में ४४ पूरे पागल थे और १२ बौने । डॉ. डेबी महाशय का वचन है कि १२१ रक्त सम्बन्धी विवाहों मे २२ तो नि:सन्तान रहे ।

डॉ. काल्डोल महाशय का वचन है कि कुटुम्ब के लोगों का परस्पर विवाह करना मानुषि अवनति का कारण होता है, इस प्रकार के विवाह के कारण यूरोप के कई राज्य परिवार नष्ट हो गए यद्यपि पहले वह शारीरिक चाल चलन और मन की शक्ति के लिए प्रसिद्ध थे ।

डॉ. बक्स्टन के कथनानुसार रक्त सम्बन्ध से सन्तानोत्पत्ति १० से लेकर १२ प्रति सैकड़ा बधिर (बहरे) होते है । १७० विवाह जो इस प्रकार के हुए और जो उनसे सन्तान हुई उसमें २६९ बच्चे बधिर और गूँगे थे।

डॉ. कैडियर का वचन है कि इस प्रकार के ५४ विवाह हुए थे । २४ वन्ध्या नीकलीं, सौत के सन्तान होकर मृत्यु को प्राप्त हुई । १८ के यहाँ क्षय के रोग में ग्रस्त, राजयक्ष्मा में ग्रस्त बहिरे, गूँगे, निर्बुद्धि बच्चे उत्पन्न हुए।

डॉ. मिचर का कहना है कि स्कॉटलैण्ड के देशो में जो पागलपन रोगी होते हैं, इनमें दश प्रतिशत रक्त सम्बन्धी विवाहों का प्रतिफल है ।

हैरी डिटरीडिसेन्ट नामक पुस्तक में लिखा है कि बेड़ौल, गंजे, लंगडे, काणे, निर्बल, कृश, अंगहीन, गूँगे, बहिरे, ठिंगने, अन्धे और कुरूप बच्चे उन परिवारों में पाए जाते हैं जहाँ कि रक्त सम्बन्धी विवाह होते हैं और असंख्य दृष्टान्त इन परिवारों के हैं ।

डॉ. एडवर्ड रीच लिखते है कि एक परिवार को अपना वंश स्थिर रखने के लिए जरूरी है कि परिवार के लोगों का स्वास्थ्य स्थिर किया जाए, परिवार के बाह्य कार्य उत्तम होने चाहिए और परिवार के लोगों में प्रफुल्लता दूर देश के लोगों के साथ विवाह करके स्थिर रखनी चाहिए जहाँ इसके विपरीत बर्ताव होगा वहाँ शारीरिक और आत्मिक निर्बलता बढ़ती जाएगी और अन्त को वह परिवार सर्वथा नष्ट हो जाएगा।

जब निर्बल बुद्धि के मनुष्य अपने निकटस्थ सम्बन्ध के छोटे घेरे में विवाह करने लग जाते हैं तो वह अपने शारीरिक दोषों के साथ अपने मस्तिष्क की बनावट भी दायभाग में छोड़ते हैं और यही कारण है इनकी सन्तान की निर्बल बुद्धि का । इस प्रकार की सन्तान यदि परस्पर विवाह करने से जीवित रह जाए तो इनके यहाँ अर्धविक्षिप्त सन्तान उत्पन्न होती है । यूरोप के बहुत से छोटे छोटे राज्यों के राजवंशी इस प्रकार के हैं और इनकी मूर्खता और पक्षपात के प्रतिफल सामाजिक और देशी कार्यो में देखे जा सकते हैं । प्रत्येक स्वतंत्र विचार, प्रत्येक उत्तम यत्न का इनकी ओर से अत्यन्त विरोध होता है ।

डॉ. फान्सिसडेवी का वचन है कि इस प्रकार के विवाहों से जो शारीरिक अवनति और चलन की निर्बलता उत्पन्न होती है । रंग रूप विकृत हो जाते है और सौन्दर्य जाता रहता है । श्वास और अन्य रोग बढते हैं । इस बात की पर्याप्त साक्षियें उपस्थित हैं कि इस प्रकार के विवाह पागलपन और सन्तान में मस्तिष्कीय निर्बलता उत्पन्न करते हैं ।

डॉ. विमिस लिखते हैं कि ३४ विवाह रक्त के सम्बन्धियों के हुए थे, सात तो बन्ध्या रहीं और २७ के यहाँ सन्तान हुई । २७ के यहाँ बच्चों की संख्या १९१ थी । १९१ बालकों में से ५७ तो बचपन में ही काल का क्लेवा हो गए और इनमें २४ की मृत्यु के कारण निम्नलिखित थे, शेष रोगों का पता नहीं।

राजयक्ष्मा - १५, मिरगी - ८, सन्निपात - १ = २४

शेष संख्या में हृष्ट पुष्ट थे । ३४ निर्बल पाए गए । ९ के स्वास्थ्य का पता नहीं लगा और ४७ इस प्रकार रोगी थे ।

श्वास रोग से ग्रसित थे	- १९	नेत्रहीन	- २		
वायु विकार	- २	लुले	- २		
मिरगी	- ४	कुष्टि	- ५	= ४७	
बधिर	- २	न्यून दृष्टि	- ६		
अर्धविक्षत	- ४	आलसी	- १		

डॉ. वीमिस ने लगातार परीक्षाओं से यह बात निश्चय की है कि बहुत से रक्त के सम्बन्धों में से जितने निकट सम्बन्धों में विवाह होते हैं उतने ही दु:ख और बुराइयाँ बढती जाती हैं ।

डॉ. जे. आर. विवेक का तर्क है कि जो एक ही माता-पिता के बालकों में पैतृक दूषण न्यूनाधिक एक ही प्रकार के रहते हैं, इसलिए यदि इनके परस्पर विवाह किएँ जाएँ तो वह दूषण इनकी सन्तान में जाकर द्विगुण हो जाते हैं ।

विवाह परित्याग का कारण दर्शाते हुए डेविस लिखते है कि जिस प्रकार प्राण विद्युत प्राण विद्युत को हटाती है आकर्षण नहीं करती इसी प्रकार समीपी सम्बन्ध में विवाह हो जाने पर एक दूसरे को घृणा करते हैं और त्याग देते हैं, इनमें आकर्षण अथवा प्रेम नहीं हो सकता । यह नियम है कि प्राण विद्युत रयि (मनकी)विद्युत आकर्षण करती हैं, अथवा यों कहो कि विरुद्ध प्रकार की बिजलियों में परस्पर मेल होता है । ठीक वैसे ही दूर दूर के सम्बन्धों में विवाह में परस्पर प्रेम बढ़ता है, परित्याग नहीं होते इसलिए समीपी सम्बन्ध में कदापि विवाह नहीं करना चाहिए ।

डॉ. ट्राल लिखते हैं कि यदि रक्त सम्बन्ध में विवाह किया जाएगा तो सन्तान भद्दी और उन्नति न करनेवाली उत्पन्न होगी । खाने-पीने और सोने में तो वह चतुर होगी परन्तु बुद्धि, आत्मिक राजनीति और परोपकार के कामों में सर्वथा अयोग्य निस्सन्देह स्वार्थ की मूर्ति होगी, जो कि रक्त के सम्बन्धों में विवाह करने वालों के माता-पिता के स्वभाव और व्यापार की लगन एक ही प्रकार की होती है इसलिए इनकी सन्तान में शारीरिक और अन्य दूषण अवश्य उत्पन्न हो जाते हैं । यदि रक्त सम्बन्ध में विवाह करने का नियम बन्द न हुआ तो मनुष्य जाति अत्यन्त नष्ट होने का मुख देखेगी । इस प्रकार के विवाह के विरुद्ध में ओर भी तर्क इसके विरुद्ध होंगे । संसार में सब से अधिक बुराइ की बात यह है कि लोगों में अत्यन्त विषयासक्ति की बात पाई जाती है और वह रुचि रक्त सम्बन्धी विवाहों से उत्पन्न हुई सन्तान में पाई जाती है अर्थात् यह कि वह अत्यन्त कामातुर होते हैं । पृथ्वी में मनुष्य जाति की शक्ति को कोई वस्तु इतनी शीघ्र नष्ट करने वाली नहीं जितनी कि यह कामातुरता करती है । बधिर, गूँगे, अन्धे लोगों की कथा के अनुसन्धान करने पर ज्ञात हुआ है कि वे प्राय: रक्त सम्बन्धी विवाह की सन्तान होते हैं । अमरीका के बहुत से राज्यों में पुकार मच रही है कि सरकार की ओर से रक्त सम्बन्धी विवाहों को अयोग्य और दण्डयोग्य ठहरा दिया जाना चाहिए ताकि सृष्टि में अयोग्य सन्तान उत्पन्न न हो ।

इस प्रकार से स्पष्ट लक्षित होता है कि सगोत्र, सप्रवर, सपिण्ड विवाह शारीरिक, मस्तिष्कीय ह्रास के भय से तथा नैतिकता के उल्लंघन के कारण भी सर्वथा परित्याज्य हैं । सगोत्र सप्रवर या सपिण्ड विवाह पर जो प्रतिबन्ध लगाए गए उसके कारण थे । पूर्व मीमांसा का एक नियम है कि यदि कोई दृष्ट या जानने योग्य कारण हो और यदि कोई अदृष्ट कारण हो ओर उसका उल्लंघन कर दिया जाए तो प्रमुख कार्य अवैध (रद्द) नहीं हो जाता, किन्तु यदि कोई अदृष्ट कारण हो और उसका उल्लंधन हो जाए तो प्रमुख कार्य की वैधता की समाप्ति हो सकती है । रोगी या अधिक या कम अंगो वाली कन्या से विवाह न करने के नियम का कारण दृष्ट है और ऐसे विवाह दु:ख और आलोचना का विषय बन जाता हैं । यदि ऐसी कन्या से कोई विवाह करे तो वह विवाह पूर्ण रूप से वैध माना जाता है । किन्तु सगोत्र एवं सप्रवर कन्या के साथ विवाह न करने का कारण अदृष्ट है और यदी ऐसा सम्बन्ध हो जाय तो वो विवाह नहीं कहा जा सकता, अत: यदि कोई किसी सगोत्र, सप्रवर या सपिण्ड कन्या से विवाह करे तो वह कन्या नियमपूर्वक उसकी पत्नी नहीं कही जा सकती ।[३२]

कुल :-

विवाह संबंध स्थापित करने के पूर्व सर्वप्रथम कुल परीक्षा करनी चाहिए । आश्वालायन गृह्यसूत्र के अनुसार माता-पिता दोनों की ओर से कुल की परीक्षा की जानी आवश्यक है ।[३३] अपने को उत्कर्ष की ओर ले जाना चाहिए यह तो सामान्य सिद्धान्त है इसी आधार पर मनु लिखते हैं "जो प्राणी अपने वंश को उन्नत करना चाहता हो वह पवित्र कुल, शील, विद्या, आचार वालों के साथ ही विवाहादि सम्बन्ध किया करे ।"[३४] भारद्वाज गृह्यसूत्र[३५]

के अनुसार कन्या से विवाह करते समय चार बातें देखनी चाहिए । यथा धन, सौन्दर्य, बुद्धि एवं कुल । इन चारों में से प्रथम कुल को अत्यंत महत्त्व दिया गया है । मनु का कथन है कि विविध प्रकार के धन-धान्य से पूर्ण होने पर भी हिन क्रिया अर्थात् जातकर्मादि संस्कारो से रहित हो, जिन में पुरुष सन्तति न होती हो, जो वेद के पठन-पाठन से रहित हों, जिसमें स्त्री और पुरुषों के शरीरों पर बहुत लम्बे और बड़े बड़े केश हो, जिनमें अर्श (बवासीर), क्षय यानी राजयक्ष्मा, मन्दाग्नि, मृगी, दाग और कृष्ट रोग जैसे दारुण रोग हों ऐसे कुल में विवाह सम्बन्ध नहीं करने चाहिए ।[३६] इस प्रकार से याज्ञवल्क्य स्मृति में भी महाकुल भी यदि संक्रमण आदि रोगों से ग्रस्त होती वे वर्जनीय कहे गए हैं ।[३७]

इसी सन्दर्भ में अमरीका के डॉ. हूब्रक महाशय ने विवाह करने वालों को सावधान किया है कि वह इन कुलों में विवाह न करें जिनमें विक्षिप्तता, गठिया, उपदंश, क्षयव्याधियुक्त, श्वास्, सदैव क्रोध, नासूर जैसे दायभागी रोग पाये जाते हैं । जर्मन देश के प्रसिद्ध वैद्य हियूफलैड महाशय इस विषय में लिखते है कि - "एक मनुष्य को ऐसे कुल में विवाह न करना चाहिए जो कि दीर्घायु के लिए प्रसिद्ध न हो, निर्मलचित्त की स्त्री, मिरगी के रोगी अथवा विक्षिप्त लोगों को विवाह नहीं करना चाहिए ।[३८]

नये व जैनीय कुल वे हैं जिनके सदस्य य तो बहुत लम्बे या ठिंगने हैं बहुत श्वेत या काले हों, विकलांग या अधिकांग हों, जो अत्यन्त विलासी तथा पाण्डु आदि रोगों से ग्रस्त हों ।[३९] मनु कन्या के दोष बताते हुए कहते हैं - "जिनके बाल भूरे हों, जो अधिकांगी हो, जो ज्यादा बीमार रहती हों, शरीर में रोम न हो अथवा बहुत रोम हों, जो बहुत बोलती हो, जिसकी आँखे पीली हों उस कन्या के साथ कभी विवाह न करें ।"[४०]

कुल की परीक्षा के विषय में इतनी अधिक सावधानी का कारण प्रधानत: प्रजननशास्त्रीय था । यथासम्भव श्रेष्ठतम सन्तति अभीष्ट थी और इस प्रयजोन के लिए बौद्धिक तथा नैतिक दृष्टि से योग्य दम्पति अनिवार्यत: अपेक्षित थे क्योंकि सन्तान में माता-पिता के अच्छे-बुरे गुणों का संक्रमण होता है । इस सम्बन्ध में हारित कहते है कि "कुलानुरूपा: प्रजा सम्भवन्ति" अर्थात् कुल के अनुरूप ही प्रजाएँ (सन्ततियाँ) उत्पन्न होती हैं । इसी प्रकार मनु की भी धारणा यही है कि "सन्तान या तो माता के या पिता के अथवा दोनों के शील को प्राप्त होती है ! किन्तु दुर्योनि से उत्पन्न सन्तति अपनी प्रकृति का त्याग कदापि नहीं कर सकती।" ह्रास से कुल की रक्षा के लिए वर या वधू-चुनने में अत्यन्त सावधानी रखनी पड़ती थी । कुविवाहों, धार्मिक क्रियाओं के लोप, वेद के अनध्ययन तथा ब्रह्मणों के अतिक्रमण से उत्तम कुल भी अकुलीनता को प्राप्त हो जाते हैं ।

असर्वण, अनुलोम एवं प्रतिलोम विवाह का निषेध :-

शास्त्राकारों का मत है कि अपने ही वर्ण अथवा जाति में विवाह करना आवश्यक है । जो व्यक्ति अपने वर्ण से बाहर अर्थात् असवर्ण विवाह करता है वह पाप का भागी होता है । समाजशास्त्रीय दृष्टि से यदि अन्तर्विवाह को परखा जाए तो इसके दो मुख्य उद्देश्य दिखाई देते हैं - प्रथमत: अन्तर्विवाह (सवर्णविवाह)का लक्ष्य प्रजातीय रक्त सम्बन्धी शुद्धता को बनाए रखना है । सामान्यतया यह धारणा पाई जाती है कि रक्तमिश्रण से प्रजाति के मूल गुणों का लोप हो जाता है । अत: अन्तर्विवाह के द्वारा इस दोष से बचा जा सकता है । दूसरा उद्देश्य है विशिष्ट वर्ण के रीतरिवाजों, परम्पराओं, संस्कृति सभ्यता आदि की दृष्टि से अन्तर्विवाह उपयोगी है । प्रत्येक वर्ण व जाति की कुछ अपनी ही रूढियाँ एवं पद्धतियाँ होती है जो उसको अन्य वर्णो अथवा जातियों से पृथक् करती है ।

वैदिक साहित्य के कुछ उदाहरणों[४१] से यह तो सिद्ध होता है कि उस समय असवर्ण विवाह प्रचलित थे, किन्तु इनमें भी एक विशिष्टता दिखाई देती है । सूत्रकारों और स्मृतिकारों ने यद्यपि सर्वत्र ही सवर्णा पत्नी को श्रेष्ठ कहा है[४२] तथापि अन्तर्जातीय अथवा असवर्ण विवाह भी प्रचलित रहे हैं । असवर्ण विवाह के भी दो रूप हैं । अपने वर्ण से निम्न वर्ण की कन्या से विवाह करना 'अनुलोम' विवाह है तथा अपने वर्ण से उच्च वर्ण की कन्या से विवाह करना 'प्रतिलोम' विवाह कहलाता है । इस में से अनुलोम विवाह के प्रति[४३] प्राय:

सभी सूत्रकारों और स्मृतिकारों ने सहमति प्रदान की है । यद्यपि शास्त्रकारों ने अनुलोम विवाह को विहित तो किया किन्तु ऐसे विवाह से उत्पन्न सन्तति को वर्णसंकर घोषित किया ।[४४] कुल में वर्णसंकर उत्पन्न होना सामाजिक निन्दा का हेतु था ।[४५] दूसरे निम्नवर्ण की स्त्री से उत्पन्न पुत्र को उत्तराधिकार में भी दाय का कम अंश प्राप्त होता था ।[४६] तीसरे उच्च वर्ण में गई हुई निम्न वर्ण की कन्या के साथ समानता का व्यवहार न किया जाता रहा हो । अनुलोम विवाह के प्रति लोक रुचि न होने के ये कारण रहे होंगें ।

प्रतिलोम विवाह अनुलोम विवाह के बिलकुल विपरीत है । यह विवाह अत्यंत निन्दित माना जाता था। ऐसे विवाह से उत्पन्न सन्तति चतुर्वर्ण में परिगणित न की जाकर अन्त्यज, निषाद तता चाण्डाल कहलाई जाती थी ।[४७] उपर्युक्त समस्त विवेचन से ज्ञात होता है, बहिर्विवाह के मूल में प्रजनन सम्बन्धी कारण ही प्रमुख हैं । अन्तर्विवाह (सवर्णविवाह)के लिए जातिगत श्रेष्ठता का भाव एवं वर्णों की विभिन्न संस्कृति एवं परम्पराएँ ही उत्तरदायी हैं ।

विवाह योग्य आयु :-

सन्तान की कामना से विवाह किया जाता था अत: विवाह के पूर्व पिता के घर में कन्या का पूर्ण शारीरिक विकास हो जाना आवश्यक है ।[४८] कन्या का पति की कामना करना और सन्तानोत्पत्ति में सक्षम होना इस तथ्य का सूचक है कि कन्या की आयु कम से कम सोलह वर्ष की अवश्य होती होगी ।

सुश्रुत संहिता में कम आयु के स्त्री पुरुष को सन्तानोत्पत्ति का निषेध किया है । सोलह वर्ष से कम आयु की स्त्री यदि पच्चिस वर्ष से कम आयु के पुरुष के साथ संयोग से गर्भाधारण करती है या तो गर्भपात हो जाता है, अथवा उत्पन्न होने पर सन्तान चिरञ्जीव नहीं होता अथवा जीवित रह जाने पर भी अत्यधिक दुर्बल इन्द्रिय वाला होता है ।[४९] आयुर्विज्ञान के अनुसार शरीर की चार अवस्थाएँ होती हैं ।

प्रथम - वृद्धि - सोलह वर्ष तक ।

द्वितीय - यौवन - पच्चीस वर्ष तक ।

तृतीय - सम्पूर्णता - चालीस वर्ष तक । इस समय शरीर के अंग, तन्तु तथा विभिन्न स्राव अपने चरम अवस्था में होते हैं ।

चतुर्थ - किञ्चित् परिहाणि - चालिस वर्ष से ऊपर । - इस समय से शरीर में वृद्धि करने वाले विभिन्न स्राव एवं वीर्य आदि क्षीण होने प्रारम्भ हो जाते हैं ।

अत: आयुर्विज्ञान के अनुसार पच्चीस वर्ष के पश्चात् विवाह आयु प्रारम्भ होती है और चालीस - बयालीस वर्ष की आयु विवाह के लिए सर्वोत्तम है । सोलह वर्ष की कन्या एवं पच्चीस वर्ष का पुरुष समान रज-वीर्य के होते हैं ।[५०]

गर्भाधान अथवा चतुर्थकर्म :-

यह संस्कार आर्यों की सुविचारित जीवन प्रणाली की परिचायक है । वंश, समाज तथा राष्ट्र की उत्तरोत्तर अभिवृद्धि के लिए पति-पत्नी सहज कामवृत्ति को नियमित एवं संयमित कर के उत्तम सन्तानोत्पत्ति के लिए मानसिक तत्परता के साथ यह संस्कार सम्पन्न करते थे । यह संस्कार एक ही बार सम्पन्न किया जाता है । इस संस्कार के द्वारा माता के गर्भ में बीज के रूप में प्रतिष्ठित किया जाता है । जिस प्रकार बीज और क्षेत्र उत्तम हो तो अन्नादि पदार्थ उत्तम होते हैं उसी प्रकार उत्तम, बलवान स्त्री-पुरुषों के द्वारा सन्तान भी उत्तम होती हैं । पूर्ण युवावस्था, ब्रह्मचर्य का पालन और विद्याभ्यास पूर्ण कर के कम से कम सोलह वर्ष की कन्या और पच्चीस वर्ष का पुरुष अवश्य हो अथवा इससे अधिक वय हो तो फल अधिक श्रेष्ठ होता है, क्यूंकि सोलह साल से कम उम्र वाले गर्भाशय में बालक को योग्य रूप से विकसने का अवकाश नहीं होता । गर्भ धारण-पोषण का सामर्थ्य नहीं होता तथा पच्चीस साल से कम उम्र वाले पुरुष का वीर्य भी उत्तम नहीं होता ।

अधिकांश गृह्यसूत्रों में दर्शाया गया है कि विवाहित व्यक्तियों को विवाह के पश्चात् कम से कम तीन रात्रि सम्भोग नहीं करना चाहिए ।[५१] विवाह और सहवास के बीच के तीन दिन-रातों के लिए विविध व्रत नियम आदि का विधान किया गाय था । पारस्कर के मत से "विवाहित युगल को चाहिए कि वे तीन रातों तक पृथिवी पर सोएं, क्षार और लवण न खाएं तथा वर्षभर अथवा बाहर रातों तक अथवा छह रातों तक अथवा कम से कम तीन रातों तक सम्भोग न करें ।[५२] इन त्रिरात्रव्रत का उद्देश्य वर-वधू को यौन जीवन में संयतमार्ग का पाठ पढ़ाना प्रतित होता है । साथ ही इन तीन रातों में वर-वधू परस्पर सुपरिचित और विश्वासपात्र हो जाते थे और मैथुन में संकोचादि दूर हो जाते थे ।[५३] भोजन के नियम से रज और वीर्य की शुद्धि और उत्तम सन्तान की प्राप्ति अभिप्रेत रही होगी ।[५४]

ऋतुदान का काल :-

स्त्री को ऋतुकाल प्राप्त होने के पश्चात् ही वह गर्भ धारण करने के योग्य होती है अर्थात् जब कन्यावस्था पूर्ण हो गई हो और वह स्त्रीधर्म में आए अर्थात् स्त्री के रजोदर्शन होने के पश्चात् ही सम्भोग करना चाहिए। एकपत्नीव्रतधारी पुरुष को अपनी पत्नी से ऋतुकाल के अतिरिक्त दिनों में भी जो कामेच्छा हो तो उसे अमावास्या आदि पर्व के दिनों का परित्याग करना चाहिए । अवशिष्ट सभी दिनों में सहवास करना चाहिए।[५५]

प्रति मास के सोलह अहोरात्र और रजोदर्शन के चार निन्दित दिनों को स्त्रीयों का ऋतुकाल माना गया है । किन्तु कभी कभी वे दिन कम-अधिक भी हो सकते हैं । इस प्रकार उनके स्वाभाविक नियमों में अपवाद है ।[५६] संक्षेप में धर्म के नियमों के अनुसार स्त्री-संग १६ + ४ = २० अहोरात्र तक नहीं करना चाहिए । स्त्री-संग के लिए केवल हर मास की अन्तिम दस रात्रियाँ उत्तम हैं ।[५७] इन अन्तिम दस रात्रियों में से भी पुरुष बालक की कामना रखने वाले पुरुष को समान अर्थात् दो से भाग की जाय और शेष अवशिष्ट न रहें ऐसी सम रात्रियों (जैसे छठ, आठम, दसम, बारश, चौदश आदि)में सहवास करना उत्तम है। खास कर के पुत्रोत्पत्ति के लिए । जब की अवशिष्ट रही (विषम) रात्रियों में सहवास करने से पुत्री उत्पन्न होती है । अतः जिन्हें पुत्री की इच्छा हो वे विषम रात्रियों में सहवास करें ।[५८]

उपर्युक्त नियमों में भी अपवाद है । जब पुरुष स्त्री से अधिक वीर्यवान होता है और विषम रात्रियों में सम्भोग करने के बावजूद भी पुत्री की प्राप्ति होती है और जब स्त्री पुरुष से अधिक वीर्यवान होती है और सम रात्रियों में सम्भोग करने के बावजूद पुत्र ही उत्पन्न होता है । और जब दोनों समवीर्यवान होते हैं तब पुत्र और पुत्री का युग्म उत्पन्न होता है अथवा नपुंसक सन्तान की उत्पत्ति होती है । अगर दोनों वीर्यवान हो तो सन्तान उत्पन्न नहीं होती अथवा कभी गर्भ रह भी जाय तो अल्प समय में गर्भपात हो जाता है ।[५९]

पुंसवन एवं सीमन्तोन्नयन :-

"पुमान् प्रसूयते येन कर्मणा तत्पुंसवन मीरितम् ।" अर्थात् पुत्र (पुरुष बालक)की प्राप्ति के हेतु यह संस्कार किया जाता है अतः 'पुंसवन' कहा जाता है । मनु तथा याज्ञवल्क्य[६०] के अनुसार गर्भ के स्पन्दन होने से पूर्व अर्थात् गर्भस्थिति के तीसरे मास में कभी भी यह संस्कार सम्पन्न किया जाता है । सुश्रुत संहिता अनुसार इस संस्कार में विशिष्ट औषधियों के रस को गर्भवती स्त्री की दाहिनी नासिका में डाला जाता था जिसके पीछे बच्चे का आरोग्य स्वस्थ हो और गर्भपात न हो जाय यह उद्देश्य था ।

सीमन्तोन्नयन संस्कार के दो उद्देश्य है । (१) गर्भिणी को अमंगलकारी शक्तियों से बचाना था और (२) गर्भिणी को यथासंभवित हर्षोल्लास में रखना । यह विधि स्मृति शास्त्रानुसार छह से आठ मास पर्यन्त किया जा सकता है । इस संस्कार का प्रधान हेतु गर्भिणी के दोहद पूर्ति का था । दोहद पूर्ण न होने से गर्भ में अनेक दोष उत्पन्न होने की सम्भावना है । मनोवैज्ञानिक महत्त्व भी इस संस्कार के पीछे है ।

यहाँ वेद से लेकर सूत्र साहित्य के ग्रंन्थो तक गर्भ विज्ञान की चर्चा की गई है । अब आयुर्वेदीय ग्रन्थों के अनुसार गर्भविज्ञान की सविस्तर चर्चा करेंगे ।

गर्भसंज्ञा एवं गर्भ का निर्माण :

गर्भाशय में शुक्र, आर्तव (शोणित) और जीव का जब जिस काल में संयोग होता है उसी का नाम 'गर्भ' है । गर्भ आकाश, वायु, अग्नि, जल और पृथ्वी इन पञ्च महाभूतों का विकार है । इसी युक्ति से पञ्च महाभूत के विचारों का समुदायात्मक और चेतना धातु का आश्रयभूत गर्भ होता है । गर्भ में पञ्चमहाभूत से पांच धातु कहे जाते है, गर्भ का छठ्ठा धातु चेतना कहा जाता है । माता, पिता, आत्मा, सात्म्य, रस, सत्त्व - इन सभी के समुदाय से गर्भ की उत्पति होती है ।[६१]

गर्भोत्पत्तिक्रम :

पुराना आर्तव जो एक मास से सञ्चित रहता है उसके निकल जाने के बाद और नूतन रज के गर्भाशय में स्थित होने पर पुनः शुद्ध होकर स्नान कर लिया है और जिस स्त्री की योनि, आर्तव, गर्भाशय दूषित नहीं है ऐसी स्त्री को 'ऋतुमति' कहा जाता है । इस प्रकार ऋतुमति हुई स्त्री के साथ, जब अव्यापन्न (शुद्ध) शुक्रवाला पुरुष सहवास करता है तब उसकी प्रसन्नता (कामोद्रक) से प्रेरित किया हुआ शरीर के श्रेष्ठ धातुओं का सार आत्मा शुक्र के स्वरूप में प्रत्येक अङ्गों से उत्पन्न होता है । वह शरीर-धातुओ का सार शुक्र स्वरूप आत्मा और आत्मा में अधिष्ठित बीजधातु (पुँबीज) स्त्री और पुरुष के मैथुनेच्छा से प्रवृत्त होने पर हर्षयुक्त आत्मा से प्रेरित होकर पुरुष के शरीर से (प्रत्येक अङ्गों से) निकल कर उचित मार्ग (योनिरन्ध्र) से गर्भाशय में प्रवेश कर आर्तव (स्त्रीबीज) से सम्बन्ध करता है अर्थात् वह पुँबीज, स्त्रीबीज से मिलकर गर्भ का बीजस्वरूप कलल बन जाता है ।[६२]

गर्भ का स्वरूप :

प्रथम मास में सर्वगुण सम्पन्न वह आत्मा गर्भावस्था को प्राप्त होकर सर्वधातुओं का सम्मिश्रण स्वरूप संकलित रूप बनकर कफ धातु का स्वरूप धारण कर अव्यक्त शरीरवाला होता है । उस अव्यक्त शरीर में अङ्ग और प्रत्यङ्ग, सत् और असत् दोनों रूप में रहते हैं ।

द्वितीय मास में वह कलल घन (गाढ़ा)बन जाता है, उसके तीन विभाग होते हैं । (१) पिण्ड, (२) पेशी और (३) अबुंद के आकार वाला । उसमें यदि पिण्ड आकार हो तो पुरुष, पेशी की आकृति हो तो स्त्री और अर्बुद के आकार का हो तो नपुंसक बालक होता है ।

तृतीय मास में सभी इन्द्रियाँ, सभी अङ्ग (शिर आदि)और सभी अवयव (नासिका, कर्ण, अङ्गुली आदि) एक साथ ही उत्पन्न हो जाते हैं । इस प्रकार भ्रूण की इन्द्रियाँ और अङ्ग एवं प्रत्यङ्ग एक साथ ही उत्पन्न होते हैं, पर उनको छोड़ कर जो भाव जन्म के बाद व्यक्त होते हैं जैसे दाँत व्यञ्जन (चिह्न जैसे बाल्यावस्था समाप्त होने पर दाढ़ी, मूँछ, कक्षा और गुह्य प्रदेश में लोम का होना, स्त्रीयों में स्तन का उभार होना ।)

चतुर्थ मास में गर्भ में स्थिरता उत्पन्न हो जाती है अर्थात् पहले की अपेक्षा बड़ा बन जाता है इस लिए चौथे मास में गर्भिणी का शरीर अधिक भारी प्रतीत होता है । पाँचवे मास में अन्य मासों की अपेक्षा गर्भस्य बालक में मांस और रक्त की अधिक वृद्धि होती है । अतः गर्भिणी इस मास में विशेष कृश हो जाती है । छठे मास में गर्भ का अन्य मासों की अपेक्षा बल वर्ण का उपचय अधिक होता है । इसलिए छठे मास में गर्भिणी के बल और वर्ण की विशेष कर हानि हो जाती है । सातवें मास में गर्भ सभी प्रकार से पुष्ट होता है इसलिए गर्भिणी और मास की अपेक्षा इस मास में अधिक दुर्बल एवं उदास प्रतीत होती है।

आठवें मास में रससंवाहिनी के द्वारा ओज माता से गर्भ के हृदय में और गर्भ से माता के हृदय में

परस्पर आता जाता रहता है क्योंकि गर्भ पूर्ण रूप से तैयार नहीं रहता इसलिए माता आठवें मास में बार बार प्रसन्न और बार बार उदास हुआ करती है । जब ओज गर्भ के हृदय में चला जाता है, तब माता उदास हो जाती है, जब पुनः ओज माता के हृदय में चला आता है, तब माता प्रसन्न दिखाई पड़ती है इस प्रकार जब गर्भ में ओज रहता हैं तो गर्भ में प्रसन्नता रहती है जब ओज माता मे चला जाता है तो उदासी छा जाती है । इस मास में यदि बालक का जन्म हो तो उसका जीवन संकटमय हो जाता है, क्योंकि ओज की स्थिति अस्थिर रहती है, इसलिए कुशल चिकित्सक प्रसव होने के लिए अष्टम मास को प्रसव के योग्य नहीं समझते हैं ।

आठवें मास के बाद एक दिन बीत जाने पर ही अर्थात् नवें मास से लेकर दसवें मास तक विघ्नरहित प्रसवकाल माना गया है । प्रसव का यही समय निश्चित रूप से होता है । दस मास व्यतीत हो जाने के बाद यदि गर्भ गर्भाशय में ही रह जाता है तो उसे विकृति मानी जाती है ।[६३]

व्यक्तिभाव :

समय से रज, शुक्र आदि अन्य इसी प्रकार के भाव जो जन्मोत्तर काल में उत्पन्न होते हैं, जैसे तरुणास्थियों का संयुक्त होना ये प्रकृति है । पुनः विकृति इसके विपरीत को कहते हैं । इस गर्भ में कुछ नित्यभाव है और कुछ अनित्य भाव होते हैं । इस गर्भ में जो अङ्गावयव नित्य होते हैं वे ही अङ्गावयव स्त्रीलिङ्ग, पुल्लिङ्ग और नपुंसक लिङ्ग को धारण करते हैं । गर्भ में स्त्रीलिङ्ग और पुल्लिङ्ग भावों में जिस भाव की विशेष रूप से प्रधानता होती है, वह प्रधानता, अधिकतावश हो या गुण के अनुसार हो, उसी के अनुसार सन्तान उत्पन्न होती है । अर्थात् स्त्रीभावों की प्रधानता होने पर स्त्री और पुरुष भावों की प्रधानता होने पर पुरुष की उत्पत्ति होती है । जैसे क्लैव्य (वृष्य शक्ति का न होना), भीरुत्व (डरपोक होना), अवैशारद्य, मोहमुग्धता, अनवस्थान (मन का चञ्चल रहना), अधोगुरुत्व, असंहनन, शैथिल्य मार्दव (और सभी भावों का मृदु होना) इसी प्रकार और अन्य भावों का इन प्रधानसंश्रय और गुणसंश्रय के अनुकूल होना (जैसे स्त्री के समान चेष्टा करना) 'स्त्रीकरभाव' कहा जाता है । इसके विपरीत भावों की प्रधानता होने पर उनको 'पुरुषकर भाव' कहा जाता है । दोनों भावों की प्रधानता हो ा उनकों 'नपुंसककरभाव' कहा जाता है ।[६४]

दोहद की उत्पत्ति :

गर्भ के शरीर में जिस समय इन्द्रियाँ अभिव्यक्त होती हैं उसी समय उस गर्भ के मन में वेदना (सुख-दुःख की प्राप्ति)होती है इसलिए उसी समय से गर्भ में स्पन्दन किया होती है और अनेक जन्मों में अनुभव किए हुए इन्द्रिय-विषयों की वह इच्छा करता है और वह इच्छा माता के हृदय से व्यक्त होती है । इसलिए उस काल में 'द्वैहृदय्य' उसकी संज्ञा होती है । गर्भ का हृदय माता के हृदय से उत्पन्न होता है और गर्भ-पोषण के लिए रसवाही धमनियों के द्वारा माता के हृदय से बालक का हृदय सम्बद्ध रहता है इसलिए उन रसवाहिनी धमनियों के द्वारा बालक अपनी इच्छा को माता के हृदय के द्वारा प्रकट करता हैं । इसी कारण को समझते हुए विद्वान दौहृद् का अपमान करना नहीं चाहते हैं ।

यदि दैहृद का अपमान कर दिया जाय तो गर्भ का नाश या गर्भ में विकृति उत्पन्न हो जाती है। उसी समय जब कि गर्भ माता के हृदय के द्वारा अपनी इच्छा को प्रकट करता है तो गर्भिणी माता गर्भ के किसी-किसी विषयों में समान योगक्षेम वाली होती है । अर्थात् बालक के इच्छानुसार वस्तुओं की प्राप्ति होने पर स्वस्थ और न प्राप्त होने पर अस्वस्थ होती हैं । इसलिए कुशल विद्वान प्रिय और हितकारी वस्तुओं से विशेष रूप में गर्भिणी की परिचर्या करते हैं ।[६५]

द्विहृदया गर्भिणी जिन-जिन इच्छाओं को व्यक्त करती है उन सभी इच्छाओं की यथासम्भव पूर्ति अवश्य करनी चाहिए पर गर्भ को नष्ट करने वाले भावों को छोड़ कर अर्थात् जिससे गर्भ नष्ट होने का भय हो उस आहार-विहार से गर्भिणी को दूर रखें ।

यदि गर्भिणी स्त्री किसी गर्भोप-घातकर भाव की अर्थात् जिससे गर्भहानि की सम्भावना है उसे ही प्रबल इच्छाओं के द्वारा माँग करती हो तो उसकी इच्छा के अनुसार अहित वस्तु को हित वस्तुओं के साथ या कल्पनाओं के द्वारा उसको हित बनाकर देना चाहिए जिससे उसकी प्रबल इच्छा शान्त हो । यदि उसकी इच्छाओं के अनुकूल वस्तुओं की प्राप्ति उसे नहीं होती है तो इच्छाओं को रोकने से कुपित हुई वायु अन्तः शरीर में चलती हुई गर्भाशय में प्राप्त गर्भ का विनाश अथवा गर्भ को कुरूप कर देती है । इसलिए गर्भिणी की इच्छाओं का प्रतिघात नहीं करना चाहिए ।[६६]

गर्भिणी के लक्षण :

गर्भिणी के गर्भ की प्राप्ति और "द्वैहृदय्य" के विशेष ज्ञान के लिए लक्षणों का ज्ञान होना अत्यावश्यक है । गर्भिणी के लक्षण[६७] इस प्रकार हैं ।

१. आर्तवादर्शन (आर्तव का बन्द हो जाना),
२. आस्यसंस्रवण (मुख से बार-बार पानी का आना),
३. अनन्नाभिलाष (अन्न खाने की इच्छा न होना),
४. वमन, भोजन में अरूचि,
५. खट्टी, चटपटी वस्तु खाने की प्रबल इच्छा,
६. आहार एवं विहार आदि भावों में ऊँच और नीच की बार बार इच्छा का होना अर्थात् कभी उच्च (उत्तम) आहार-विहार में मन लग जाय और कभी नीच (हीनगुणवाले) आहार-विहार में,
७. शरीर में भारीपन का अनुभव होना,
८. आँखो में ग्लानि होना,
९. स्तनों में दूध का आ जाना,
१०. दोनों ओठ एवं दोनों स्तनमण्डलों का अधिक काला हो जाना,
११. पैरों में कुछ कुछ शोथ का हो जाना,
१२. रोमराजी का उद्गम,
१३. योनी का अत्यर्थ विस्तृत हो जाना - ये सभी लक्षण गर्भ प्राप्ति के होते हैं ।

गर्भ वृद्धि के कारण :

माता, पिता, आत्मा, सात्म्य, सत्त्व रस आदि गर्भकर छः भावों की सम्पत्ति (अदोषता) होने से और माता के वृत्त (आहार-विहार और आचार) की सुष्ठुता गोने से अर्थात् गर्भिणी के लिए दर्शाए गए नियम एवं आहार का समुचित रूप से सेवन से) माता के हृदय से आयी हुई रसवाहिनी के द्वारा प्राप्त उपस्नेह और माता के ही शरीर से प्राप्त उपस्वेद और काल द्वारा परिपाक होने से एवं स्वभाव सिद्ध अपने बढ़ने वाली प्रकृति से गर्भ गर्भाशय में वृद्धि को प्राप्त करता है ।[६८]

गर्भ की व्यापत्ति (अजन्म) के कारण :

माता और पिता आदि गर्भकर भावों में व्यापत्ति (दुष्टि) होने से गर्भ का जन्म नहीं होता अर्थात् माता के आर्तव एवं गर्भाशय के विकृत होने पर और माता पिता के शुक्र में विकृति होने से गर्भ की उत्पत्ति ही नहीं होती, सात्म्य आदि भावों की विकृति होने पर गर्भ धारण होने पर भी उसकी मृत्यु हो जाती है या विकृति हो जाती है अतः उसे भी अजन्म ही माना जाता है ।[६९]

कुक्षि में गर्भ नाश के हेतु :

जो गर्भाशय में गर्भवृद्धि के कारण दर्शाए गए हैं उसमें यदि विपरीतता आ जाय तो गर्भ का उदर में ही विनाश (मृत्यु) हो जाता हैं अथवा उसका स्राव या पात हो जाता है ।[७०]

गर्भ सम्पूर्ण रूप से नष्ट न हो कर विकृत होने के कारण :

गर्भ में विकृति आर्तव का प्रभाव (जिन कारणों) से गर्भ सम्पूर्ण रूप से नष्ट न हो कर विकृति को प्राप्त होता है वह इस प्रकार हैं । जब वातादि दोषों को प्रकुपित करने वाले आहार-विहार का स्त्री सेवन करती है तब वातादि दोष कुपित हो कर शरीर में फैलते हुए रक्त और गर्भाशय को प्राप्त करते हैं, परन्तु सम्पूर्ण रक्त अथवा गर्भाशय को दूषित नहीं करते ऐसी दशा में जब वह स्त्री गर्भ धारण करती है तब उसे गर्भ के मातृज और पितृज अवयवों में से किसी एक अथवा अधिक अवयवों में विकृति उत्पन्न हो जाती है।

जिस-जिस अवयव के बीज में अथवा बीजभाग में दोष प्रकुपित होते हैं उन-उन बीजों या बीज भागों से उत्पन्न होनेवाले अवयवों में विकृति होती है । जब उस स्त्री के शोणित तथा गर्भाशय के बीजभाग प्रदुष्ट होते हैं तब वह स्त्री वन्ध्या संतति उत्पन्न करती है । जब उस स्त्री के शोणित में गर्भाशय के बीजभागावयव और स्त्रीकर बीज, शरीर बीज भागों के एक देश में विकृति उत्पन्न होती है तब स्त्री, अधिक स्त्री की आकृतिवाली स्त्री-भिन्न वार्ता नामक संतति उत्पन्न करती है इसलिए इसे 'स्त्रीव्यापत्' कहते है ।[७१]

गर्भ में विकृत शुक्र का प्रभाव :

जब पुरुष बीज में सम्पूर्ण उत्पादक भाव कुपित हो जाते हैं तब वह पुरुष का बीज बन्ध्य पुत्र उत्पन्न करता है । और जब पुरुष के बीज में बीजभाग का एक अंश कुपित होता है तो 'पूतिप्रज' सन्तान उत्पन्न होती है । जब पुरुष के बीज में प्रजनन भाग का एक अंश एवं पुरुष-कर शरीर के उत्पादक भाग का एक अंश दुष्ट होता है तब पुरुष की आकृति से अधिक समानता रखने वाला पुरुष से भिन्न अपुरुष 'तृणपुत्रिक' नामक संतान उत्पन्न होती है । उसे 'पुरुषव्यापद्' कहते है ।[७२]

वन्ध्या न होती हुई स्त्री के देर से गर्भ धारण का कारण :

योनि में दोष होने से, मानसिक कष्ट होने से, शुक्र-आर्तव के दूषित होने से, उचित आहार-विहार के न होने से, अकाल में (ऋतुकाल के अतिरिक्त समय में) सम्भोग करने से, रोगादिकों के कारण बल का क्षय हो जाने से, एकबार जिसे बच्चा उत्पन्न भी हुआ हैं ऐसी स्त्री देर से गर्भ धारण करती है।[७३]

गर्भ होकर नष्ट हो जाने के कारण :

दुष्ट वायु द्वारा आर्तव को रुका हुआ देख कर कभी-कभी अल्पज्ञ लोग स्त्री को गर्भ रह गया है ऐसा निश्चय कर लेतें हैं क्योंकि वह रुका हुआ रक्त गर्भाशय में बढ़ तक गर्भ का लक्षण - (जैसे नयन, स्तनों का स्थूल होना आदि) उत्पन्न कर देता है । बाद में अग्नितप, सूर्यताप, श्रमजन्य थकावट, शोक और रोग से अथवा उष्ण अन्न-पान के सेवन से गिरते हुए रक्त को देखकर कुछ मुर्ख मनुष्य निश्चय रूप से उसे गर्भ समझ बैठते हैं ।[७४]

पुत्र अथवा पुत्री की उत्पत्ति :

शुक्र के अधिक होने से पुत्र उत्पन्न होता है । आर्तव के अधिक होने से पुत्री उत्पन्न होती है ।

पुत्र-पुत्री जुड़वा सन्तान की उत्पत्ति :

जब शुक्र-आर्तव मिलित बीज भाग को वायु समान भाग में बाँटती है तो जिस भाग में शुक्र की अधिकता होती है उस से पुत्र, जिस भाग में आर्तव की अधिकता होती है उस भाग में कन्या - इस प्रकार पुत्र व पुत्री साथ उत्पन्न होते हैं ।

जुड़वा पुत्रों की उत्पत्ति :

जब बीज-भाग को वायु ऐसा दो भाग करती है जिन दोनों भागों में शुक्र की ही अधिकता होती है तब उस भाग से दो पुत्र होते हैं ।

जुड़वा पुत्रीयों की उत्पत्ति :

जब बीजभाग को वायु ऐसा दो भाग करती है जिसमें आर्तव की अधिकता होती है तो दो पुत्रीयाँ (कन्यायें) उत्पन्न होती हैं ।

बहुत (अनेक) सन्तान एक ही समय पर :

गर्भाशय में गये हुए शुक्र-आर्तव को गर्भाशय में ही उत्पन्न बढ़ी हुई वायु जितना अधिक विभाग करती है उतनी ही सन्तानें होती हैं । चरक का मानना है कि यह बात पूर्वजन्म के कर्म के अनुसार होती हैं इसमें स्त्री का कोई भी वश नहीं होता हैं ।

सन्तान देर से होने के कारण :

जब गर्भ को उचित आहार नहीं मिलता या गर्भाधान होने पर भी योनी से स्राव होता रहता है तो गर्भ सूख जाता है । ऐसे गर्भ को स्त्री देर से प्रसव करती है ।

गर्भाशय में ही दो सन्तानों में से एक पुष्ट और दूसरा दुर्बल होने के कारण :

कर्म के वशीभूत हो कर गर्भाशयगत शुक्रार्तव मिलित भाग को वायु विषम अंश में विभाजित करता है अर्थात् एक भाग छोटा दूसरा भाग बड़ा होता है । जो भाग बड़ा है उससे उत्पन्न होने वाला गर्भ पुष्ट एवं बड़ा होता है जो भाग छोटा होता है उससे दुर्बल और छोटा होता है । इस प्रकार जोड़े होनेवाले गर्भ में एक विशेषकर पुष्ट एवं बड़ा होता है ।[७५]

गर्भों की आठ प्रकार की विकृतियाँ[७६] :

१. नपुंसक सन्तान की उत्पत्ति :

आर्तव और शुक्र के समान भाग होने से और आर्तव और शुक्र से वातादि दोषों से दुष्ट होने से स्त्री और पुरुष दोनों के केवल लक्षण युक्त 'द्विरेता' (नपुंसक) की उत्पत्ति होती है ।

२. पवनेन्द्रिय (सन्तान) की उत्पत्ति :

गर्भाशय में गया हुआ गर्भ (पुत्र) के शुक्राशय को गर्भाशयगत विकृति वायु नष्ट कर देती हैं तब बालक 'पवनेन्द्रिय' उत्पन्न होता है ।

३. संस्कारवाही, (४) नरषण्ड तथा (५) नारीषण्ड सन्तानों की उत्पत्ति :

गर्भाशय में दुष्ट वात (कुपितवायु) गर्भस्य बालक के शरीर में ही शुक्राशय के द्वार को विघटित (विकृत रूप से दूषित) कर देता है । इससे 'संस्कारवाह' सन्तान की उत्पत्ति होती है । मन्द शक्ति और अल्प शुक्र-आर्तव वाले पुरुष-स्त्री जो दुर्बल हों और उनमें हर्ष न हो अर्थात् लिङ्ग में उत्थान न हो ऐसे स्त्री-पुरुष मैथुन में प्रवृत्त होते हैं तो स्त्री-पुरुष दोनों की विकृति होने से 'नरषण्ड' (पुरुष नपुंसक) और नारीषण्ड (स्त्री नपुंसक) उत्पन्न होते है ।

६. वक्री एवं (७) ईर्ष्यारति सन्तानों की उत्पत्ति :

मैथुन काल में माता की मैथुन में इच्छा न हो अथवा माता का शरीर सीधा न हो कर मैथुन काल में टेढ़ा रहे या पिता के वीर्य में दुर्बलता हो तो बालक 'वक्री' होता है । माता-पिता में मैथुन करने की प्रबल इच्छा न हो पर ईर्ष्या से मैथुन में प्रवृत्त हो उससे उत्पन्न सन्तान 'ईर्ष्यारति' नपुंसक उत्पन्न होता है।

८. वातिक षण्ड की उत्पत्ति :

गर्भाशय में दुष्ट वायु और अग्नि (पित्त) कुपित होकर गर्भाशय गत सन्तान का वृषण (अण्डकोष) नष्ट कर देते हैं । इसे 'वातिकषण्ड' कहते हैं ।

इस प्रकार कर्म के अनुसार गर्भों की आठ प्रकार की विकृतियाँ होती हैं ।

स्त्री कुक्षि में स्त्री, पुरुष और नपुसंक के लक्षण :

जो स्त्री सभी चेष्टाएँ वाम भाग से करती हैं, जो पुरुष की इच्छा मैथुन के लिए करती है, जो स्वप्न में स्त्री या स्त्री-लिङ्ग पदार्थों को प्राप्त करती है, जो स्त्री-लिङ्ग खाद्य और पेय पदार्थों में अपनी अधिक इच्छा प्रकट करती हैं, जो स्त्रियों की तरह स्वभाव और चेष्टाएँ या हाव-भाव करती है, जिस स्त्री के वाम भाग में गर्भ के रहने से वाम कुक्षि में उभार प्रतीत होता है, गर्भ का आकार गोलाकार न हो अर्थात् उदर गोलाई लिए न बढ़ा हो, वाम स्तन में दुग्ध प्रथम उत्पन्न हो वह स्त्री निश्चित रूप से कन्या का ही प्रसव करती है । इससे भिन्न लक्षण प्रतीत हो तो पुत्र प्रसव करती है, जैसे दक्षिण भाग से चेष्टाएँ करती है, मैथुन की इच्छा नहीं करती हैं, स्वप्न में पुरुष या पुल्लिङ्गवाचक खाद्य-पेय पदार्थों में अधिक इच्छा व्यक्त करती है, पुरुष की तरह स्वभाव वाली और पुरुष की तरह चेष्टाएँ करती है, दक्षिण भाग में गर्भ की स्थिति रहती है, उदर गोलाकार प्रतीत होता है, दक्षिण स्तन में प्रथम दुग्ध उत्पन्न होता है तो पुत्र का प्रसव करती है। इन दोनों लक्षणों से मिश्रित लक्षण होने पर नपुंसक का प्रसव करती है ।[७७]

सन्तान के सदृश होने के कारण :

गर्भ की उत्पत्ति के समय स्त्री का मन जिस किसी प्राणी की ओर आकृष्ट होता है, उसी प्राणी के सदृश सन्तान को स्त्री उत्पन्न करती है । माता-पिता के सदृश होने से द्वितीय कारण सभी गर्भों के शरीर की उत्पत्ति में सभी मातृज-पितृज-आहारज और आत्मकृत कर्म - ये चार और चार महाभूत (वायु, अग्नि, जल, पृथिवी) कारण हैं । इन कारणों में जिस माता-पिता और कर्मज कारण की जब विशेष रूप से प्रधानता होती है, तब उस प्रधान रूप महाभूत के सदृश और मन में भी जिस सत्त्व, रज और तम गुण की प्रधानता होती है उसी के समान सन्तान उत्पन्न होती है ।[७८]

विकृति, हीन, अधिक और विकलेन्द्रिय (इन्द्रियशून्य) सन्तानों की उत्पत्ति के कारण :

शुक्र-शोणित स्वरूप बीज, आत्मीय पूर्वदेह का अशुभ कार्य, गर्भाशय और काल की विकृति से, माता के आहार-विहार के दोष से, अर्थात् गर्भावस्था में पालनीय आहार-विहार का त्याग करने आदि विविध कारणों से विकृत वातादि दोष, गर्भ के संस्थान (आकृति), वर्ण, रूप और इन्द्रियों को विकृत कर देते हैं। वर्षाकाल में संयोगवश यदि कोई वृक्ष नदी के स्रोत में पड़ जाय तो काष्ठ, पत्थर से संयुक्त नदी का भयंकर वेग उसे जिस प्रकार अनिश्चित रूप से विकृत कर देता है, उसी प्रकार गर्भाशय में विकृत वातादि दोष गर्भ को अनिश्चित रूप से विकृत कर देते हैं ।[७९]

गर्भोपघातकर भाव :

आचार्य चरक ने गर्भ का उपघात (नाश) करने वाले भावों की सविस्तर चर्चा करते हुए कहा है कि उत्कट आसन से बैठना, विषम (ऊँच-नीच) आसन पर बैठना, कठिन आसन पर लगातार बैठना, वात, मूत्र, पुरीष (मल) के वेगों को रोकना, कठोर या अनुचित रूप से व्यायाम करना, तीक्ष्ण और उष्ण द्रव्यों को अधिक मात्रा में सेवन करना, अल्प मात्रा में भोजन करना आदि, इनका गर्भिणी जब सेवन करती है तो गर्भाशय में गर्भ मर जाता हैं, या अकाल में उसका स्राव या पात हो जाता है, या गर्भाशय में ही गर्भ सूख जाता हैं ।

किसी भी प्रकार गर्भाशय पर आघात लगने से या दबाव पड़ने से अधिक गहरे गढ़े या कूप में झांकने से, प्रपात (जहाँ बहुत ऊँचे स्थान से नदी का जल गिरता है उस स्थान को प्रपात कहते है) को बार बार देखने से, अकाल में ही गर्भ का स्राव या पात हो जाता है । अधिक रूप में शरीर में क्षोभ उत्पन्न करनेवाली सवारी (जैसे एक्का आदि) पर चलने से, अत्यन्त अप्रिय शब्दों के अधिक सुनने से गर्भ समय से पूर्व गिर जाता है। निरन्तर उत्तान शयन करनेवाली स्त्री के गर्भस्थ बालक के कण्ठ को नाभि के आश्रित नाड़ी बाँध देती है जिससे बालक की मृत्यु का भय उरपस्थित हो जाता है ।

जो गर्भवती स्त्री खुली जगहों में अकेले शयन करती है, या रात में अकेले इधर-उधर भ्रमण करती है वह उन्मत्त (पागल) सन्तान उत्पन्न करती है । कलिप्रिय (-वचन मात्र से लड़ाकू), या कलहप्रिय (शरीर से लड़ाकू), गर्भवती स्त्री अपस्मार रोग से युक्त सन्तान को उत्पन्न करती है । गर्भावस्था में भी जो स्त्री निरन्तर सहवास में रत रहती है उस स्त्री की सन्ताने विकृत शरीरवाली, निर्लज्ज और स्त्रैण होती हैं। जो गर्भवती स्त्री निरन्तर शोकग्रस्त रहती है उस स्त्री की सन्तानें ड़रपोक, कृश अथवा अल्प आयुवाली होती हैं । मन में सदा दूसरों के प्रति द्रोह रखने वाली गर्भवती स्त्री की सन्तानें दूसरों को दु:ख देनेवाली (दुष्ट), ईर्ष्यालु अथवा स्त्री के वश में रहनेवाली होती हैं । गर्भावस्था में चोरी करनेवाली स्त्री की सन्तानें अधिक परिश्रम करनेवाली, अत्यन्त द्रोह बुद्धिवाली, बुरा कर्म न करनेवाली होती हैं । क्रोध करने वाली गर्भवती स्त्री की सन्तानें क्रोधी, कपटी और परमनिन्दक होती हैं । अधिक शयन करने वाली गर्भवती स्त्री की सन्तानें तन्द्रायुक्त, मूर्ख और मन्दाग्नि रोग से सदा पीड़ित रहनेवाली होती हैं । निरन्तर शराब पीने वाली गर्भवती स्त्री अधिक प्यास से युक्त, अल्प स्मरण-शक्ति से युक्त और चञ्चल मनवाली सन्तान को उत्पन्न करती है।

जिस गर्भवती को गोधा (गोह) का मांस अधिक प्रिय हो और उसे खाती भी हो उसकी सन्तानें शर्करा, अश्मरी रोग और शनैर्मेह रोग से युक्त होती हैं । जिस गर्भवती को सूअर का मांस अधिक प्रिय हो और उसे वह गर्भकाल में खाती भी हो तो उसकी सन्तानें लाल नेत्र वाली, हकलाने वाली और खुरदरे रूखे केशवाली होती हैं । मछलीका मांस निरन्तर खाने वाली गर्भवती स्त्री की सन्तानें चिरनिमेष (=जिस बालक के नेत्र की पलकें देर से गिरती हैं) और स्तब्धाक्ष (जिसके नेत्र जकड़े रहते हैं) होती हैं । जो गर्भिणी लगातार अधिक मधुर रस का सेवन करती है वह प्रमेही, गूँगी और अधिक मोटी सन्तान को उत्पन्न करती है ।

जो गर्भिणी गर्भावस्था में अम्ल (खट्टे) रस का अधिक सेवन करती है उनकी सन्तानें रक्तपित्त रोग से तथा त्वचा और आँख के रोगों से युक्त होती है । जो गर्भवती लवण रस अधिक खाती है उसकी सन्तानें शीघ्र ही वली (त्वचा में झुर्रियाँ पड़ना) पलित (बाल का पकना) और खालित्य (शिर के बाल का गिर जाना) रोग से पीड़ित होती है । जो गर्भवती कटु रस का अधिक सेवन करती है उसकी सन्तानें दुर्बल (बलहीन), अल्प शुक्र वाली तथा अनपत्य (शुक्र की कमी के कारण सन्तान उत्पन्न करने की शक्ति से हीन, नपुंसक अथवा अल्प मैथुन-शक्ति वाली होने से सन्तानरहित) होती हैं । जो गर्भवती तिक्त रस को अधिक खाती है उसकी सन्तानें शोष (सुखण्डी) रोग या यक्ष्मा रोग से युक्त, बलहीन और बिना ड़ील-ड़ौल की (कुरूप) होती हैं । जो गर्भवती कषाय रस का अधिक सेवन करती है वह स्त्री श्याम वर्ण वाली, आनाह और उदावर्त रोग से युक्त सन्तान को उत्पन्न करती है । जो जो आहार एवं जिस-जिस रोग का निदान (कारण) बताया गया है, उन-उन आहार एवं विहारों को जब गर्भिणी स्त्री सेवन करती है तब उन-उन रोगों से पीड़ित या भविष्य में पीड़ित होनेवाली सन्तानें उत्पन्न करती है । इस प्रकार इन गर्भ के उपघात (नाश) या गर्भ में हानि करनेवाले भावों की व्याख्या कर दी गई है ।

अहितकर भावों का त्याग आवश्यक है । उत्तम गुणयुक्त सन्तान की इच्छा रखनेवाली स्त्री अहित आहार एवं विहारों को विशेष रूप से त्याग दे । सुन्दर आचरणों से युक्त रहती हुई अपनी आत्मा (शरीर) का हितकारी आहार एवं विहारों से रक्षा करे ।[८०]

गर्भिणी की परिचर्या मासानुसार :

विकाररहित बढ़ते हुए गर्भ के लिए मासानुसार गर्भिणी की परिचर्या के बारे में भी चरक ने उपदेश दिया है । उसमें कहा गया है कि प्रथम मास में यह सन्देह हो जाय कि गर्भ की स्थिति हो गई है तो वह गर्भिणी समय-समय शीतल दूध मात्रा से पीए, वह दूध किसी भी औषध से पकाया न हो । सायं प्रातः प्रकृति के अनुकूल भोजन करें । द्वितीय मास में मधुरगण से पकाया हुआ दूध ही समय-समय पीवे। तृतीय मास में दूध में मधु और घृत मिला कर समय-समय पर पीवें । चतुर्थ मास में दूध में मक्खन मिला कर या दूध से निकाला

गया मक्खन दो तोला की मात्रा में खाये । पाँचवे मास में घृत मिला कर या दूध से निकला घृत पीवे या खाये । छठे मास में मधुरगण की औषधियों से सिद्ध किये दूध में घृत मिला कर पीवे । यह प्रयोग सातवें मास में भी करें । क्रमशः गर्भ के बढ़ने से पीड़ित वात, पित्त, कफ, उरोभाग में आकर दाह उत्पन्न करता है। तब दाह के बाद उरोभाग में ही खुजली (खाज़) उत्पन्न होती है, खाज़ होने से किक्किस रोग की प्राप्ति हो जाती है।

आठवें मास में यवागू को दूध में पका कर और उसी में घृत मिला कर समय समय पर पीवें। इस प्रकार आहार करती हुई गर्भिणी, स्वयं रोगरहित हो कर आरोग्य, बल, वर्ण, संहनन की सम्पत्ति (उत्तमता) से युक्त उत्तम सन्तान उत्पन्न करती है । नवें मास में गर्भिणी को मधुरवर्ग की औषधियों से पकाए हुए तैल से अनुवासन बस्ति देना चाहिए और इसी तैल में कपड़े का फाहा भिगों कर गर्भ-स्थान और गर्भमार्ग (योनि) को स्नेहन करने के लिए, योनि में धारण करना चाहिए ।

यह जो प्रथम मास से लेकर नव मास पर्यन्त प्रत्येक मास को पृथक् पृथक् कर्म बताया गया है, इससे गर्भिणी के गर्भसमय (प्रसवसमय) और गर्भ धारण समय में कुक्षि, उदर, कमर, पार्श्व और पीठ मृदु हो जाते हैं और वायु अनुलोम हो जाता है । मूत्र और मल अपने स्वाभाविक रूप में रहते हुए सुखपूर्वक बाहर निकल जाते हैं । चर्म और नख कोमल हो जाते हैं । गर्भिणी के शरीर में बल और वर्ण की उत्तमता रहती है और वह गर्भिणी सुखपूर्वक समय पर अपने मन के अनुकूल, सर्वगुणसम्पन्न एवं सुखी स्वस्थ पुत्र को जन्म देती है।[८१]

मनोनुकूल पुत्रोत्पत्ति के उपाय :

जो स्त्री गौर, श्याम, कृष्ण आदि वर्ण की सन्तान की इच्छा करती हो उसी के अनुसार श्वेत, श्याम और कृश रूप वाले पान, अशन, वसन, भूषण, गृह, शयन आदि का सेवन करे । जो स्त्री जिस प्रकार का पुत्र उत्पन्न करने की आशा करती हों, उस स्त्री की उस प्रकार की पुत्रेच्छा को सुनकर जिस देश के अनुसार पुत्र की इच्छा स्त्री करे उस देश का मन से ध्यान करें । उस उस देशों को मन में ध्यान कर जो स्त्री जिन जिन मनुष्यों के अनुसार पुत्र उत्पन्न करने की आशा करे उस स्त्री से उन-उन देशों के आहार-विहार उपचार और परिच्छदों (वस्त्र, बात-चीत, कथा, इतिहास आदि) का सेवन करे । इस प्रकार मनोनुकूल सन्तान की प्राप्ति होती है ऐसा बताया गया है ।[८२]

पञ्चमहाभूतों की रूपोत्पत्ति में कारणता :

केवल ये ऊपर बताये हुए कर्म ही वर्ण (रूप) विशेष की उत्पत्ति में कारण नहीं है किन्तु तेज (पित्त) धातु एवं जल और आकाश धातु प्रायः गौर वर्णकारक होते हैं अर्थात् जब तेज, जल और आकाश में मिल जाता है तब गौर वर्ण की सन्तान उत्पन्न करता है । जब तेज, पृथिवी और वात धातु प्रधान होता है तब काले वर्ण की सन्तान उत्पन्न करता है । जब समरूप से सभी आकाश, वायु और जल पृथिवी धातु से मिलते है तब श्याम वर्ण की सन्तान उत्पन्न होती है ।[८३]

इन सब विषयों के अलावा पुत्रेष्टि यज्ञ, गर्भस्थापक औषधियाँ, गर्भिणी की चिकित्सा, लीन-गर्भ के लक्षण और चिकित्सा, मृतगर्भा की चिकित्सा, गर्भ शल्योद्धरण के पश्चात् चिकित्सा जैसे गर्भावस्था के साथ जुड़े अनेक विषयों की चर्चा शास्त्रग्रन्थों एवं आयुर्वेदीय ग्रन्थों में भरी पडी है । लेख की मर्यादा को ध्यान में रखते हुए इन मुद्दों की चर्चा इस लेख में नहीं की गई है ।

संक्षेप में सुसन्तिति निर्माण एक गहन शास्त्र है । आधुनिक विज्ञान विविध ऋतुओं में पशु-पंखियों के व्यवहार मनुष्य के मानस में उत्पन्न होते परिवर्तनों का अभ्यास करने के बाद इस निष्कर्ष पर पहुँचा है कि कामतृप्ति के पीछे कुदरत का मूल आशय प्रजोत्पत्ति का, सृष्टि में जीवन की कड़ी को संजोये रखना है, अखंड रखना हैं । अनेक संशोधनों के बाद वैज्ञानिकों ने यह निष्कर्ष निकाला है, लेकिन हमारे महर्षियों तो युगों से कुदरत के नवसर्जन के आवेग की सूक्ष्म प्रक्रिया से भलीभाँति अवगत थे । अतः उन्होंने श्रेष्ठ प्रजा के निर्माण के लिए

निरंकुश कामतृप्ति के स्थान पर इस ऊर्जा को योग्य दिशा देने के लिए विवाह प्रथा का विधान किया और गृहस्थाश्रम की रचना की, जिससे संसारी मनुष्य संयमित कामतृप्ति से श्रेष्ठ संतानो को जन्म दे सके ।

महर्षियोंने सुप्रजनन के नियमों में पति-पत्नी की योग्यता पर प्रबल भार दिया है । जिस प्रकार उत्तम अनाज के लिए योग्य भूमि, योग्य ऋतु और योग्य जल आदि की आवश्यकता होती है उसी प्रकार श्रेष्ठ गर्भोत्पत्ति के लिए भी तंदुरस्त जनन-अवयव धारण करनेवाली स्त्री, ऋतुकाल तथा स्त्री के शरीर में आवश्यक पर्याप्त धातु, स्वस्थ बीज और शुक्राणु आदि होना आवश्यक है । स्त्री-पुरुष के कुल में विद्यमान एवं अविद्यमान स्वस्थ, दीर्घायु और स्थिरेन्द्रिय होने चाहिए जिससे वंशानुगतिक व्याधि न आवें । उन्होंने एक ही गोत्र, प्रवर, पिंड में विवाह करना इसलिए मना किया है कि उससे आनुवंशिक रोगों की संभावना बढ़ जाती है । अतः स्त्री-पुरुष दोनों स्वस्थ होने चाहिए, उनमें निष्ठुरता, कामान्धता, क्षिप्रकोपता, ईर्ष्या, उद्विग्नता, अहंकार समाज के विरोधी वर्तन और मानसिक विकार न हों । संक्षेप में दोनों स्वस्थ, सक्षम और प्रफुल्लित रहने चाहिए। इस तरह उत्तम सन्तति उत्पन्न करने के लिए छोटी-छोटी बातें ध्यान में रखी जाती थी ।

अचानक एक बालक का गर्भाधान करना और प्रायः अभान स्थिति में उसके देह की रचना करना यह तो पशु भी करते हैं । मानव के पास मन और बुद्धि दो विशेष तत्त्व हैं उसका उपयोग कर के इस दिशा में श्रेष्ठ सर्जन कर सकते हैं । इस कार्य में पति-पत्नि दोनों प्रधान हैं ।

आज श्रेष्ठ संतति असम्भव सी हो गई है क्योंकि गर्भविज्ञान कहीं खो गया है । लोगों को गर्भविज्ञान का सही बोध ही नहीं है ऐसे में इस लेख में प्रस्तुत की गई सामग्री समाज एवं राष्ट्र में सुसन्तति निर्माण के लिए उपयुक्त होंगी तो यह लेख लिखने का प्रयत्न सार्थक होगा ।

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PMS:-01

A STUDY OF DM TECHNIQUES FOR CRM

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ABSTRACT: Customer- relationship Management (CRM).CRM is a broadly used term, and covers a wide variety of functions, not all of which require data mining.1 These functions include *marketing automation* (e.g., campaign management, cross- and up-sell, customer segmentation, customer retention), *sales force automation* (e.g., contact management, lead generation, sales analytics, generation of quotes, product configuration), and *contact center management* (e.g., call management, integration of multiple contact channels, problem escalation and resolution, metrics and monitoring, logging interactions and auditing), among others. We focus on how backend data mining and analytics can make these functions more effective.

There are 3 aspects of CRM, which can be implemented in isolation from each other:

1) Operational – automation of customer process that offers support to a company's sales & service representative.

2) Collaborative - the program communicates to customers without a company's sales or service representative.(self-service)

3) Analytical – analysis of customer information for multiple purposes.

In this paper, we discuss in detail the technology consider ations, analysis of data mining in CRM, Data mining challenges & opportunities in CRM and applications of DM to CRM. Finally, it is concluded that CRM is absolutely essential to compete effectively in today's Business environment. In fact, the more effectively we use the information about our customers to meet their needs, the more profitable we would be.

Keywords: DM, CRM, Analytical CRM, Business Problem, Marketing database.

1. Introduction:

CRM: Customer Relationship Management (CRM) is a broadly used term, and covers a wide variety of functions, not all of which require data mining. These functions include *marketing automation* (e.g., campaign management, cross- and up-sell, customer segmentation, customer retention), *sales force automation* (e.g., contact management, lead generation, sales analytics, generation of quotes, product configuration), and *contact center management* (e.g., call management, integration of multiple contact channels, problem escalation and resolution, metrics and monitoring, logging interactions and auditing), among others. We focus on how backend data mining and analytics can make these functions more effective.

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3) Analytical – analysis of customer information for multiple purposes.

Technology considerations:

The technological requirements of a CRM strategy can be complex and far reaching. The basic building blocks include:

i) Customer information operational CRM requires a database for which is required customer agent support software.

ii) Collaborative CRM requires an interactive system. Eg., An interactive web site automated phone systems etc.

iii) Analytical CRM requires statistical analysis software as well as software that manage any specific marketing companies.

Each of these can be implemented in a basic manner or in a high – end complex installation.

2. Definition of CRM:

Customer relationship management in its broadest sense simply means managing all customer interactions. In practice, this requires the using of information about your customers and prospects for more effective interaction with your customers in all stages of your relationship with them. We refer to these stages as the customer life cycle.

The customer life cycle has three stages:

- Acquiring customers
- Increasing the value of the customer
- Retaining good customers

Data mining can improve the profitability in each of these stages through integration with operational CRM systems or as independent applications.

3. Acquiring new customers via dm :

The first step in CRM is to identify prospects and convert them to customers. Let's look at how data mining can help manage the costs and improve the effectiveness of a customer acquisition campaign.

Big Bank and Credit Card Company (BB&CC) annually conducts 25 direct mail campaigns each of which offers one million people the opportunity for a credit card. The conversion rate measures the proportion of people who become credit card customers, which for BB&CC is about 1% per campaign.

Getting people to fill out an application for the credit card is only the first step. Then BB&CC must decide whether the applicant is a good risk and accept them as a customer. Not surprisingly, poor credit risks are more likely to accept the offer than are good credit risks. So while 6% of the people on the mailing list respond with an application, only about 16% of those are suitable credit risks, for a net of about 1% of the mailing list becoming customers.

BB&CC's experience of a 6% response rate means that within the million names are 60,000 people who will respond to the solicitation. Unless BB&CC changes the nature of the solicitation – using different mailing lists, reaching customers in different ways, altering the terms of the offer – they are not going to get more than 60,000 responses. And of those 60,000 responses, only 10,000 will be good enough risks to become customers. The challenge BB&CC faces is getting to those 10,000 people most efficiently.

The cost of mailing the solicitations is about $1.00 per piece for a total cost of $1,000,000. Over the next couple of years, these customers will generate about $1,250,000 in profit for the bank (or about $125 each) for a net return from the mailing of $250,000.

Data mining can improve this return. Although it won't precisely identify the 1,00,000 eventual credit card customers, it will help focus marketing efforts much more cost-effectively. First BB&CC did a test mailing of 50,000 and carefully analyzed the results, building a predictive model of who would respond (using a decision tree) and a credit scoring model (using a neural net). It then combined these two models to find the people who were both good credit risks and most likely to respond to the offer.

The model was applied to the remaining 950,000 people in the mailing list from which 700,000 people were selected for the mailing. The result was that from the 750,000 pieces mailed overall (including the test mailing), 9,000 acceptable applications for credit cards were received. In other words, the response rate had risen from 1% to 1.2%, a 20% increase. While the targeted mailing only reaches 9,000 of the 10,000 prospects – no model is perfect – reaching the remaining 1,000 prospects is not profitable. Had they mailed the other 250,000 people on the mailing list, the cost of $250,000 would have resulted in another $125,000 of gross profit for a net loss of $125,000

The following table summarizes the results.

	Old	New	Difference
Number of pieces mailed	1,000,000	750,000	(250,000)
Cost of mailing	$1,000,000	$750,000	($250,000)
Number of responses	10,000	9,000	(1,000)
Gross profit per response	$125	$125	$0
Gross profit	$1,250,000	$1,250,000	($1,250,000)
Net profit	$250,000	$375,000	$125,000
Cost of model	0	40,000	$40,000
Final profit	$250,000	$335,000	$85,000

Notice that the net profit from the mailing increased to $125,000. Even when you include the $40,000 cost of the data mining software, computer, and people resources used for this modeling effort the net profit increased to $85,000. This translates to a return on investment for modeling of over 200% which far exceeded BB&CC's ROI requirements for a project.

3.1 Increasing the value of your existing customers: cross selling via data mining

Guns and Roses (G&R) is a company that specializes in selling antique mortars and cannons as outdoor flower pots. They also offer a line of indoor flower pots made from large caliber antique pistols and a collection of muskets that have been converted to unique holders of long stemmed flowers. Their catalog is sent to about 12 million homes.

When a customer calls in to place an order, G&R identifies the caller using caller ID when possible; otherwise they ask for a phone number or customer number from the catalog mailing label. Next, they look up the customer in the database and then proceed to take the order.

G&R has an excellent chance of selling the caller something additional – cross-selling. But G&R had found that if the first suggestion fails and they try to suggest a second item, the customer may get irritated and hang up without ordering anything. And there are some customers who resent any attempt at all to cross-sell them on additional products.

Before trying data mining, G&R had been reluctant to cross-sell at all. Without the model, the odds of making the right recommendation were one in three. And because making any recommendation is for some customers unacceptable, they wanted to be exceptionally sure that they never made a recommendation when they should not. In a trial campaign, they had less than a 1% sales rate and had a substantial number of complaints. They were reluctant to continue for such a small gain.

Infact, the situation changed dramatically with the use of data mining. Now the data mining model operates on the data. Using the customer information in the database and the new order, it tells the customer service representative what to recommend. They successfully sold 2% of the customers an additional product with virtually no complaints.

Developing this capability involved a process similar to solving the credit card customer acquisition problem. As with that situation, two models were needed. The first model predicted whether someone would be offended by recommendations. G&R found out how their customers would react by conducting a very short telephone survey. To be conservative, they counted anyone who declined to participate in the survey as someone who would find recommendations intrusive. Later on, to verify this assumption, they made recommendations to a small but statistically significant subset of those who had refused to answer the survey questions. To their surprise, they found that the assumption was not warranted. This enabled them to

make more recommendations and further increase profits. The second model predicted which offer would be most acceptable. Finally, data mining helped G&R better understand their customers' needs. When the data mining models were incorporated in a typical cross-selling CRM campaign, the models helped G&R to increase its profitability by 2%.

3.2 Increasing the value of your existing customers: personalization via data mining

Note that, Big Sam's Clothing (motto: "Rugged outdoor gear for city dwellers") has set up a website to supplement their catalog. Whenever you go to their site they greet you with "Howdy Pardner!" but once you have ordered or registered with them they greet you by name. If you have a record of ordering from them, they will also tell you about any new products that might be of particular interest to you. When you look at a particular product, such as a waterproof down parka, they will suggest other things that might supplement such a purchase.

When they first put up the site, there was none of this personalization. It was just an on-line version of their catalog – nicely and efficiently done but not taking advantage of the sales opportunities presented by the Web.

Data mining greatly increased the sales at their website. Catalogs frequently group products by type to simplify the user's task of selecting products. In an on-line store, however, the product groups may be quite different, often based on complementing the item under consideration. In particular, the site can take into account not only the item you're looking at, but what is in your shopping cart as well, thus leading to even more customized recommendations.

First, Big Sam's used clustering to discover which products grouped together naturally. Some of the clusters were obvious, such as shirts and pants. Others were surprising, such as books about desert hiking and snakebite kits. They used these groupings to make recommendations whenever someone looked at a product.

They then built a customer profile to help them identify those customers who would be interested in the new products they were always adding to their catalog. They found that steering people to these selected products not only resulted in significant incremental sales, but also solidified their relationship with the customer. Surveys established that they were viewed as a trusted advisor for clothing and gear.

To extend their reach further, Big Sam's started a program through which customers could be selected to receive e-mail about new products that the data mining models predicted would interest them. While the customers viewed this as another example of proactive customer service, Big Sam's found it to be a program of profit improvement.

The effort in personalization paid off for Big Sam's with significant, measurable increases in repeat sales, average number of sales per customer, and average size of a sale.

3.3 Retaining good customers via dm

Central to the business strategy of every financial service company is the ability to retain the existing customers and reach new prospective customers. Data mining is adopted to play an important role in these efforts. DM is an interactive process that combines business knowledge, machine learning methods & tools, and large amounts of accurate and relevant information to enable the discovery of non-intuitive insights hidden in the organization's corporate data. This information can refine existing processes, disclose trends & help formulate policies regarding company's relation to its customers & employees.

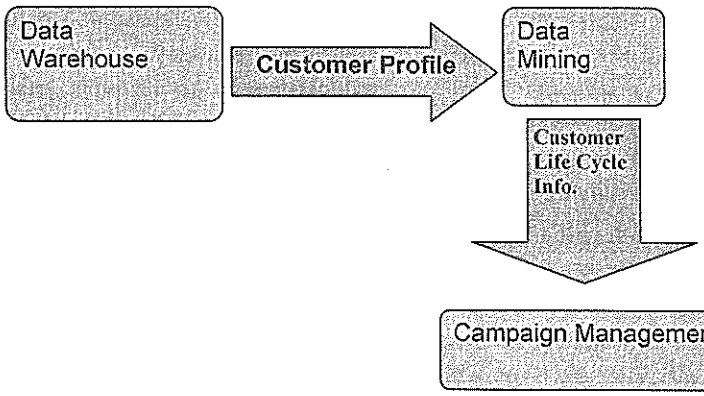
For almost every company, the cost of acquiring a new customer exceeds the cost of keeping good customers. This was the challenge facing Know Service, an Internet Service Provider (ISP) whose attrition rate was the industry average, 8% per month. Since they have one million customers, this means 80,000 customers left each month. The cost to replace these customers is $200 each, or $16,000,000 – plenty of incentive to start an attrition management program.

The first thing Know Service needed was to prepare the data for predicting which customers would leave. They wanted to select the variables from their customer database and perhaps transform them. The bulk of their users were dial-in clients (as opposed to clients who are always connected through a T1 or DSL line), so they knew how long each user was connected to the Web. They also knew the volume of data transferred to and from a user's computer, the number of e-mail accounts a user had, the number of e-mail messages sent and received, and a customer's service and billing history. In addition, they had demographic data that customers provided at sign-up.

Next they were supposed to identify who were "good" customers. This is not a data mining question but a business definition (such as profitability or lifetime value) followed by a calculation. Know Service built a model to profile their profitable customers and their unprofitable customers. They used this model not only for customer retention but to identify customers who were not yet profitable but might become so in the future.

4 Analysis of Data Mining in CRM

- DM helps to determine the behavior surrounding a particular lifecycle event Find other people in similar life stages and determine which customers are following similar behavior patterns



Data Mining in CRM customer life cycle

Data Mining in CRM: Customer Life Cycle

· Customer Life Cycle

· The stages in the relationship between a customer and a business

· Key stages in the customer lifecycle

· **Prospects:** people who are not yet customers but are in the target market

· **Responders:** prospects who will show an interest in a product or service

· **Active Customers:** people who are currently using the product or service

· **Former Customers:** may be "bad" customers who did not pay their bills or who incurred high costs

· It's important to know the life cycle events (e.g. retirement).

The analysis is carried out in the following manner:

1) Problem Context: The maximization of lifetime values of the (entire) customer base in the context of a company's strategy is a key objective of CRM. Various processes and personnel in an organization must adopt CRM practices that are aligned with corporate goals. For each institution, corporate strategies such as diversification, coverage of market niches or minimization of operative costs are implemented by "measures", such as mass customization, segment-specific product configurations etc. The role of CRM is in supporting customer-related strategic measures.

Customer understanding is the core of CRM. It is the basis for maximizing customer lifetime value, which in turn encompasses customer segmentation and actions to maximize customer conversion, retention, loyalty and profitability. Proper customer understanding and Actionability lead to increased customer lifetime value. Incorrect customer understanding can lead to hazardous actions. Similarly, unfocused actions, such as unbounded attempts to access or retain *all* customers, can lead to decrease of customer lifetime value (law of diminishing return). Hence, emphasis should be put on correct customer understanding and concerted actions derived from it. Figure 1 shows an idealized CRM cycle.

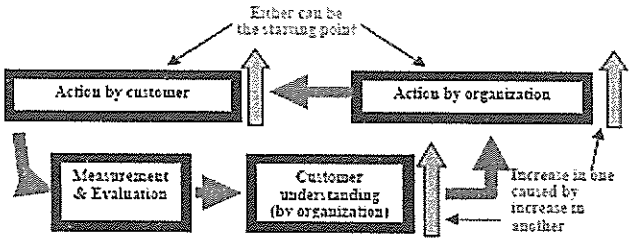


Figure 1. The Basic CRM Cycle.

In this figure, boxes represent actions:

• The customer takes the initiative of contacting the company, e.g. to purchase something, to ask for after sales support, to make a reclamation or a suggestion etc.

• The company takes the initiative of contacting the customer, e.g. by launching a marketing campaign, selling in an electronic store or a brick-and-mortar store etc.

• The company takes the initiative of understanding the customers by analyzing the information available from the other two types of action. The results of this understanding guide the future behaviour of the company towards the customer, both when it contacts the customer and also when the customer contacts it.

The reality of CRM, especially in large companies, looks quite different from the central coordination and integration suggested by Figure 1:

• Information about customers flows into the company from many channels, but not all of them are intended for the acquisition of customer-related knowledge.

• Information about customers is actively gathered to support well-planed customer-related actions, such as marketing campaigns and the launching of new products. The knowledge acquired as the result of these actions is not always juxtaposed to the original assumptions, often because the action-taking organizational unit is different from the information-gathering unit. In many cases, neither the original information, nor the derived knowledge are made available outside the borders of the organizational unit(s) involved. Sometimes, not even their existence is known.

• The limited availability of customer-related information and knowledge has several causes. Political reasons, e.g. rivalry

among organization units, are known to lead often in data and knowledge hoarding. A frequently expressed concern of data owners is that data, especially in aggregated form, cannot be interpreted properly without an advanced understanding of the collection and aggregation process. Finally, confidentiality constraints, privacy considerations and law restrictions often disallow the transfer of data and derived patterns among departments.

• In general, one must assume that data gathered by an organization unit for a given purpose cannot be exported unconditionally to other units or used for other purpose and that in many cases such an export or usage is not permitted at all.

• Hence, it is not feasible to strive for a solution that integrates all customer-related data into a corporate warehouse. The focus should rather be in mining non-integrated, distributed data while preserving privacy and confidentiality constraints. A more realistic picture of current CRM, incorporating the typical flow of information, is shown in Figure 2:

• Data is collected from multiple organizational units, for different purposes, and stored in multiple locations, leading to redundancies, inconsistencies and conflicting beliefs.

o No organization unit has access to all data and to all derived knowledge.

o Some data are not analyzed at all.

o Not all background knowledge is exploited.

o Data analysis is performed by many units independently.

o Some analyses do not mount to actions.

Ideally, the CRM cycle should encompass:

• the exploitation of all data and background knowledge

• the coordination of analyses, and resulting actions, in different parts of the organization

Figure 2. Expanded CRM Cycle – Current State.

Gap Analysis: The grand KDD challenges in CRM arise from the objectives of exploiting all information and coordinating analysis and actions. These objectives require methods to deal with several specific challenges, which we discuss in turn:

• ***Cold start:*** In CRM, one tries to influence customer behavior on the basis of prior knowledge. Often, there is no (reliable) such prior knowledge.

• ***Correct vs. incorrect customer understanding:*** CRM is about understanding the customer. It's about time to elaborate on the impact of *misunderstanding* the customer, and to fold this into our analyses and action workflows.

• ***Data sovereignity:*** There is no such thing as a CRM data warehouse; we are faced with multiple data sources. If and when problems of semantic disparity are solved, we will still face legislative and the political hurdles. We need solutions where the data owner is allowed to specify what data she wants to deliver, at what level of abstraction, and with what meta-information.

• ***Data quality:*** Some Customer-Company-Interaction channels deliver very good data. Others deliver notoriously poor quality data; web server logs belong to the latter category. The issue of data sovereignty impedes integration of raw data. Despite these odds, data must be enhanced to ensure that the results of the analysis are reliable.

• ***Deeper understanding:*** Profiling is based on some rudimentary behavioral data and some preferences, carefully extracted from questionnaires or learned from the data using data mining methods. Integration of cultural and psychological data is at its infancy. The experts in those domains come from outside of the KDD community (marketing researchers, practitioners, etc.) and we should establish collaborative relationships with them.

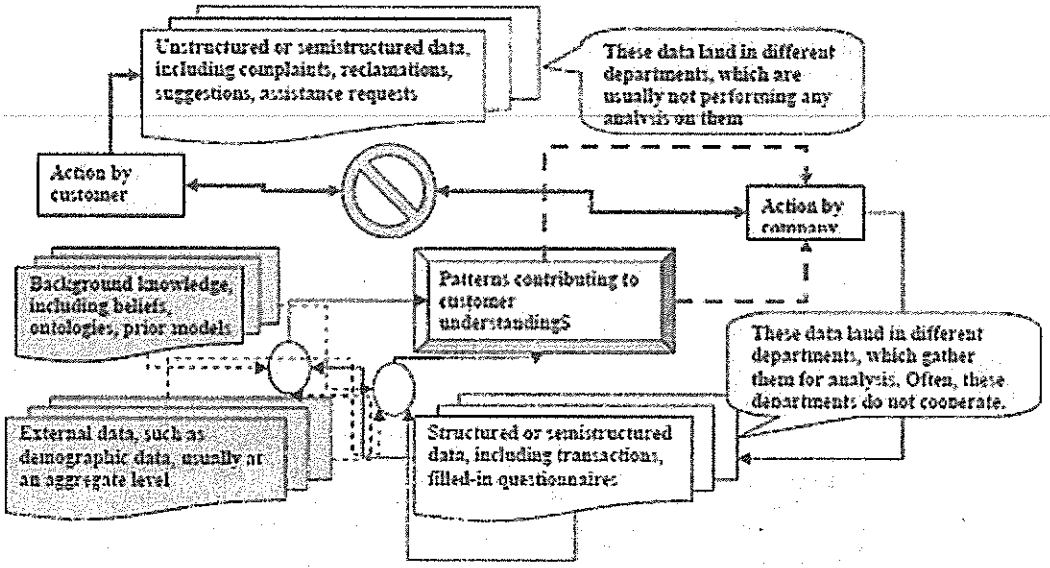


Figure 2. Expanded CRM Cycle – Current State.

• ***Questioning prior knowledge:*** Everything associated with prior knowledge is assumed correct. We need mechanisms that capture and align prior knowledge in the face of conflicting information.

• ***Actionability:*** Pattern discovery should lead to actions. In some cases, this is straightforward, e.g., site customization and personalization, but this step is often omitted. We need mechanisms that these are organizational and legal challenges that can be resolved in one way or another. However, this is a separate (non-technical) dimension of CRM.

Incorporate patterns into the action-taking processes in a seamless way. We also need an understanding of the action-taking processes and their influence on what patterns are most valuable.

5 Data Mining Challenges & Opportunities in CRM

In this section, we build upon our discussion of CRM and Life Sciences to identify key data mining challenges and opportunities in these application domains. The following is a list of challenges for CRM:

i **Non-trivial results almost always need a combination of DM techniques.** Chaining/composition of DM, and more generally data analysis, operations is important. In order to analyze CRM data, one needs to explore the data from different angles and look at its different aspects. This should require application of different *types* of DM techniques and their application to different "*slices*" of data in an interactive and iterative fashion. Hence, the need to use various DM operators and combine (chain) them into a single "exploration plan".

ii **There is a strong requirement for data integration before data mining.** In both cases, data comes from multiple sources. For example in CRM, data needed may come from different departments of an organization. Since many interesting patterns span multiple data sources, there is a need to integrate these data before an actual data mining exploration can start.

iii **Diverse data types are often encountered,** which requires the integrated mining of diverse and

Heterogeneous data. In CRM, while dealing with this issue is not critical, it is nonetheless important. Customer data comes in the form of structured records of different data types (e.g., demographic data), temporal data (e.g., web logs), text (e.g., emails, consumer reviews, blogs and chat-room data), (sometimes) audio (e.g., recorded phone conversations of service reps with customers).

iv **Highly and unavoidably noisy data must be dealt with.** In CRM, weblog data has a lot of "noise" (due to crawlers, missed hits because of the caching problem, etc.). Other data pertaining to customer "touch points" has the usual cleaning problems seen in any business-related data.

v **Privacy and confidentiality considerations for data and analysis results** are a major issue. In CRM, lots of demographic data is highly confidential, as are email and phone logs. Concern about inference capabilities makes other forms of data sensitive as well—e.g., someone can recover personally identifiable information (PII) from web logs.

vi **Legal considerations influence what data is available for mining and what actions are permissible.** In some countries it is not allowed to combine data from different sources or to use it for purposes different from those for which they have been collected. For instance, it may be allowed to use an external rating about credit worthiness of a customer for credit risk evaluation but not for other purposes. Ownership of data can be unclear, depending on the details of how and why it was collected, and whether the collecting organization changes hands.

vii **Real-world validation of results is essential for acceptance.** In CRM, as in many DM applications, discovered patterns are often treated as hypotheses that need to be tested on new data using rigorous statistical tests for the actual acceptance of the results. This is even more so for taking or recommending actions, especially in such high-risk applications as in the financial and medical domains. Example: recommending investments to customers (it is actually illegal in the US to let software give investment advice).

Viii **Developing deeper models of customer behavior:** One of the key issues in CRM is how to understand customers. Current models of customers are mainly built based on their purchase patterns and click patterns at web sites. Such models are very shallow and do not have a deep understanding of customers and their individual circumstances. Thus, many predictions and actions about customers are wrong. It is suggested that information from all customer touch-points be considered in building customer models. Marketing and psychology researchers should also be involved in this effort. Two specific issues need to be considered here. First, what level should the customer model be built at, namely at the aggregate level, the segment level, or at the individual level? The deciding factor is how personalized the CRM effort needs to be. Second is the issue of the dimensions to be considered in the customer profile. These include demographic, psychographic, macro-behavior (buying, etc.), and micro-behavior (detailed actions in a store, e.g. individual clicks in an online store) features.

ix **Acquiring data for deeper understanding in a non-intrusive, low-cost, high accuracy manner:** In many industrial settings, collecting data for CRM is still a problem. Some methods are intrusive and costly. Datasets collected are very noisy and in different formats and reside in different departments of an organization. Solving these pre-requisite problems is essential for data mining applications.

x **Managing the "cold start/bootstrap" problem:** At the beginning of the customer life cycle little is known, but the list of customers and the amount of information known for each customer increases over time. In most cases, a minimum amount of information is required for achieving acceptable results (for instance, product recommendations computed through collaborative filtering require a purchasing history of the customer). Being able to deal with cases where less

than this required minimum is known is a therefore a major challenge.

xi **Evaluation framework for distinguishing between correct/ incorrect customer understanding:**

Apart from the difficulty of building customer models, evaluating them is also a major task. There is still no satisfactory metric that can tell whether one model is better than another and whether a model really reflects customer behaviors. Although there are *some* metrics for measuring quality of customer models (e.g., there are several metrics for measuring the quality of recommendations), they are quite rudimentary, and there is a strong need to work on better measures. Specifically, the recommender systems community has explored this area.

xii **Good actioning mechanisms:** Once data mining has been conducted with promising results, how to use them in the daily performance task is critical and it requires significant research effort. It is common that after some data results are obtained, the domain users do not know how to use them in their daily work. This research may require the participation of business and marketing researchers. Another way to accommodate actioning mechanisms is to integrate them into the knowledge discovery process by focusing on the discoveries of actionable patterns in customer data. This would make easier for the marketers or other domain experts to determine which actions should be taken once the customer patterns are discovered.

xiii **Incorporating prior knowledge:** This has always been a problem in practice. Data mining tends to find many pieces of patterns that are already known or redundant. Incorporating prior domain knowledge can help to solve these problems, and also to discover something novel. However, the difficulties of incorporating domain knowledge result in little progress in the past. There are a number of reasons for this. First of all, knowledge acquisition from domain experts is very hard. This is well documented in AI research, especially in the literature of expert systems building. Domain experts may know a lot but are unable to tell. Also, many times, domain experts are not sure what the relevant domain knowledge is, which can be very wide, although the data mining application itself is very narrow. Only after domain experts have seen some discovered patterns then they remember some domain knowledge. The second reason is the algorithmic issue. Many existing methods have difficulty to incorporate sophisticated domain knowledge in the mining algorithm. Also, once the new patterns are discovered, it is important to develop methods that integrate the newly discovered knowledge with the previous knowledge thus enhancing the overall knowledge base. Although there is some general work on knowledge enhancement, much more needs to be done to advance this area and adapt it to CRM problems. Also, integration of these methods with existing and novel Knowledge Management approaches constitutes a fruitful area of research.

6 Applying dm to CRM

In order to build good models for your CRM, there are a number of steps to be followed. The two crows' dm process model described below is similar to other process models such as the CRISP_DM model, differing mostly in the emphasis it places on the different steps.

Note that while the steps appear in a list, the Datamining process is not linear – you will inevitably need to loop back to previous steps. For example, what you learn in the "explore data" step may require you to add new data to the dm database. The initial models we build may provide insights that lead to create new variables.

The basic steps of data mining for effective CRM are :

Step1. Define business problem
Step 2 Build marketing database
Step 3 Explore data
Step 4 Prepare data modeling
Step 5 Build model
Step 6 Evaluate model
Step 7 Deploy model and results.

Step 1. Define business problem. Each CRM application will have one or more business objectives for which you have to build the appropriate model. Depending on your specific goal, such as "increasing the response rate" or "increasing the value of a response, "you will build a very different model. An effective statement of the problem will include a way of measuring the results of your CRM project.

Step 2. Build a marketing database. Steps two thru 4 constitute the core of the data preparation. Together, they take more time and effort than all the other steps combined. There may be repeated iterations of the data preparation and model building steps as you learn something from the model that suggests you the data. These data preparation steps may take anywhere from 50% to 90% of the time and effort of the entire data mining process!

You will need to build a marketing database because your operational databases and corporate data warehouse will often not contain the data you need in the form you need it. Furthermore, your CRM applications may interfere with the speedy and effective execution of the system.

When you build your marketing database you will need to clean it up – if you want good models you need to have clean data. The data you need may reside in multiple databases such that as the customer database, product database, and transaction databases. This means you will need to integrate and consolidate the data into a single marketing database and reconcile differences in data values from the various sources. Improperly reconciled data is a major source of quality problems. There are often large differences in the way data is defined and used in different databases. Some inconsistencies may be easy to uncover, such as different addresses for the same customer. Making it more difficult to resolve these problems is that hey are often subtle. For example, the same customer may have different names or –

worse – multiple customer identification numbers.

Step 3 Explore data. Before you can build good predictive models, you must understand your data. Start by gathering a variety of numerical summaries (including descriptive statistics such as averages, standard deviations and so forth) and looking at the distribution of the data. You may want to produce cross tabulations (pivot tables) for multi-dimensional data.

Graphing and visualization tools are a vital aid in data preparation, and their importance to effective data analysis cannot be overemphasized. Data visualization most often provides the Aha! leading to new insights and success. Some of the common and very useful graphical displays of data are histograms or box plots that display distributions of values. You may also want to look at scatter plots in two or three dimensions of different pairs of variables. The ability to add a third, overlay variable greatly increases the usefulness of some types of graphs.

Step 4 Prepare data modeling. Infact, this is the final data preparation step before building models and the step where the most "art" comes in. Actually there are 4 main parts to this step:

First you want to select the variables on which to build the model. Ideally, you would take all the variables you have, feed them to the data mining tool and let it find those which are the best predictors. In practice, this doesn't work very well. One reason is that the time it takes to build a model increases with the number of variables. Another reason is that blindly including extraneous columns can lead to models with less rather than more predictive power.

The next step is to construct new predictors derived from the raw data. For example, forecasting credit risk using a debt-to-income *ratio* rather than just debt and income as predictor variables may yield more accurate results that are also easier to understand.

Next you may decide to select a subset or sample of your data on which to build models. If you have a lot of data, however, using all your data may take too long or require buying a bigger computer than you would like. Working with a properly selected random sample usually results in no loss of information for most CRM problems. Given a choice of either investigating a few models built on all the data or investigating more models built on a sample, the latter approach will usually help you develop a more accurate and robust model of the problem.

Last, you will need to transform variables in accordance with the requirements of the algorithm you choose for building your model.

Step 5. Data mining model building. The most important thing to remember about model building is that it is an iterative process. You will need to explore alternative models to find the one that is most useful in solving your business problem. What you learn in searching for a good model may lead you to go back and make some changes to the data you are using or even modify your problem statement.

Most CRM applications are based on a protocol called supervised learning. You start with customer information for which the desired outcome is already known. For example, you may have historical data because you previously mailed to a list very similar to the one you are using. Or you may have to conduct a test mailing to determine how people will respond to an offer. You then split this data into two groups. On the first group you train or estimate your model. You then test it on the remainder of the data. A model is built when the cycle of training and testing is completed.

Step 6. Evaluate your results. Perhaps the most overrated metric for evaluating your results is accuracy. Suppose you have an offer to which only 1% of the people will respond. A model that predicts "nobody will respond" is 99% accurate and 100% useless. Another measure that is frequently used is lift.

Lift measures the improvement achieved by a predictive model. However, lift does not take into account cost and revenue, so it is often preferable to look at profit or ROI. Depending on whether you choose to maximize lift, profit, or ROI, you will choose a different percentage of your mailing list to whom you will send solicitations.

Step 7. Incorporating data mining in your CRM solution. In building a CRM application, data mining is often only a small, albeit critical, part of the final product. For example, predictive patterns through data mining may be combined with the knowledge of domain experts and incorporated in a large application used by many different kinds of people.

The way data mining is actually built into the application is determined by the nature of the customer interaction. There are two main ways you interact with your customers: they contact you (inbound) or you contact them (outbound). The deployment requirements are quite different.

Outbound interactions are characterized by your company originating the contact such as in a direct mail campaign. Thus you will be selecting the people to whom you mail by applying the model to your customer database. Another type of outbound campaign is an advertising campaign. In this case you would match the profiles of good prospects shown by your model to the profile of the people your advertisement would reach.

For inbound transactions, such as a telephone order, an Internet order, or a customer service call, the application must respond in real time. Therefore the data mining model is embedded in the application and actively recommends an action.

In either case, one of the key issues you must deal with in applying a model to new data is the transformations you used in building the model. Thus if the input data (whether from a transaction or a database) contains age, income, and gender fields, but the model requires the age-to-income ratio and gender has been changed into two binary variables, you must transform your input data accordingly. The ease with which you can embed these transformations becomes one of

the most important productivity factors when you want to rapidly deploy many models.

Conclusion

Implementing CRM is hard. As Ciborra bluntly states, "CRM seems to have no built in mechanisms by which it acquires its own momentum and the diffusion becomes a self-feeding process" (Ciborra 2000).

This seems to leave us with two alternatives. The first is to accept an upward struggle of organizational interventions and in particular use the managerial tools of change management. As this case, and others, (Schwartz 2002; Tafti 2002) have shown, the challenge is a large one, and not necessarily successful.

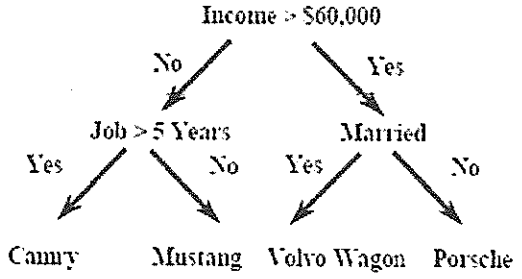
The second option is to accept the technological drift, that the system will be used in other ways than intended. The mechanisms at work at micro level are only partly controllable by management techniques, and often so interwoven with local culture and routines that in practice it is impossible to predict the outcome. In the view of CRM's close ties to strategic management and BPR this is a paradox.

Finally it can be concluded that CRM is essential to compete effectively in today's marketplace. Operational CRM needs analytical CRM with predictive data mining models at its core. The route to a successful business requires that you understand your customers and their requirements, and data mining is essential guide.

Appendix: Data mining technology

Decision trees

Decision trees are a way of representing a series of rules that lead to a class or value. For example, you may wish to offer a prospective customer a particular product. The figure shows a simple decision tree that solves this problem while illustrating all the basic components of a decision tree: the decision node, branches and leaves



A simple classification tree.

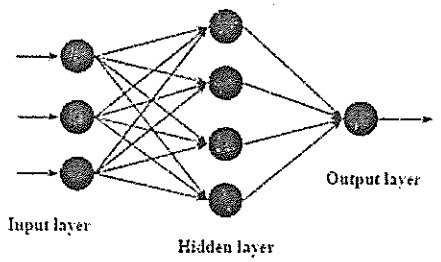
The first component is the top decision node, or root node, which specifies a test to be carried out. Each branch will lead either to another decision node or to the bottom of the tree, called a leaf node. By navigating the decision tree you can assign a value or class to a case by deciding which branch to take, starting at the root node and moving to each subsequent node until a leaf node is reached. Each node uses the data from the case to choose the appropriate branch.

Decision trees models are commonly used in data mining to examine the data and induce a tree and its rules that will be used to make predictions. A number of different algorithms may be used for building decision trees including CHAID (Chi-squared Automatic Interaction Detection), CART (Classification And Regression Trees), Quest, and C5.0.

Neural networks

Neural networks are of particular interest because they offer a means of efficiently modeling large and complex problems in which there may be hundreds of predictor variables that have many interactions. (Actual biological neural networks are incomparably more complex.) Neural nets are most commonly used for regressions but may also be used in classification problems.

A neural network (see figure) starts with an *input layer*, where each node corresponds to a predictor variable. These input nodes are connected to a number of nodes in a *hidden layer.* Each input node is connected to every node in the hidden layer. The nodes in the hidden layer may be connected to nodes in another hidden layer, or to an *output layer.* The output layer consists of one or more response variables.

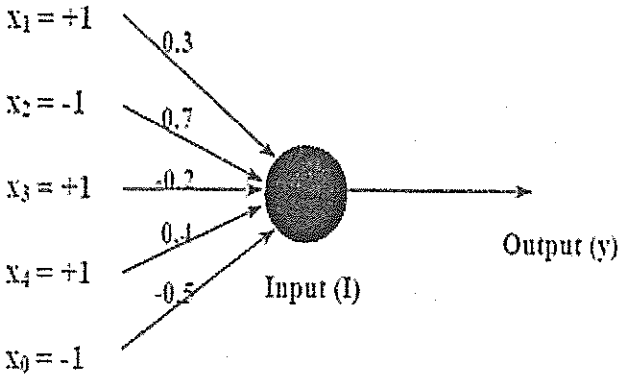


A neural network with one hidden layer.

After the input layer, each node takes in a set of inputs, multiplies them by a connection weight adds them together, applies a function (called the activation or squashing function) to them, and passes the output to the node(s) in the next layer. For example, the node above has five inputs (x0 through x4) each of which is multiplied by a weight and then added together resulting in a sum I:

I = .3X1+.7X2-.2X3+.4X4-.5X5= .3-.7-.2+.4+.5=.3

This output y is then the sum that has been transformed by the non-linear activation function, in this case to a value of .57



The goal of training the neural net is to estimate the connection weights so that the output of the neural net accurately predicts the test value for a given input set of values. The most common training method is back propagation. Each training method has a set of parameters that control various aspects of training such as avoiding local optima or adjusting the speed of conversion.

Neural networks differ in philosophy from many statistical methods in several ways. First, a neural network usually has more parameters than does a typical statistical model. For example, a neural network with 100 inputs and 50 hidden nodes will have over 5,000 parameters. Because they are so numerous, and because so many combinations of parameters result in similar predictions, the parameters become uninterruptible and the network serves as a "black box" predictor. However, this is acceptable in CRM applications. A bank may assign the probability of bankruptcy to an account and may not care what the causes are.

One myth of neural networks is that data of any quality can be used to provide reasonable predictions and they will sift through it to find the truth. However, neural networks require as much data preparation as any other method, which is to say they require a lot of data preparation.

The most successful implementations of neural networks (or decision trees, or logistic regression, or any other method) involve very careful data cleansing, selection, preparation and preprocessing. For instance, neural nets require that all variables be numeric. Therefore categorical data such as "state" is usually broken up into multiple dichotomous variables (e.g., "California," "New York") , each with a "1" (yes) or "0" (no) value. The resulting increase in variables is called the *categorical explosion.*

Clustering

Clustering divides a database into different groups. The goal of clustering is to find groups that are very different from each other, and whose members are very similar to each other. Unlike classification, you don't know what the clusters will be when you start, or by which attributes the data will be clustered. Consequently, someone who is knowledgeable in the business must interpret the clusters. After you have found clusters that reasonably segment your database, these clusters may then be used to classify new data. Some of the common algorithms used to perform clustering include Kohonen feature maps and K-means.

Don't confuse clustering with segmentation. Segmentation refers to the general problem of identifying groups that have common characteristics. Clustering is a way to segment data into groups that are not previously defined, whereas classification is a way to segment data by assigning it to groups that are already defined.

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AN EFFICIENT MATHEMATICAL MODEL FOR NON-LINEAR TIME-DEPENDENT FLOWS IN A DENSELY PACKED POROUS LAYER

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1. Introduction: This paper deals with the analytical investigation of a mathematical model to study the linear and non-linear time dependent porous convection in a densely packed porous layer under a modulated environment. The model happens to be a Darcy model with the stress free planar boundaries. Linear as well as nonlinear theories are discussed in detail by the extended Stuart-Davis technique in order to know the qualitative as well as the quantitative features of the phenomenon. The time variation is introduced by oscillating the layer in the vertical direction. All the physical quantities like, volume expansion coefficient, kinematic viscosity, permeability, thermal diffusivity etc. are assumed to be constants.

2. Mathematical Formulation

The physical configuration consists of a densely packed fluid saturated porous layer confined between two infinite horizontal planes that are stress free and kept at constant temperatures. The mean distance between the two plates is '**d**'. Further, the lower plate is at a temperature T_h, whereas the upper plate is at a temperature T_c with $T_h > T_c$. The whole system is under gravity modulation so that

$$\bar{g} = g_0(1 + g(t))\hat{k}$$

Under the suitable assumptions and approximations the governing equations of motion in the dimensionless form are:

The conservation of momentum

$$\left[-\nabla p + \frac{1}{P_L}\right] q + \bar{H} + g(t)\,\bar{f}\,R\theta\,\hat{k} - \nabla p = 0 \qquad (2.1)$$

The conservation of energy

$$\left(\frac{\partial}{\partial t} + \vec{q}\cdot\nabla\right)T = \kappa\nabla^2 T + Q \qquad (2.2)$$

The conservation of mass

$$\nabla\cdot\vec{q} = 0 \qquad (2.3)$$

The equation of state

$$\rho = \rho_0(1-\alpha(T-T_0)) \qquad (2.4)$$

where (2.4) is in the dimensional form and α, ν, κ and ρ_0 are the constant coefficients of thermal expansion, kinematic viscosity, thermal diffusivity and reference density of the fluid respectively. The other quantities have their pre-defined meanings.

The scales used in making the equations dimensionless are:

Length : d Velocity: $\frac{\kappa}{d}$ Temperature: $\frac{\beta d}{\kappa}$

Time: $\frac{d^2}{\kappa}$ Pressure: $\frac{\rho_0\nu\kappa}{d^2}$ (2.5)

In the process of non-dimensionalization the following dimensionless parameters appear:

$R = \frac{\alpha\beta g_0 d^4}{\nu\kappa}$ Rayleigh number ;

$\sigma = \frac{\nu}{\kappa}$ Prandtl number;

$Q = \frac{\pi^2 k}{d^2}$ Porous Parameter / Darcy number; ... (2.6)

Further, a bar indicates the horizontal average. As in the previous chapters, we write from the equation of the conservation of energy:

$$\left(\frac{\partial}{\partial t} - \frac{\partial^2}{\partial z^2}\right)\bar{T} = \overline{wT} \qquad (2.7)$$

Here T is the horizontal average of T and $\theta = T - \bar{T}$

The analysis is restricted to the case of two-dimensional flow only under the limit of Prandtl number tending to infinity. The above assumption enables us to have the solutions in the closed form. We now write (2.1) in the component form so that

$$\left(\sigma^{-1}\frac{\partial}{\partial t} - \frac{1}{P_L}\right)u - \frac{\partial p}{\partial x} = 0 \qquad (2.8)$$

$$\left(\sigma^{-1}\frac{\partial}{\partial t} - \frac{1}{P_L}\right)w - (1-g(t))R\theta - \frac{\partial p}{\partial z} = 0 \qquad (2.9)$$

By operating $\left[\frac{\partial}{\partial x}(2.8) - \frac{\partial}{\partial z}(2.9)\right]$ on the above set of equations, the pressure is eliminated, so that we have the following:

$$\frac{1}{P_L}\nabla^2 w - (1-g(t))R\theta_{xx} = 0 \qquad (2.10)$$

$$\left(\frac{\partial}{\partial t} - \nabla^2\right)\Omega - \sigma\Theta_x = \sigma(\overline{wT})_z \qquad (2.11)$$

$$\left(\frac{\partial}{\partial t} - \frac{\partial^2}{\partial z^2}\right)\bar{T} = \overline{wT}_z \qquad (2.12)$$

$$u_x + w_z = 0 \qquad (2.13)$$

The above set of equations will be solved in the domain $-\infty < x < \infty$, $0 \le z \le \pi$, $t \ge 0$.

Boundary Conditions :

The horizontal boundaries are assumed to be planar, stress-free and perfectly conducting so that

$$w = u_z = \theta = 0 \quad \text{on } z = 0, \pi \qquad (2.14)$$

and

$$\bar{T}(0,t) = \pi \quad \bar{T}(\pi,t) = 0 \qquad (2.15)$$

As discussed in the previous chapters, the problem will be completely specified only when the initial conditions are imposed. The two time regions emerge from the asymptotic analysis in the small parameter $(R-R_L)^{1/2}$ range where R_L is the critical value of the Rayleigh number corresponding to the linear theory. Since, the analysis is restricted to a single wave-number in the x-direction (i.e. only a single disturbance), the linear theory grows in the 'inner' layer. Thus the evolution of this mode will be considered in the outer region. Therefore, the **appropriate initial conditions** are given by

$$\left.\begin{aligned} w(x,z,o) &= W_0\cos\alpha x \sin z,\\ \theta(x,z,0) &= \Theta_0\cos\alpha x \sin z,\\ u(x,z,0) &= U_0\sin\alpha x\cos z \end{aligned}\right\} \qquad (2.16)$$

where,

$$W_0 = \frac{P_L^2(R-R_L)W_0}{P_L R_L g(o) + \sigma^2 R} \qquad (2.17)$$

and

$$U_0 = -W_0 \alpha^{-1} \qquad (2.18)$$

are the compatibility conditions. On obtaining (2.17) and (2.18), the initial conditions (with finite number of modes) appropriate to the 'outer layer' are imposed and the results of the linear theory are anticipated.

3. The Expansion Procedure

In this section, the linearized problem is considered and the basic state solution is given by

$$q = 0, \qquad \bar{T} = T_0(z) \quad \text{and} \quad \theta = 0 \qquad (3.1)$$

where, $T_0(z) = -(z - \pi)$ (3.2)

We now consider the linearized system given by

$$\frac{1}{P_L}\left(\frac{\partial^2}{\partial z^2} - a^2\right) w_1 = a^2 R\theta_1 - g(t)\, a^2 \zeta_1 \qquad (3.3)$$

$$\left(\frac{\partial}{\partial t} - \frac{\partial^2}{\partial z^2} + a^2\right)\theta_1 - w_1 = 0 \qquad (3.4)$$

with $w_1 = \zeta_1 = 0$ on $z = 0, \pi$ (3.5)

In the above set of equations, the x-dependence of all the variables is considered in the form $e^{i\alpha x}$ and also $\overline{T_{0z}} = 1$

We seek the solution to the system of equations (3.3) to (3.5) in the form;

$$(w_1, \theta_1) = (F_1(t), G_1(t)) \exp(a_0 t) \sin z \qquad (3.6)$$

with the condition that F_1 and G_1 must satisfy:

$$-\frac{1}{P_L}(a^2 + 1) F_1 = a^2 R F_1 - g(t) a^2 G_1 \qquad (3.7)$$

and

$$-\left(\frac{d}{dt} + a_0 + \alpha^2 + 1\right) G_1 = F_1 \qquad (3.8)$$

The solutions of (3.7) and (3.8) are:

$$G_1(t) = G_1(0) \exp\left[-\frac{\alpha^2 R P_L}{(\alpha^2 + 1)} \int_0^t g(s)\, ds\right] \qquad (3.9)$$

$$F_1(t) = \frac{\alpha^2 R (1 - g(t))\, P_L}{(\alpha^2 + 1)} G_1(t) \qquad (3.10)$$

where

$$a_0 = \frac{\alpha^2 (R - R_L) P_L}{(\alpha^2 + 1)} \qquad (3.11)$$

$$R_L = \frac{(\alpha^2 + 1)^2}{\alpha^2 P_L} \qquad (3.12)$$

A careful observation of the solutions reveals that ,

(i) the solutions are composed of the products of two parts viz. $\exp(a_0 t)$ and a time bounded factor whenever g is integrable on $[0, \infty]$ (ii) the permeability has its strong influence on all the factors and

(iii) the factor $\exp(a_0 t)$ represents the exponential growth of the perturbations and the growth rate becomes arbitrarily small for $R \sim R_L$.

Since, an exponentially growing disturbance quickly invalidates linearization, an unknown function **A(t)** which grows exponentially in the absence of non-linear terms is considered. The function **A(t)** has the property that it remains bounded for all time in the presence of nonlinearities. Thus, formal expansions for the variables can be written in terms of **A(t)**, where it is assumed that

$$\frac{dA}{dt} = a_0 A - a_2 A^3 - \ldots\ldots\ldots \qquad (3.13)$$

In a time dependent phenomenon, secular and resonant terms appear during the nonlinear mathematical analysis. Accordingly, here the coefficients a_i are so chosen so that the secular terms which make the expansion non-uniformly valid in time, are suppressed.

The expansions for the physical variables are

$$\theta(x, z, t) = A(t)\, \theta_1(z, t) - A^3(t)\, \theta_3(z, t) - \ldots \cos x - A^2(t)\, \theta_2(z, t) - \ldots \cos 2x - A^2(t)\, \theta_0(z, t) - \ldots - A^3(t)\, \theta_4(z, t) - \ldots \cos 3x - \ldots\ldots \qquad (3.14)$$

$$w(x, z, t) = A(t)\, w_1(z, t) - A^3(t)\, w_3(z, t) - \ldots \cos x - A^2(t)\, w_2(z, t) - \ldots \cos 2x - A^2(t)\, w_0(z, t) - \ldots - A^3(t)\, w_4(z, t) - \ldots \cos 3x - \ldots\ldots \qquad (3.15)$$

$$u(x, z, t) = A(t)\, u_1(z, t) - A^3(t)\, u_3(z, t) - \ldots \cos x - A^2(t)\, u_2(z, t) - \ldots \cos 2x - A^2(t)\, u_0(z, t) - \ldots - A^3(t)\, u_4(z, t) - \ldots \cos 3x - \ldots\ldots \qquad (3.16)$$

$$\frac{dA}{dt} = a_0 A - a_2(t) A^3 - \ldots\ldots \qquad (3.17)$$

together with the **boundary conditions**

$\theta_i(0, t) = \theta_i(\pi, t) = w_i(0, t) = w_i(\pi, t) = 0$

$u_i(0, t) = u_i(\pi, t) = 0$ (3.18)

and the **initial conditions**

$\theta_1(z, 0) = \Theta_0 \sin z$; $w_1(z, 0) = w_0 \sin z$; $u_1(z, 0) = U_0 \cos z$ (3.19)

$T_0(z, 0) = -(z - \pi)$; $\theta_i(z, 0) = w_i(z, 0) = 0$ (3.20)

$u_i(z,0) = T_{2i}(z,0) = 0\ (i>1)$ (3.21)

But, for the case of finite Prandtl number, the amplitude is of the form :

$$(\alpha^2 - 1)^{-1}(P-1)^{-1}\frac{d^2A}{dt^2} - \frac{dA}{dt} = a_0 A - a_2(t)A^3 - \ldots \quad (3.22)$$

which is similar to that of Segel & Stuart (1962) for the case of steady basic state.

4. **Different Order Solutions:**

In this section the expansions (3.14) to (3.21) are substituted into (3.3) to (3.5) and a sequence of linear homogeneous problems is obtained. The solutions corresponding to different order systems are computed.

The order one / zeroth order equations are:

$$\left(-\frac{\partial}{\partial t} - D^2\right) T_0 = 0 \quad (4.1)$$

where

$$D \approx \frac{\partial}{\partial z} \quad \text{and} \quad (4.2)$$

$$T_0(0,t) = \pi, \qquad T_0(\pi,t) = 0, \qquad T_0(z,0) = -(z-\pi)$$

Clearly, $T_0(z,t) = -(z-\pi)$ (4.3) is the basic state whose stability is to be discussed.

The second order set of equations O(A cos αx) correspond to linear theory.

The set of equations are:

$$\frac{1}{P_L}\left(D^2 - \alpha^2\right) W_1 - \alpha^2 R\theta_1 - g(t)F_1 = 0 \quad (4.4)$$

$$\left(-\frac{\partial}{\partial t} D^2 - \alpha^2 - a_0\right)\theta_1 - W_1 = 0 \quad (4.5)$$

The solution satisfying the boundary conditions (2.14) to (2.16) and the initial conditions (2.17) and (2.18) satisfying (3.3) to (3.4) are:

$$(\theta_1, W_1) = (G_1(t), F_1(t))\sin z \quad (4.6)$$

By eliminating F_1 from

$$-\frac{1}{P_L}(\alpha^2 - 1)F_1 - \alpha^2 R\theta_1 - g(t)G_1 = 0 \quad (4.7)$$

and

$$\frac{dG_1}{dt} - (\alpha^2 - 1 - a_0)G_1 - F_1 = 0 \quad (4.8)$$

we obtain after some simplification the following differential equation.

$$\frac{dG_1}{dt} - \frac{\alpha^2 R P_L}{(\alpha^2 - 1)}g(t)G_1 = 0 \quad (4.9)$$

By applying the initial conditions, we get the solutions of (4.9) as

$$G_1(t) = G_1(0)\exp\left[-\frac{\alpha^2 R P_L}{(\alpha^2 - 1)}\int_0^t g(s)ds\right] \quad (4.10)$$

From (4.7) and (4.10) :

$$F_1(t) = \frac{\alpha^2 R P_L}{(\alpha^2 - 1)}(1 - g(t))G_1(t) \quad (4.11)$$

where a_0 and R_L are given by (3.11) and (3.12).

We now proceed to compute the first correction to the linear theory. These involve terms of $O(A^2\cos 2\alpha x)$. The second-order set of equations are:

$$\frac{1}{P_L}(D^2 - 4\alpha^2)w_2 - 4\alpha^2 R(1 - g(t))\theta_2 = 0 \quad (4.12)$$

$$\left(-\frac{\partial}{\partial t} D^2 - 2a_0 - 4\alpha^2\right)\theta_2 - w_2 = \frac{1}{2}(w_1\theta_{1z} - w_{1z}\theta_1) \quad (4.13)$$

subject to the **boundary conditions**

$$\theta_2 = w_2 = 0 \quad \text{at} \quad z = 0, \pi \quad (4.14)$$

and the **initial conditions**

$$\theta_2 = w_2 = 0 \quad \text{at} \quad t = 0 \quad (4.15)$$

It can be easily checked that from (4.10) and (4.11)

$$1/2\,[w_1\theta_{1z} - w_{1z}\theta_1] = 0 \quad (4.16)$$

which shows that the contribution from the non-linear term to this correction is zero. Further, it is found from the initial condition (2.15) that

$$w_2 = u_2 = \theta_2 = 0 \quad (4.17)$$

Also, from (2.7), the minimizing second-order terms which correct the mean temperature are of $O(A^2)$:

$$\left(D^2 - \frac{\partial}{\partial t} - 2a_0\right)T_2 = \frac{1}{2}(w_1\theta_1)_z = \frac{F_1 G_1 \sin 2z}{2}$$
$$= \frac{1}{2}\frac{\alpha^2 R(1 - g(t))}{\alpha_L} - a_0^2 \exp\left[-\frac{2\alpha^2 R}{\alpha_L}\int_0^t g(s)ds\right]\sin 2z \quad (4.18)$$

with

$$T_2(0,t) = T_2(\pi,t) = 0 \quad (4.19)$$

and

$$T_2(Z,0) = 0 \quad (4.20)$$

where

$$\alpha_L = (\alpha^2 + 1)/P_L \quad (4.21)$$

The solution of (4.18) subject to (4.19) and (4.20) is given by

$$T_2(z,t) = H_2(t)\exp\left[-\frac{2\alpha^2 R}{\alpha_L}\int_0^t g(s)ds\right]\sin 2z \qquad (4.22)$$

where $H_2(t)$ satisfies the following integro-differential equation:

$$\frac{dH_2}{dt} + \left[4 + 2a_0 - \frac{2\alpha^2 R}{\alpha_L}g(t)\right]H_2 = \frac{1}{2}\frac{\alpha^2 R(1-g(t))}{\alpha_L}a_0^2 \qquad (4.23)$$

Obviously, the integrating factor of (4.23) is:

$$I_2(t) = \exp\left[(4 + 2a_0)t - \frac{2\alpha^2 R}{\alpha_L}\int_0^t g(s)ds\right] \qquad (4.24)$$

Therefore, the solution of (4.23) is given by

$$H_2(t) = \frac{1}{2}a_0^2 I_2^{-1}(t)\int_0^t \frac{\alpha^2 R}{\alpha_L} I_2(s)(1-g(s))ds \qquad (4.25)$$

We next proceed to compute the third-order correction to the mean temperature which are of $O(A^3\cos\alpha x)$.

The corresponding differential equations are given by:

$$\frac{1}{P_L}(D^2-\alpha^2)w_3 + \alpha^2 R(1-g(t))\theta_3 = 0 \qquad (4.26)$$

$$\left[D^2-\alpha^2-\frac{\partial}{\partial t}-3a_0\right]\theta_3 + w_3 = a_2\theta_1 + w_1 T_{2z} \qquad (4.27)$$

subject to the **boundary conditions**

$$\theta_3 = w_3 = 0 \quad \text{on} \quad z = 0, \pi \qquad (4.28)$$

and the **initial conditions**

$$\theta_3 = w_3 = 0 \quad \text{at} \quad t = 0 \qquad (4.29)$$

We now eliminate w_3 from (4.26) and (4.27):

$$\frac{1}{P_L}(D^2-\alpha^2)\left[D^2-\frac{\partial}{\partial t}-\alpha^2-3a_0\right]\theta_3 - \alpha^2 R(1-g(t))\theta_3 = V_1(t)\sin z + V_3(t)\sin 3z \qquad (4.30)$$

Now, the left-hand side of (4.30) represents a self-adjoint Fredholm Operator subject to (4.28). After some simplification, we write

$$V_1(t) = \alpha_L\left[a_2 G_1 + F_1 H_2 \exp\left[-\frac{2\alpha^2 R}{\alpha_L}\int_0^t g(s)ds\right]\right] \qquad (4.31)$$

$$V_3(t) = -F_1 H_2 \exp\left[-\frac{2\alpha^2 R}{\alpha_L}\int_0^t g(s)ds\right] + \alpha_{9L} \qquad (4.32)$$

where

$$\alpha_{9L} = \frac{(\alpha^2 + 9)}{P_L}$$

subject to the **boundary conditions**

$$\theta_3 = \theta_{3zz} = \theta_{3zzzz} = 0 \quad \text{on} \quad z = 0, \pi \qquad (4.33)$$

and the **initial conditions**

$$\theta_3 = 0 \quad \text{at} \quad t = 0 \qquad (4.34)$$

It is important to note that the system (4.26) to (4.29) has solutions if the right-hand side is orthogonal to θ_1, the solution to the homogeneous problem. The appearance of the operator x/t prevents the operator on the left to be of Fredholm type. The orthogonality condition which is mentioned above suppresses the replication terms. (i.e. terms on the right-hand side which have a z-dependence) and this enables us to get an expression for a_2.

Particular Solution :

We now proceed to compute a particular solution of (5.3.30) by taking $\theta_3(t) = C_n(t)\sin nz$ for $n = 1, 3$ by considering terms containing sin nz on the right hand side of (4.30). Accordingly, we obtain

$$\frac{dC_n}{dt} + \alpha_{nL}(3a_0 + n^2 + \alpha^2) - \alpha^2 R(1-g(t))C_n(t) = V_n(t) \qquad (4.35)$$

$$\frac{dC_n}{dt} + \left[(3a_0 + n^2 + \alpha^2) - \frac{\alpha^2 R}{\alpha_{nL}}(1-g(t))\right]C_n(t) = \frac{V_n(t)}{\alpha_{nL}} \qquad (4.36)$$

where $V_n(t)$ is bounded in the time for all **n**. For solving the differential equation (4.36) we first compute the integrating factor:

$$I_n(t) = \exp\left[\left[3a_0 - \frac{\alpha^2}{\alpha_{nL}}\right]R - \frac{\alpha_{nL}(n^2+\alpha^2)}{\alpha^2}\right]t + \frac{\alpha^2 R}{\alpha_{nL}}\int_0^t g(s)ds \qquad (4.37)$$

Accordingly, the solution of (4.36) is given by:

$$C_n(t) = \frac{I_n^{-1}(t)}{\alpha_{nL}}\int_0^t V_n(s)I_n(s)ds + \text{const.}\; I_n^{-1}(t) \qquad (4.38)$$

where

$$\alpha_{nL} = (n^2+\alpha^2)/P_L \qquad (4.39)$$

We find that when $n = 3$ and $R > R_L$,

$$I_3(t) = \exp\left[\beta_3 t + \gamma_3\int_0^t g(s)ds\right] \qquad (4.40)$$

where $\beta_3 > 0$. Also it should be noted that β_3 happens to be of **O(1)** when $R \to R_L$. This suggests that for large t,

$$C_3(t) \sim (\text{Const.})\; I_3^{-1}\int_0^t I_3(s)V_3(s)ds \qquad (4.41)$$

In other words,

$$\lim_{t\to\infty} C_3(t) = (\text{Const.})\;\beta_3^{-1} \qquad (4.42)$$

and obviously $C_3(t)$ is bounded for all time. But, it is interesting to note that $\lim_{t\to\infty} C_1(t)$ is unbounded. Specifically, if $R > R_L$, then

$$I_1(t) = \exp\left|\beta_1 t + \gamma_1 \int_0^t g(s)ds\right| \quad (4.43)$$

in which case $\beta_1 > 0$ and tends to zero when $R \to R_L$. This suggests that

$$I_1^{-1}(t) \int_0^t V_1(s)I_1(s)ds \geq \inf.|V_1(t)|I_{p1}I_{p2} \quad (4.44)$$

where

$$I_{p1} = \exp\left|-\gamma_1 \int_0^t g(\tau)d\tau\right| \quad (4.45)$$

$$I_{p2} = \int_0^t \exp\left|\gamma_1 \int_0^t g(\tau)d\tau\right| ds \quad (4.46)$$

Also (4.44) tends to infinity as $t\to\infty$ and $R \to R_L$.

The above result prompts us to choose $a_2(t)$ in such a way that $V_1(t) = 0$. In fact, in the absence of the operator x/t this is the requirement that is expected. Therefore, from (4.31), we obtain the following important result:

$$a_2(t) = -F_1(t)G_1^{-1}(t)H_2(t)\exp\left|-\frac{2\alpha^2 R}{\alpha_L}\int_0^t g(s)ds\right| \quad (4.47)$$

In other words, by choosing $a_2(t)$ as given by (4.47), we are suppressing the replication terms which add complexities to the problem.

5. Analysis of the Amplitude Equations

In this section a detailed analysis and discussion of the amplitude equation governing the densely packed modulated convective phenomenon is made by considering three different cases.

The amplitude equation derived from the previous section is

$$\frac{dY}{dt} = \gamma_0(t)Y - \gamma_2(t)Y^3 \quad (5.1)$$

where,

$$Y(t) = G_1(t)A(t) \quad (5.2)$$

From (5.1) and (5.2), we can write,

$$\frac{dG_1}{dt} - a_0 G_1 = \gamma_0(t)G_1 \quad (5.3)$$

which yields:

$$\gamma_0(t) = a_0 - \frac{\alpha^2 R}{\alpha_L}g(t) \quad (5.4)$$

Now, we can write the integrating factor of (5.1) as

$$k(t) = \exp\left|2\int_0^t \gamma_0(s)ds\right| \quad (5.5)$$

Therefore, the solution of (5.1) can be written as

$$Y^{-2} = (\text{const.})k^{-1}(t) + 2k^{-1}(t)\int_0^t \gamma_2(s)k(s)ds \quad (5.6)$$

Clearly, **at t = 0, $[Y(0)]^{-2}$ = const.** That is $[Y(0)]^{-2} = x_0^{-2}$ **(since $Y(0) = X_0$)** (5.7)

Therefore, from (5.7) and (5.6):

$$Y(t) = \left|\Theta_0^{-2}k^{-1}(t) + 2k^{-1}(t)\int_0^t \gamma_2(s)k(s)ds\right|^{-\frac{1}{2}} \quad (5.8)$$

We now proceed to compute the results corresponding to the next higher approximation. By comparing the coefficients of A^3 in (5.1), we obtain

$$\gamma_2(t) = a_2(t)G_1(t) \quad (5.9)$$

From (4.9), (4.10), (4.24) and (5.9) we obtain,

$$\gamma_2(t) = \frac{1}{2}\left|\frac{\alpha^2 R}{\alpha_L}\right|^2 (1 - g(t))J_2^{-1}(t)\int_0^t (1 - g(s))J_2(s)ds \quad (5.10)$$

where, $J_2(t)$ is given by (4.24).

We observe that, as in the fluid case, $\gamma_2(t) > 0$ for all time, if $(1-g(t)) > 0$ (independent of the sign of $(R-R_L)$). This suggests that nonlinearities are always stabilizing.

We now discuss the following **three** cases with regard to gravity modulation:

Case I : $g(t) = 0$

In this case, we obtain the following simplified results:

$$Y(t) = k^{1/2}(t)\left|\frac{\alpha_L}{\alpha^2 R}\right|\left|W_0^{-2} + \frac{1}{4 + 2a_0}\left|\frac{e^{2a_0 t} - 1}{2a_0} + \frac{e^{-4t} - 1}{4}\right|\right|^{-1/2}$$

$$Y^2(t) = 8a_0\left(\alpha_L/\alpha^2 R\right)^2 = Y_*^2 \quad \text{as } t \to \infty \quad (5.11)$$

From (5.11), it is observed that when $R > R_L$, $Y^2(t) = Y_*^2$ and $Y^2(t) \to 0$ as $t \to \infty$, when $R < R_L$, for a fixed value of the Porous parameter.

Case II: $g(t) = \epsilon e^{-t}$

Suppose, we consider the stability of a porous layer whose upper boundary is impulsively cooled, then the basic state

(Foster1965 a, b; II) takes the form q . 0 The expression for Y(t) is very lengthy and the results are discussed through graphs.

Case III: $g(t) = \epsilon\sin(t)$

This case corresponds to the oscillating case. The expression for Y(t) is very lengthy and the results are discussed through graphs.

6. Results and Discussion

In this section, the results of the present paper are

presented through graphs (figures 1 to 8). In figures 1 to 8, the graphs of $Y_N(t) \equiv Y(t)\ Y^1$ are plotted for

$t_0 = 0.8 \in = 0.2, w_0 = 0.05$

In figures 1, 2,3,4,7,8 the graphs of Y_N *vs* t are presented for $g(t) = 0, 0.2\exp(-t)$ and $0.2\sin t$, with $1/P_L = 1000,$; $R = 1.1 R_L$, $R = 1.2R_L$, $R = 1.3 R_L$ These figures predict the dominating influence of the modulation of Y_N. It is found that for a given value of the parameters,

$Y_N(t)\big|_{g(t)=0} > Y_N(t)\big|_{g(t)=0.2\exp(-t)}$ In both the cases, Y_N increases initially and then reaches a constant maximum value (≈ 1.2). The graphs also reveal that the permeability of the medium has a significant effect on Y_N in the range $1 \le t \le 10$. For large t, the parameters R and $1/P_L$ have no influence on the profiles.

In the case of $g(t) = 0.2 \sin t$, the behaviour of the curves Y_N *vs* t is peculiar (figures 2,4,6,8) and the influence of $1/P_L$ is remarkable. The curves have peaks in the range $20 \le t \le 30$.

In figures 1,3,5,7 a comparison of the curves for $g(t) = 0, 0.2\exp(t)$ is made . As expected, the upper curve corresponds to $g(t) = 0$ and the two curves merge for $t \ge 10$ and attain a constant value.

Thus, the initial decrease of $Y_N(t)$ in the time-dependent case slows the growth of $Y_N(t)$ for all time. The nonlinearities are stabilizing if $(1-g(t))>0$ and $\gamma_2(t) > 0$ otherwise, destabilizing.

The figures reveal that by a proper choice of $g(t)$, P_L and R, it is possible to have a good control over the time-dependent convective phenomenon considered here.

AN IMPROVEMENT IN STOPPING FORCE OF LEVEL SETS FORIMAGE SEGMENTATION

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1.0 INTRODUCTION

Level set method is a geometric deformable model that has many applications in image segmentation. It is a numerical technique for computing the position of propagating fronts. The technique applies in the case of a front propagating normal to itself with a speed F that depends only on position and is always either positive or negative. The applications of such a technique include surface advancement in lithographic development and isotropic etching and deposition in the manufacturing of microelectronic structures. The use of these techniques is being explored in a variety of other applications including medical image segmentation in two- and three-dimensions, motion analysis, and image registration.

The idea behind active contours, or deformable models, for image segmentation is quite simple. The user specifies an initial guess for the contour, which is then moved by image driven forces to the boundaries of the desired objects. In such models, two types of forces are considered - the internal forces, defined within the curve, are designed to keep the model smooth during the deformation process, while the external forces, which are computed from the underlying image data, are defined to move the model toward an object boundary or other desired features within the image.

There are two forms of deformable models. In the parametric form, also referred to as snakes, an explicit parametric representation of the curve is used. This form is not only compact, but is robust to both image noise and boundary gaps as it constrains the extracted boundaries to be smooth. However, it can severely restrict the degree of topological adaptability of the model, especially if the deformation involves splitting or merging of parts. In contrast, the implicit deformable models, also called implicit active contours or level sets, are designed to handle topological changes naturally. However, unlike the parametric form, they are not robust to boundary gaps and suffer from several other deficiencies as well.

1.1 Overview of Level Sets (Implicit Active Contours)

Osher and Sethian introduced the implicit active contour, or level sets approach. The basic idea is to start with a closed curve in 2-dimensions (or a surface in 3- dimensions) and allow the curve to move perpendicular to itself at a prescribed speed. The numerical approximation technique is implemented, it relays on computing the evolution of all the level sets, not simply the zero level set corresponding to the front itself. As such, it is a computationally expensive technique, since an extra dimension has been added to the problem. However, it has the advantage of having a curvature term that reduces the speed at onset of small leakages.

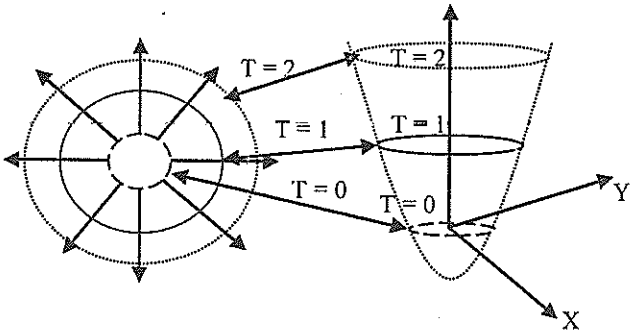


Fig.1: The Evolution of the Curve is Represented by the Level Set Function.

1.1.1 Evolution of Level Set Function

In order to illustrate the origins of this PDE, we next consider the evolution of the function ϕ as it evolves in a direction normal to itself with a known speed F. Here, the normal is oriented with respect to an outside and an inside. In 2-D level-set approach for shape modeling a 2-D curve γ is represented by a 3-D surface (Figure 1). The height of surface ϕ at each point is defined as the distance d, from the correspond-

ing image point x to 2D curve γ according to the equation (2)

$$\left\| \nabla T \right\| F = 1 \quad (1)$$

$$\phi(x, t=0) = \pm d \quad -(2)$$

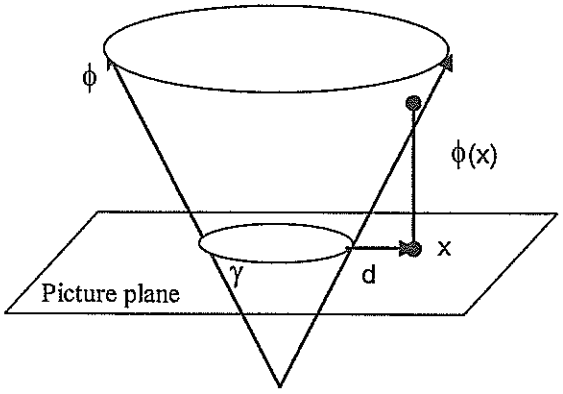


Fig.2: Level Sets algorithm illustration.

The sign in equation (2) determines whether the point lies outside or inside the 2D curve γ (t=0).
This way γ is represented by the zero level set $\gamma(t) = \{ x \in R^2 \mid \phi(x, t) = 0 \}$ of the 3D surface. The evolving front is zero level set (i.e. a contour with value zero) of this function ϕ.

The level set method then evolves the 3-D surface ϕ instead of the original 2-D curve γ. The motion of ϕ is described by partial differential equation (3)

$$\frac{\partial \phi(x,t)}{\partial t} + F|\nabla \phi| = 0 \quad (3)$$

$$i.e. \quad \phi_t + F|\nabla \phi| = 0 \quad (4)$$

$$\phi_y^{n+1} = \phi_y^n - \Delta t F \left| \Delta y \, \phi_y^n \right| \quad (5)$$

Equation (5) is an initial value partial differential equation in one higher dimension than the original problem.

1.1.1.1 Limitations of Existing Methods

Even though level sets have dominated several fields of imaging science, it suffers from some problems like initial placement of the contour and bleeding of boundary. If the initial contour is much closer to the first portion of the object boundary compared to the second portion, then the evolving contour crossed boundary. This is because the stop does not turn out to be zero.

1.2 Improvements Done to Overcome the Limitations

We have included three Improvements to overcome the limitations in earlier methods.

1.2.1 Improvement -1

One of the controlling factors for the stop function is the gradient of the image. The relationship of the stop function to the gradient is its inverse, and also depends upon the index power m in the relation $\frac{1}{1+\left|\nabla G_0 * I(x,y)\right|^m}$

For stopping the propagation, the denominator should be larger which means the words, if m is high, and then the gradient is high, which means the weak boundaries are not detected well and will be easily crossed over by the evolving curve. If m is low (low threshold), then the level set will stop at noisy or at isolated edges.
(In our project, we have tried for the value, m = 3, which is suitable for most of cases. The value, m = 2 caused still little amount of leakage. But m = 4 caused, the evolutions unable to reach the boundary.)

1.2.2 Improvement -2

The main characteristic of the level set is its ability to pick up the right topology of the shape we are segmenting. The accuracy of the segmentation process depends upon where and when the propagating hyper-surface needs to stop. Consider the special case of a surface moving with a speed V > 0. Let T be the time at which the surface crosses a given point. The function T then satisfies $|\nabla T| V = 1$. This equation simply says that the gradient of the arrival time is inversely proportional to the speed of the surface. If a propagating surface needs to stop close to the vicinity of the segmenting topological shape, then the speed of the surface should approximate closely to zero near the final segmenting shape. This means that the gradient values at the final shape boundary (in 2-D) or surface (in 3-D) should be very high (since the speed needed at the boundary is zero.) thus the accuracy of the segmentation process higher the gradient value, the faster is the propagation of curve/surface, which results in a strong clamping force. As a result, one has robust and accurate segmentation. Thus we see that the "stopping force" for the propagating surface is strongly dependent upon the gradient change of the final shape to be segmented.
The speed F depends on many factors including the local properties of the curve, such as the curvature, and the global properties, such as the shape and the position of the front. It can be used to control the front in several different ways. The original level set method proposed using F as the sum of two terms:
$F = F_0 + F_1(k)$
where F_0 is a constant propagation term and F_1 is a scalar function of the curvature k,

$$k = \text{div}\left(\frac{\nabla \phi}{\|\nabla \phi\|} \right)$$

The propagation term F_0, sometimes referred to the "balloon force", is independent of the geometry of the moving front and the front uniformly expands or contracts with speed F_0, depending on its sign. Note that the F_0 term is hyperbolic, while the F_1 term is parabolic. The key idea is to play one term against the other the hyperbolic term leads to the formation

of shocks from which a representation of the shape can be deduced, while the curvature term smooth the front, which enables us to distinguish the more significant shape features from the less significant ones.

Since we are using level sets for image segmentation, we want the zero-th level set to stop evolving at an edge in the image. This can be accomplished by multiplying the speed term by an image-dependent stopping factor g (x, y) given by the following equation:

$$g(x,y)=1/\left(1+\frac{\nabla I_{\pi}^{2}}{\lambda^{2}}\right) \qquad (6)$$

where Iπ is the image I convolved with a Gaussian defined as follows:

$$G\pi(x,y)= \frac{1}{2\pi\sigma^{2}}\exp\left(\frac{x^{2}+y^{2}}{2\sigma^{2}}\right) \qquad (7)$$

Equation (6) is the one used by Perona and Malik in their work on smoothing images using the diffusion equation. In the original work, this term was used to stop the diffusion process near an edge of an image. When used in the context of level set segmentation, it has the effect of reducing the propagation speed near an edge in the image where the gradient is high. By suitably changing the value of λ, we can control the strength of the edges that cause the speed to become zero near an edge. With this definition of the speed F, the level set equation can be written as,

$$\frac{\partial\phi}{\partial t}= g(x,y)\|\nabla\phi\|\left(div\left(\frac{\nabla\phi}{\|\nabla\phi\|}\right)+F_0\right) \qquad (8)$$

We have made further Improvement to the speed term, referring proposals by several authors. For example Yezzi et.al., observe that the stopping factor given by Equation (6) will not force the front to stop at edge unless it is exactly zero, a situation that rarely occurs in realistic images. They propose adding an additional term of form (∇g.∇ϕ) to the right hand side of Equation (8) resulting in the following equation of the level set:

$$\frac{\partial\phi}{\partial t}= g(x,y)\|\nabla\phi\|\left(div\left(\frac{\nabla\phi}{\|\nabla\phi\|}\right)+F_0\right)\pm(\nabla g.\nabla\phi) \qquad (9)$$

Since the edge can be defined as a step function, and ∇g involves two derivatives of the image, the term g acts as a "doublet" near an edge. It has the effect of attracting the evolving contour as it approaches an edge and then pushing the contour back out if it should pass the edge. This additional term is called the pullback term.

1.2.3 Improvement-3

But with above improvement, we observed the fronts to stop earlier than reaching edge. Hence we add one more extra multiplier - β to (∇g.∇ϕ) and controlled its value, so that the front should stop at the edge. The final modified equation of the level set is:

$$\frac{\partial\phi}{\partial t}g(x,y)=\|\nabla\phi\|\left(div\left(\frac{\nabla\phi}{\|\nabla\phi\|}\right)+F_0\right)\pm\beta(\nabla g.\nabla\phi) \qquad (10)$$

(It is verified that, the value of β =0.001 is found to work more appropriately for different kinds of images)

The level set equation (7) can be written as

$$\frac{\partial\phi}{\partial t}=g(x,y)\|\nabla\phi\|div\left(\frac{\nabla\phi}{\|\nabla\phi\|}\right)+F_0 g(x,y)\|\nabla\phi\|+\beta(\nabla g.\nabla\Phi) \qquad (11)$$

The first term on the right hand side is the curvature term and is the parabolic contribution to the equation. This is discretized using a second-order accurate central difference scheme described by Weickert. The second term is the hyperbolic propagation term and is discretized using the first-order accurate upwind differencing scheme given is Sethian. The third term is a pure advection term and is also discretized using a similar first-order accurate upwind differencing scheme.

1.3 Result

A MEDICAL X-RAY IMAGE OF A PATIENT

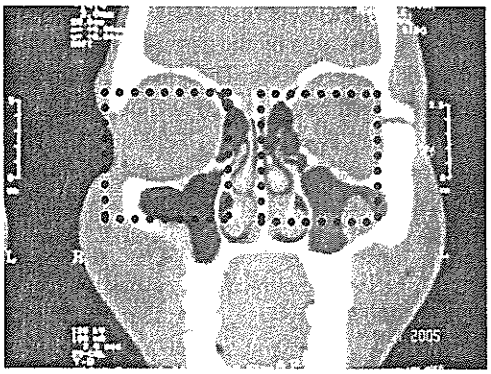
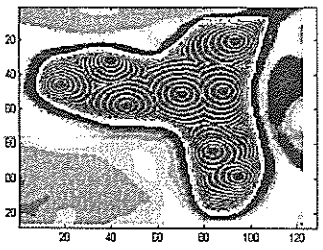
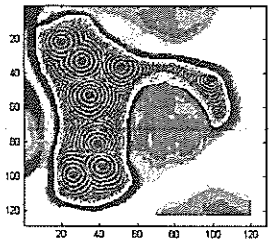


Fig.3: Test Case-1 (Given Image)



Area of object-1 =34717 Pixels

Fig.4: Test Case-1a (Result).



Area of object-2 = 17503 Pixels

Fig.5: Test Case-1b (Result)

2.0 CONCLUSION

This paper outlines a preliminary study of the use of the level sets for image segmentation. We observed that while the active contour approach is computationally expensive and requires the setting of several parameters , it generates closed contours,which can be very useful in separating the outer boundaries of an object from the background.

ACKNOWLEDGEMENT

I am very grateful to **Dr. B.S.Anami,** Head of Department, Computer Science and Engineering, B.V.V.S.Engg. College, Bagalkot whose timely help, valuable suggestions, moral support and discussions helped in channelising my efforts in the right direction. I express my sincere appreciation and deep sense of gratitude to **Prof. Sandeep.V.M.,** Head of Department, Information Science and Engineering, K.B.N. College of Engineering, Gulbarga, for his valuable guidance and he has made me to understand many new concepts

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APPLICATION OF REMOTE SENSING AND GEOGRAPHICAL INFORMATION TECHNICAL TOOLS IN GROUND WATER PROSPECTING.

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INTRODUCTION:

Water is a prime natural resource, forms the basis of all life. It is the key resource in all economic activities ranging from agriculture to industry. India accounts for 22% of global land and 6% of water resources but has to support 16% of world' population. With ever increasing pressure of human population, there is severe stress on water asset. In India per capita availability of water is 2.1(1000m^3). Normally man consumes 1.5 kg of food, 2.5liters of water and 15 kg of air per day. It is well understood that any developmental activity will have impact on environment, but to what extent degradation is tolerable for sustainable development is to be understood. The environmental impact is already visible. Land degradation, soil erosion, industrial pollution, water table declination, deforestation and loss of biodiversity are serious illustrations of environmental problems. Ecofriendly economic growth has emerged as a necessary and environmental resource such as air, water, minerals are no longer freer. The livelyhood of over 70% of our population depends on land, quarry and water based occupations. Hence, the conservation and sustainable management of land, water, forests, biodiversity and natural resources are essential for sustainable agriculutre and rural livelyhood security. It is not exaggerated to say that the ancient civilization has been originated on the banks of river. Still now several cities are located on the banks of water bodies.

In many places where lack of food threatens human survival reflects the lack of water that limits food production. Water plays key role in the development of earths's surface, moderating climate and diluting pollutants.Infact, without water life cannot exists. It is an essential raw material for photosynthesis of green plants which becomes food used by various living systems in all trophic levels. Atmospheric humidity which constitutes water is highly essential for all terrestrial life to protect from dehydration. Atmospheric water is the key factor in combination with tempertature in influencing the global ecology, and as a function of hydrological cycle covering 70% of land surface; it influences weather and global climate and flora and fauna. In view of the above it is significantly linked with social, economic, political and ecological intricacies.

INDIAN WATER STATUS:

Taking the global average, there is an adequate fresh water source to maintain nearly one more population doubling, given the present use of pattern. Indian water resources can accounts for about 2.5 % of those in the entire world on which 1.03 billion people constituting 16% of world population are dependent for domestic and non-domestic purposes. India accounts for 2.2% of the global land and 6% of world water resources. In India, average rainfall is about 105 cm. India receives 3 trillion m^3 of water. The total amount of water received is among the largest in the world. The country is rich in precipitation and surface water resources. In India, the average run-off of water in the river system is 1869 km^3 whereas its utilizable portion is about 690 km^3. India has about 630 cubic kilometers of surface water and 450 cubic kilometers of ground water. India has one of the lowest per capita availability of water. In spite of the huge potential water resources, India has very low per capita availability of drinking water, about 2.43 thousand cu.m. per annum. The annual per capita availability of water fell from 6008 cubic meters in 1947 to 2464 cubic meters in 1990 to 2266 cubic meters in 1997 (Pachuari and Sridharan 1998) and 1869 cubic meters in 2001 with great variation in water availability in different river basins. Even this amount of water is too often in the wrong places, at wrong time, and sometimes of wrong quality. Water consumption in India is rising rapidly, making waste water reclamation and recycling increasingly important to add to our fast depleting water resources. Wastewater can also be harvested

and reused in different ways to add to our fast depleting water resources. Reuse will not solve the whole problem of water shortage but will help relieve it to some extent. The consequent water borne infections accounts for 60% of the diseases of the entire country. Indian water mass accounts for 2.5% of World resource India has about 630 cubic kilometers of surface water and 450 cubic kilometers of ground water.

In India out of total rainfall in an area of 3290 lakh hectares, a rainfall of 4000 billion cubic meters annually occurs. Out of the total, 41% is lost as evaporation, 40% is lost as run off, 10 % is retained as soil moisture, 9% seeps in for recharging ground water. Of the 40% stream flow water, 8% is used for irrigation, 2% for domestic use, 4% for industry, and 12% for hydroelectric power generation. Out of the total water resource 1869bcm, the usable, water resources are only 1122 bcm, which consists surface water of 690bcm, groundwater 432bcm which the present per capita available water resources is 1122cm and by 2050 it is likely to reduce to 748 cm. When the countries per capita water availability is less than 1700 cm than it is considered to be as water stress country.

The projected water use pattern for India in 2006 for 1900 Mm^3 of annual water available is given table: 1.

Table: 1

Sector	Projected water use in %
Agriculture, including livestock and irrigation	79.6%
Domestic water supplies	3.5%
Industrial	3.2%
Power	13.7%
	100%

From Table: 1 it is evident that agriculture sector consumes 80% of water resource.

All the rivers in India are polluted with toxic items (including small and big) (Agarwal et al., 1999). The major source of water is the Krishna River.

WORLDWIDE SUPPLY, RENEWAL AND DISTRIBUTION:

Only a tiny fraction of the planet's abundant water is available to be fresh water. About 97% is found in the oceans and is too salty and unusable, irrigation or industry. The remaining 3% is fresh water. Of this 3% about 2.997% of it is locked up in the polar region in the form of ice caps or glaciers or is buried so deep that it costs too much to extract. Only about 0.0035% of Earth's total volume of water is available to us as soil moisture, exploitable groundwater, water vapor, and lakes& streams. The distribution pattern of Earth's water resources is shown in

Table: 2.

GROUND WATER RESOURCE:

Groundwater is the source of about 90% of country's domestic and drinking water supplies. In rural areas almost all of the water supply comes from groundwater only and more than one third of our 100 largest cities depend on it for at least part of their supply. Historically, groundwater has been considered to be safe to drink. However, of late groundwater becoming contaminated with industrial effulents discharged on land and septic systems, as well as illegal and uncontrolled hazardous waste sites. Once contaminated, ground water is difficult, if not impossible, to restore.

Some precipitaiton infiltrates into the ground and fills the pores in soil and rock. The sub-surface area where all available soil and rock pores spaces are filled by water and is called the Zone of saturation, and water in these pores is called groundwater. The water table is the upper surface of the zone of saturation; it is poorly deamarcated and fluctuating the dividing the line between saturated soil and rock (in whicch every available pore is full) and unsaturated (but still wet) rock and soil in which the pores can absorb more water. The water table falls in dry weather and rises in wet weather.

The total quantity of Earth's available groundwater is estimated to be more than 50 million cu.km. Of this, 4

Table: 2 Earth's Water Resources:

	Volume (In thousands of km+)	% Total water	Average residence time
Total	1,403377	100	2800
Ocean	1,370000	97.6	3000 years to 30,000 years
Ice and snow	29,000	2.07	1to 16,000
Groundwater down to 1Km	4000	0.28	From days to thousands of years
Lakes and reservoirs	125	0.009	1 to 100 years
Saline lakes	104	0.007	10 to 1000 years
Soil moisture	65	0.005	2 weeks to year
Biological mositure in plants and animals	65	0.004	1 week
Atmosphere	13	0.001	8 to 10 days
Swamps and marshes	1.7	0.0001	10 to 30 days
Rivers and streams	1.7	0.0001	10 to 30 days

million cu.km. are considered as a reasonable quality and quantity of fresh water could be exploited, which excludes water that will not drain from small pore spaces, saline water and water lying deep in confined aquifers.

The total groundwater reserves of the coutnry upto a depth of 300 metres are estimated to be at 3,700 million hectare metres (mham) and the usable groundwater is around 42 mham, per year. Out of this 27.37% is already exploited.

Depletion of groundwater sources due to the withdreawl of water at a rate far exceeding the natural recharge rare is currently a matter of global concern. The widespread use of groundwater for irrigation is also leading to marked fall in the water table of this renewable resource.The declining groundwater resource water table is alaraming in the states of Punjab, Haryana, Uttar Pradesh, Maharashtra, Andhra Pradesh and Karnataka in the wake of intensive irrigation through tube wells.

USE AND OVERDRAFT OF WATER RESOURCES;

The present golbal population of 6.185 billion is expected to rise 8.303 by the year 2025. Current water demand of about 6,650km^3 to produce plant food is expected to rise to 9000 km^3 by 2025. At present demand for water is growing by 2.4% per year. Total water use in the world has increased from 1000km^3 y^{-1} in 1940 increased to 4130 km^3 y^{-1} in 1990, 5000 km^3 y^{-1} in2000 increased to 6650 km^3 y^{-1} in2002 and 9000 km^3 y^{-1} in 2020 is projected.

Previous reports confirmed that, at least one fifth of the world's people lack access to safe drinking water. 80 countries accounts for 40% of world's population.

Forecasts are that by 2025 as much as 2/3 of the world's population will be affected by moderte to severe water scarcity unless appropriate mitigation measures are taken. At present, 28 countries with a population of 315 miilion suffering from water shortage, and 2025, this number will increase to 50 including India involving a population of 3 billion.The demand for domestic water supply is increasing fast continuously in per capita demand linked with more sewage disposal and transport, profile use of water using gadgets and increased recreational activities. Possible means of meetiong out of the impending water deficit problem include

* Reclamation of sewage and waste water.
* Development of groundwater sources and surface storage.
* Long range of fore casting of rain.
* Rain making.
* Rain water harvesting.
* Transfer of surplus water and
* Desalination of sea water.

The year 2003 was been declared as the International Year of Freshwater, underlining the urgent need to raise the awareness of the importance of protecting the Earth's freshwater resources.

There is tremendous increase in the Global Water usage in different sectorsd like agriculture, industry, and domestic. However, there is a considerable variety how these resources are used in different parts of World.

IMPORTANCE OF REMOTE SENSING AND INFORMATION TECHNOLOGY:

In rapidly expanding horizon of science and technology, Remote Sensing has become an important and effective toll for geological studies. Remote Sensing has 'widened' man's ability to detect significant earth features in spectral ranges beyond the normal visibility range. With the advent of Remote Sensing technology using temporal satellite data, it is now possible to quickly map mining area reliably using satellite data at regular intervals.

Remote sensing data (satellite/aerial) are being used to map/monitor/survey/manage various natural resources. The technique is being used to study landuse/cover, soil, geology, geomorphology, agriculture, forestry, water resources (both surfaceand sub-surface), urban areas, wastelands, coastal zone, glaciers, volcanoes, earthquakes, floods, drought, oceans etc.

This technology can also be used to assess environmental impact due to mining at different time period. Such observations have yielded useful, interesting and updated scientific information about earth's resources. Moreover monitoring of dynamic changes in mining activity in space and time over water bodies can be done conveniently and accurately by using temporal satellite images, which was not possible by conventional method. Satellite data forms an excellent source of information for understanding geological set up of the area. Now live in what often termed as "Information Age". Information superhighways are merging for rapid dissemination of new data and discoveries. Increased population needs food grain, land for shelter, and free air for breathing, good potable water for drinking and fertile arable land for production.

One of the first applications of remote sensing in water resources area is for surface water inventory. Presently remote sensing data is being used for number of applications viz. Irrigation water management, commond area surveys/monitoring/management, dam/reservoir assessment, canal alignment, snow melt Run off forecasting, Snow glacier studies, Surface water bodies mapping/monitoring, River/water body pollution assessment, Resevoir sedimentation/ siltation assessment and capacity evaluation, water quality mapping and monitoring etc.

Remote sensing data helps in delineating the potential groundwater occurrence zone with less time and cost effective manner than conventional methods. The thematic layers on geology, geomorphology, drainage, soil and land use generated from satellite data, are essential in identifying the ground water prospect zones. Remote sensing technology has been used for preparation of hydrogeomorphological maps of the entire country on 1: 250,000 scale using satellite images to provide sources of safe drinking water in problematic villages by delineating broad groundwater prospective zones for further follow-up through hydrogeological and geophysi-

cal methods.

METHODOLOGY;

Latest PAN IRS image of 5.8 meter resolution has been collected. Furhter LISS 3 satellite image of 5 metre resolution is collected for detailed studies. LISS 3 image is used for local studies. PAN+LISS merged data is used for regional studies.

Basic toposheet has been collected at first stage. Identification of pediments, planes, valley courses and stream flow areas have been done carefully. Each geomorphological feature have been traced out over tracing sheet and used as basis for further studies. Traced out features have been confirmed with ground truth and compared with satellite image. Both the features subjected to overlaping process. The sharp boundaries have been rectified and redefined with respect to satellite image. With the help of geomorphological guides' groundwater propsect map has been prepared to locate the prospective groundwater zones. Later on lineament map will be preapared to harness the probable groundwater resource. Vertical Electrical Sounding methods of survey have been conducted to locate the exact area of water occurences.

Groundwater Prospects:

RS based GW prospect zone map serves as a base for further exploration using hydro geological and geophysical methods to locate well sites.Studies have shown that if RS is used at first level to delineate prospective zones and further followed it up with hydro geological and geophysical surveys, higher success rate could be achieved besides savings in terms of cost, time and work.

Further RS helps in identifying suitable areas for recharging GW and assessing the possibility of GW pollution.

Remote Sensing is useful in drawing information on landforms, lithology, land use/land cover, soil, drainage and topography of the area for ground water propspecting.

GROUND WATER INVESTIGAIONS:

Remote sensing technologies have been applied to groundwater investigations with some success.

Aquifers: Permeable rock formations which store ground water and transmit sufficient quantity of it to a pumping well are called "Aquifers".

There are basically two types of aquifers;

1. Confined Aquifers
2. Unconfined Aquifers

There are two catagories of indicators for groundwater propsecting with Remote Sensing which are:

First-order indicators:

These are directly related to ground-water occurrence such as springs, canals, lakes, ponds, and other surface water features.

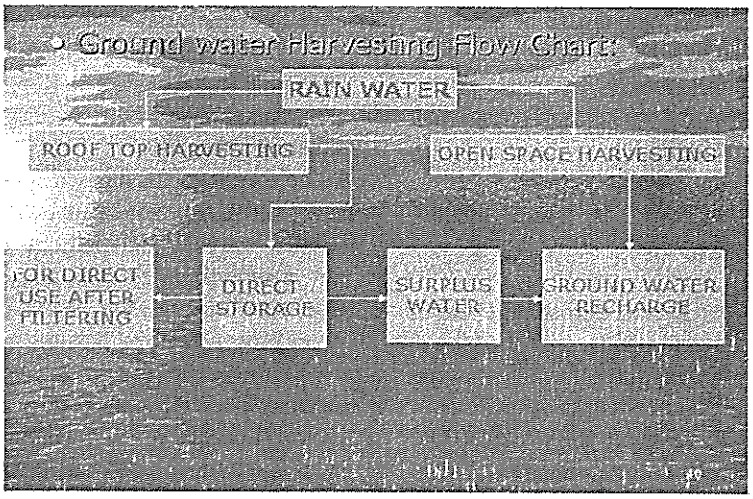
Second-order indicators:

These include hydrogeological parameters that may reflect the ground-water regime, such as drainage characteristics, fracture systems, geological structure, and landform characteristics.

NEED FOR ROOFTOP RAINWATER HARVESTING:

* To meet ever increasing demand for water.
* To develop ecological and financial sense not to waste a pure natural resource available in large quantity in one's roof.
* To encourage water conservation and self-dependence.
* To avoid purchase of water from tankers, this is of unreli able quality and is also expensive.
* To supplement domestic water requirement during drought, summer etc.
* To avoid flooding of roads.
* To augment the ground water storage and control decline of ground water levels.
* To solve water problems in areas having inadequate water resources.
* To reduce ground water pollution and improve the quality of ground water.
* To reduce soil erosion and runoff which chokes storm drains.

Ground water Harvesting Flow Chart:



CONCLUSION:

Integration of Remote Sensing, Geological, Structural, Morphological and Geophysical data has helped in locating potential water bearing zones.

Based on the study, an action plan for ground water development in the study area has been suggested like development of percolation / water retention ponds at the sites identified; bore wells along the lineament zones, utilisation of paleochannels for storing the flood water.

Thus the right combination of technology and traditional wisdom would be a winning combination, a plan that integrate - mega projects with micro efforts like rainwater harvesting and watershed management.

Thus in all fields RS plays a dominant role and effective tool for getting information.

It is just like –

"EYE IN THE SKY".....

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THE EFFECT OF GRAVITY MODULATION ON FINITE AMPLITUDE DOUBLE DIFFUSIVE CONVECTION

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1. Introduction :

The study of the phenomenon of convection has attracted a number of researchers owing to its very wide variety of applications for example, Heat and Mass transfer problems, Industrial and Astrophysical problems, Crystal growth, Biomechanical problems etc. Depending upon the constraint on the physical system, the governing parameters are attached to the system. For instance, in the present study thermal and solutal Rayleigh numbers, permeability parameter and Gravity modulation parameter appear. The aim of the present investigation is to predict the cumulative effect of the permeability of the medium and the modulation parameter on the finite amplitude motions in a double diffusive regime, where the medium is densely packed.

2. Mathematical Formulation of the Problem:

The physical model consists of a density packed fluid saturated layer confined between two horizontal plates of infinite horizontal extent, subject to the destabilizing temperature gradient and a stabilizing concentration gradient. The system is under gravity modulation and the boundaries are stress free.

The governing differential equations are:

The conservation of momentum

$$\frac{\partial \vec{q}}{\partial t} = -\frac{1}{\rho_m}\nabla p + g.G(\tau)(\alpha T - \beta S)\hat{k} - \vartheta\nabla^2 \vec{q} \qquad (1)$$

The conservation of heat

$$\frac{\partial T}{\partial t} + \left(\vec{q}.\nabla\right)T - W\frac{\Delta T}{d} = K\nabla^2 T \qquad (2)$$

The conservation of solute

$$\frac{\partial S}{\partial t} + \left(\vec{q}.\nabla\right)S - W\frac{\Delta S}{d} = K_s\nabla^2 S \qquad (3)$$

Where the equation of state is

$$\rho = \rho_m (1 - \alpha T + \beta S) \qquad (4)$$

Here,

$\vec{q} = (u, w)$ is the fluid velocity

t is the time,

ρ, ρ_m are the densities,

P, is the pressure

$\vec{g} = g + g(t) = g\left(1 + \frac{g(t)}{g}\right) = gG(\tau)$ is the gravity modulation a, â are the thermal and solute expansion coefficients, $\frac{L}{k}$ is the unit vector in the vertical direction, g is the kinematic viscosity, k is the permeability of the medium, T,S are the temperature and concentration $\Delta T \ \Delta S$ are the differences in temp and concentration K, Ks are the kinematic diffusivity coefficients.

Equations (1)-(3) are made dimensionless and the pressure is eliminated by cross – differentiating (1) and (2). The resulting equations are :

$$\left(\frac{1}{\sigma}\frac{\partial}{\partial t} - \nabla^2\psi\right)\nabla^2\psi = -R\frac{\partial T}{\partial x} + R_s\frac{\partial S}{\partial x} \qquad (5)$$

$$\left(\frac{\partial}{\partial t} - \nabla^2\right)T + \frac{\partial \Psi}{\partial x} = J(\psi, T) \qquad (6)$$

$$\left(\frac{\partial}{\partial t} - \tau\nabla^2\right)S + \frac{\partial \psi}{\partial x} = J(\psi, S) \qquad (7)$$

Where

$\vec{q} = \vec{q}' \frac{K}{d}, \ t = t^1 \frac{d^2}{K} \ (x, z) = d(x^1, z^1), \ T = T^1 \Delta T, S = S^1 \Delta S, p^1 = pd^2 / \rho_m \gamma K \ \Psi = K\Psi^1$ are the scales for velocity, time, space, temperature., concentration, pressure and stream function $u = \frac{\partial \Psi}{\partial z}$

$w = \frac{-\partial \Psi}{\partial x}$ J is the Jacobian : $J(f,g) = \frac{\partial f}{\partial x}\frac{\partial g}{\partial z} - \frac{\partial f}{\partial z}\frac{\partial g}{\partial x}$

The boundaries are assumed to be stress free:

$$\Psi = \frac{\partial^2 \Psi}{\partial z^2} = T = S = O \ @ z = 0, 1 \qquad .....(8)$$

The following are the Dimensionless parameters:

Ratio of diffusivities $\tau = \frac{K_s}{K}$

Prandtl number: $\sigma = \frac{\gamma}{K}$

Thermal Rayleigh number: $R^* = \frac{R}{G(\tau)} = \frac{\alpha g \Delta T d^3}{\gamma K}$

Solute Rayleigh number: $R_x^* = \frac{Rs}{G(\tau)} = \frac{\beta g \Delta s d^3}{\gamma K}$ (9)

3. Solution Procedure:

The physical variables Ψ T and S are expanded in terms of truncated Fourier series. Thus, let

$\Psi = A(t) \sin \pi\alpha x \ \text{Sin} \ \pi z$

$T = B(t) \text{Cos} \ \pi\alpha x \ \text{Sin} \ \pi z + C(t) \text{Sin} 2 \ \pi z$

$S = D(t) \text{Cos} \ \pi\alpha x \ \text{Sin} \pi z + E(t) \text{Sin} \ 2 \ \pi z \qquad (10)$

Where A, B, C, D and E are functions of time and α is the horizontal wave number of the cell. (α is determined through linear theory).

Substituting (10) into (9), we get the following equations for the amplitudes:

$$\frac{\pi^4}{\sigma}A^*(\alpha^2+1) + \pi^4(\alpha^2+1)A = -\pi\alpha R^* B + \pi\alpha Rs^* D \qquad (11)$$

$$B^* = -\pi^2(\alpha^2+1)B - \pi\alpha A - \pi^2\alpha AC \qquad (12)$$

$$C^* = -4\pi^2 C + \frac{1}{2}\pi^2\alpha AB \qquad (13)$$

$$D^* = -\tau\pi^2(\alpha^2+1)D - \pi\alpha A - \pi^2\alpha AE \qquad (14)$$

$$E^* = -\tau 4\pi^2 E + \frac{1}{2}\pi^2\alpha AD \qquad (15)$$

Setting the LHS to zero, we get

$$C = \frac{1}{8}\alpha AB \qquad (16)$$

$$E = \frac{1}{8\tau}\alpha AD \qquad (17)$$

Substituting (16) into (12) and (17) into (14)

$$B = -\frac{\pi\alpha A}{\pi^2\left(\alpha^2 + 1 + \frac{\alpha^2 A^2}{8}\right)} \qquad (18)$$

$$D = -\frac{\pi\alpha A\tau}{\pi^2\left\{\tau^2(\alpha^2+1) + \frac{\alpha^2 A^2}{8}\right\}} \qquad (19)$$

Now, substituting the values of B and D in (11), we get the following quadratic equation for $A^2/8$:

$$\left(\frac{A^2}{8}\right)^2 \left[\sigma\pi^4\alpha^4(\alpha^2+1)^2\right] + \frac{A^2}{8}\left[\sigma\pi^8\alpha^2(\alpha^2+1)^3(1+\tau^2)+\sigma\pi^4\alpha^4(\tau R_s^*+R^*)\right]$$

$$+ \sigma\left[\pi^8(\alpha^2+1)^4\tau+\pi^4\alpha^2(\tau R_s^*+\tau^2 R^*)(\alpha^2+1)\right] = 0 \qquad (20)$$

The discriminant equated to zero yields after some simplification the following expression for the Rayleigh number corresponding to finite amplitude motions :

$$R_f^* = \left[(\tau R_s^*)^{1/2} + \frac{(\delta^2)^{3/2}}{\pi\alpha}\sqrt{(1-\tau^2)}\right]^2 \text{ where } \delta^2 = \pi^2(\alpha^2+1) \qquad (21)$$

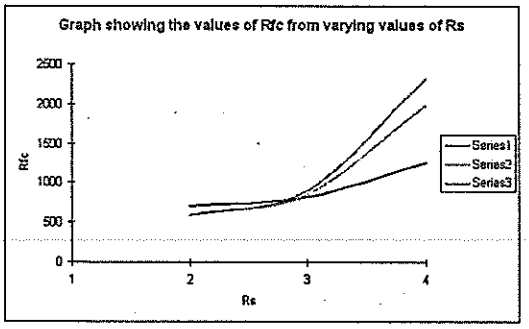
From (21), it is clear that for steady finite amplitude motions to occur, $\tau^2 < 1$ always. Equation (21) can be written as

$$R_f = \left[(\tau R_s)^{1/2} + \frac{\delta^3}{\pi\alpha}\sqrt{\frac{(1-\tau^2)}{G(\tau)}}\right]^2 \qquad (22)$$

As long as $\tau^2 < 1$ R_f is always positive for all values of the governing parameters a Suberitical motions do exist. Following the above procedure, the results are presented for the viscous case also.

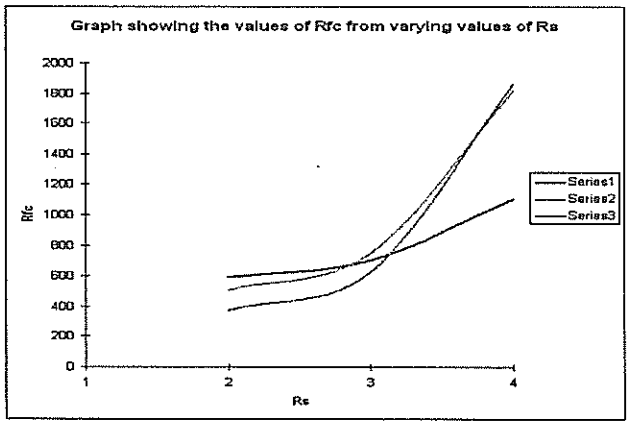
Rfc values For G(τ)=1

Rs Value	Series 1	Series 2	Series 3
10	705	599	589.5
100	824.26	859	899.4
1000	1253.8	1989.16	2311.7



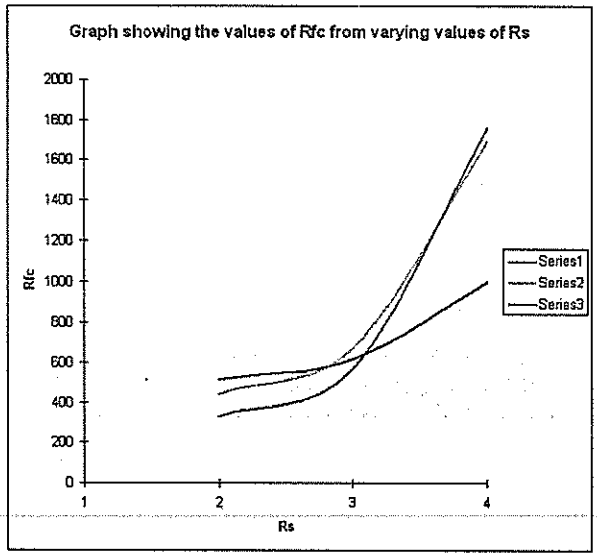
Rfc values For G(τ)=1.2

Rs Value	Series 1	Series 2	Series 3
10	589.90	506.57	374.85
100	699.60	747.59	629.11
1000	1108.10	1817.46	1863.90



Rfc values For G(τ)=1.4

Rs Value	Series 1	Series 2	Series 3
10	509.04	441.18	328.46
100	611.29	667.67	568.56
1000	996.16	1691.55	1758.57



4. Results and Discussion :

The results of the computation are presented through graphs. The influences of the different governing parameters on the double diffusive finite complitude motions in a modulated environment are studied in detail. The results are compared with those of unmodulated case and are found to be in excellent agreement. It is found that modulation enhances subesitical motions.

"A MATHEMATICAL MODEL FOR NONLINEAR BACTERIAL BIO-POROUS – CONVECTION (BPC) IN A GRAVITY MODULATED ENVIRONMENT"

Prof. Dr. P.K. SRIMANI & SUJATHA D. (Ph.D)
Bangalore University, Bangalore.

1. INTRODUCTION: World's major part constitutes bio-mass. Complex bio-convection patterns are observed when suspensions of some bacterial organisms like '***Bacillus subtilis***' is placed in a chamber with its upper face open to the atmosphere. The pattern formation depends on many factors; in particular on the tactic nature of the micro-organism. (Wager 1911; Pedley & Kessler 1992; et al 1994).

2. MATHEMATICAL MODEL:

The governing equations are :

the equation for cell conservation :

$$\frac{\partial N}{\partial T} = -\nabla.[NU + NV - D_N.\nabla N] - (1)$$

where the cell flux vector contains an advection term with the bulk fluid velocity and two terms describing cell swimming. The diffusive term (D_N. ∇N) describes the random aspects of cell swimming and V is the superimposed average swimming velocity.

The equation for oxygen conservation:

$$\frac{\partial C}{\partial T} = -\nabla(CU - Dc\nabla C) - KN - (2)$$

where the oxygen flux vector contains terms for advection and diffusion of oxygen (D_C : oxygen diffusivity) and K is the rate of oxygen consumption by the bacteria.

Assumption:

i. Suspension is sufficiently dilute.

ii. The time scale over which patterns form is very much smaller than the timescale for the bacterial reproduction.

iii. Contribution to D_N from Brownian motion is neglected.

iv. The effect of gyrotaxis (i.e. the orientation of the cells by viscous forces in a shear flow) is ignored.

Thus, the Navier – stokes equation under the Boussinesq approximation :

$$\rho_w\left[\frac{\partial U}{\partial T} + (U.\nabla)U\right] = -\nabla Pe + \nu\nabla(\rho_c - \rho_w)Ng + \mu\Delta U - \frac{\mu}{k}U - (3)$$

The conservation of mass :

$?.U = 0$ ——————————— (4)

where,

ρ_w, ρ_c : densities of water and cells
μ : the viscosity of the suspension
v : volume of one cell.
$P_e(x,t)$: the excess pressure above the hydrostatic.
g : $g + g(t) = g(1 + g(t)/g) = g\,.\,G(\Gamma)$
$G(\Gamma)$ = modulation parameter.

The governing equations in the dimensionless form:

$$\frac{\partial n}{\partial t} = \nabla[H(\theta)\nabla n - un - H(\theta)\gamma n\nabla\theta] - (5)$$

$$\frac{\partial \theta}{\partial t} = \nabla[\delta\nabla\theta - \theta u] - H(\theta)\delta\beta n - (6)$$

$$Sc^{-1}\left(\frac{\partial u}{\partial t} + (u.\nabla)u\right) = -\nabla p_e + \tau n\hat{z} + \Delta u - P_L u - (7)$$

$?.U = 0$ ——————————— (8)

THE SCALE USED :

$$n = \frac{N}{N_o}, z = \frac{z}{h}, t = \frac{D_{No}}{h^2}T,$$

$$\vec{u} = \frac{h}{D_{No}}U, p_e = \frac{h^2}{\mu D_{No}}P_e$$

$$\beta = \frac{K_o N_o h^2}{D_o(C_o - C_{min})}, \gamma = \frac{av_e}{D_{No}}, \delta = \frac{D_o}{D_{No}},$$

THE DIMENSIONLESS PARAMETERS ARE

$$\tau = \frac{v\alpha N_o g h^3}{vD_{No}}, SC = \frac{v}{D_{No}}, v = \frac{\mu}{\rho_w}, P_L = h^2/k$$

β : Strength of the oxygen consumption relative to its diffusion – Depth parameter,
γ : relative strengths of directional and random swim ming,
δ : ratio of oxygen diffusivity to cell diffusivity.
τ : Bio- Rayleigh number.
Sc : Schmidt number
P_L : Porous parameter
h : depth of the chamber,
N_o : initial cell concentration
z = measured downwards, (z=1 (bottom), z=0 free surface, top, planar)
α = $(\rho_c - \rho_w)/_w$

BOUNDARY CONDITIONS:

(i) Bottom surface (Z=1) : no slip condition, upper surface (Z=0): stress free surface.

(ii) Zero vertical components of velocity at the boundaries.

(iii) Zero cell flux at the boundaries.

(iv) Zero Oxygen thus at the bottom and $C=C_0$ at the free surface.

At $z = 0$

$$u.\hat{z} = 0, \frac{\partial^2}{\partial z^2}(u.\hat{z}) = 0, \theta = 1;$$

$$H(\theta)\frac{\partial n}{\partial z} - \gamma n H(\theta)\frac{\partial \theta}{\partial z} = 0;$$

At $z = 1$,

$$u.\hat{z} = 0, u \times \hat{z} = 0, \frac{\partial \theta}{\partial z} = 0, \frac{\partial n}{\partial z} = 0$$

Integrating (5) over a volume v, gives

$$\int_v n\,dx = const. = 1 \quad (9)$$

which represents conservation of cells

1. STEADY STATE SOLUTION AND LINEAR STABILITY ANALYSIS.

It is important to note that, in the steady state, diffusion of cells (random cell swimming) balances chemotaxis (i.e., swimming up the oxygen gradient), while oxygen diffusion is balanced by oxygen consumption.

Two Cases:

(i) Shallow Chamber: The oxygen concentration is greater than C_{min} (i.e., q >0) throughout the suspension. In other words, all the cells are actively swimming and consuming oxygen.

(ii) Deep layer: The oxygen concentration below a certain depth falls to C_{min} (i.e.q =0) and the bacteria, in this lower oxygen – depleted region become inactive and cease to swim or consume oxygen.

Closed form solution exists (for steady state) for the shallow layer case:

$$\theta_0 = 1 - \frac{2}{\gamma} ln\left\{\frac{Cos(A/2(1-z))}{Cos(A/2)}\right\} \quad (10)$$

$$no = \frac{A^2}{2\beta\gamma} \sec^2(A/2(1-z)) \quad (11)$$

Where $\tan(A/2) = \frac{\beta\gamma}{A}$

$\theta_0 > 0$ for all $z < \frac{1}{2}$ and the chamber is shallow if

$$\beta \le \frac{2}{\gamma}\phi \arctan\phi \quad (12)$$

Where $\phi = (e^{\gamma} - 1)^{1/2}$

Weakly nonlinear analysis ($k_c \neq 0$)

From the weakly nonlinear analysis, we predict three types of patterns formed near the critical (viz., Rolls, Squares and Hexagons).

The variables are expanded in terms of a small parameter $\in$ (which measures the departure of τ from the critical τ_c). Solvability condition is derived at each order (which describes the solution of the amplitude of the pattern).

Consider

$$\tau = \tau_c + \in \tau_1$$

$$u = \in u_1 + \in^2 u_2 + \ldots.$$

$$n = n_0 + \in n_1 + \in^2 n_2 + \ldots.$$

$$\theta = \theta_0 + \in \theta_1 + \in^2 \theta_2 + \ldots..(13)$$

$$p = p_e + \in p_1 + \in^2 p_2 + \ldots.$$

$$\tau = \in t$$

In general (following Hillesdon & pedley 1996), we consider $n_1 = N(z) f(x,y)$ $\theta_1 = C(z) f(x,y)$, $W_1 = W(z) f(x,y)$ On a hexagonal lattice, the horizontal planform function f(x,y) is

$$f(x,y) = \mathrm{Re}(A_1(\tau)e^{iky} + A_2(\tau)e^{-1/2\sqrt{3}ikx - 1/2iky} + A_3(\tau)e^{1/2\sqrt{3}ikx - 1/2iky});$$

and for Rolls : $A_1 = A, A_2 = A_3 = 0$ and for hexagons $A_1 = A_2 = A_3 = A$ These are substituted in the governing equations and the corresponding boundary conditions are also considered

Equation for O(∈):

$$\frac{\partial n_1}{\partial t} = \nabla\left[H(\theta)\nabla n_1 - u_1 n_0 - H(\theta)\gamma(n_0\nabla\theta_1 - n_1\nabla\theta_0\right] - (14)$$

$$\frac{\partial\theta_1}{\partial t} = \nabla\left[\delta\nabla\theta_1 - \theta_0 u_1\right] - H(\theta)\delta\beta n_1 - (15)$$

$$Sc^{-1} = -\nabla p_1 + (\tau_c n_1 + \tau_1 n_0)\hat{z} + \Delta u_1 - P_L u_1 - (16)$$

$$\nabla . u_1 = 0 \quad (17)$$

RESULTS:

The mathematical details are not presented here because they are very lengthy. It s observed that at the bifurcation point (Common node) both rolls & hexagons coincide. Bifurcation starts at O ($\in^2$). Some of the results are presented here for the limiting case of small P_L. Results are in excellent agreement with those of Hillesdon & Pedley (1996). It is found that gravity modulation has its dominating influence in the behavior of the system. The work is in progress.

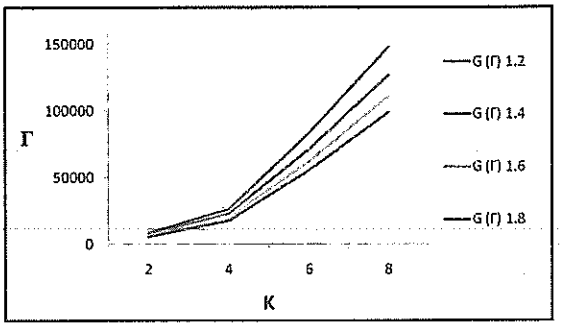


Fig. 1 : δ=1, γβ=0.05. The τ(k) curve.

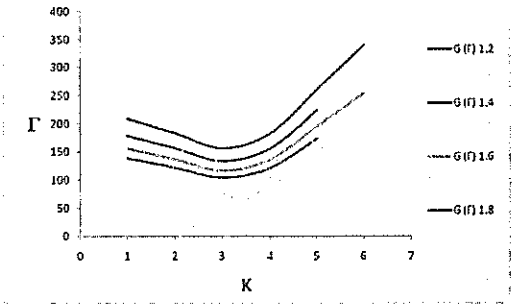


Fig. 2

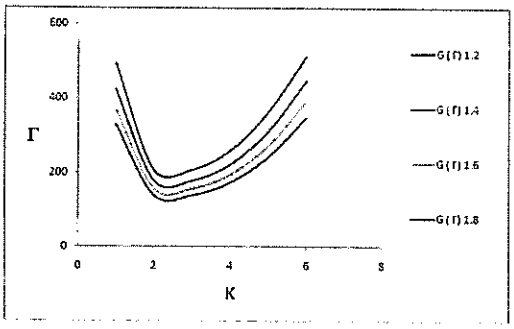


Fig. 3

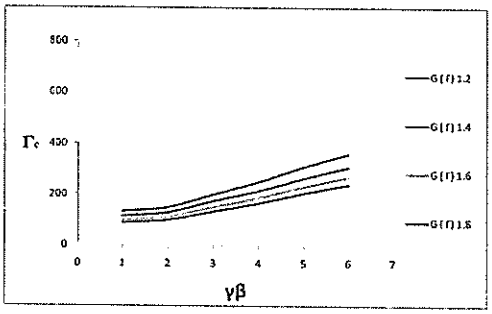


Fig. 6

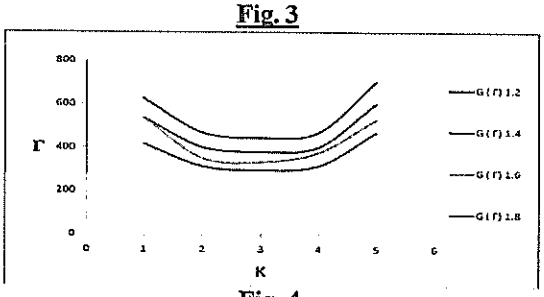


Fig. 4

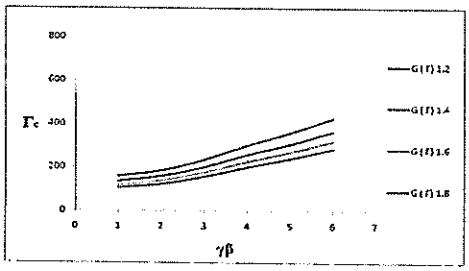


Fig. 7

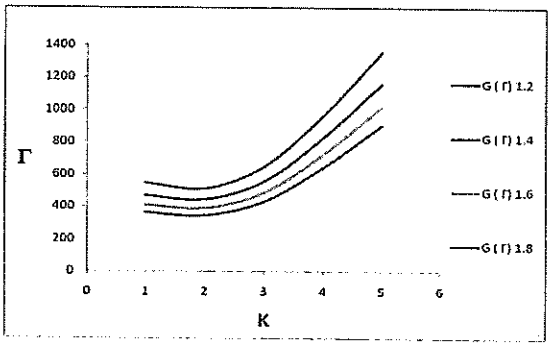


Fig. 5

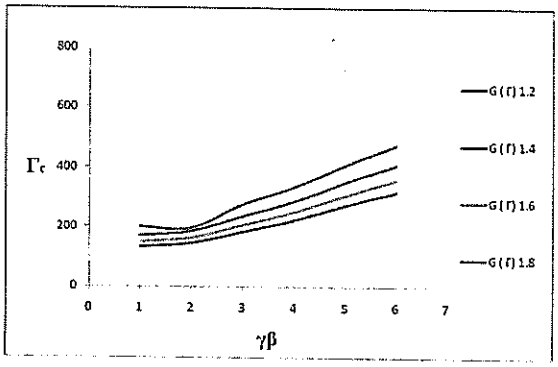


Fig.8

A MATHEMATICAL MODEL FOR FINITE AMPLITUDE DOUBLE DIFFUSIVE PORUS CONVECTION IN MODULATED ENVIRONMENT

Prof.DR.PK.SRIMANI & Smt G.S.MYTRA
Bangalore

Introduction

The study of the phenomena of convection has not attached a number of researchers owing to its very wide variety of applications. For example, Heat and Mass transfer problems, Industrial and Astrophysical problems, Crystal growth, Biomechanical problems etc. Depending upon the constrain on physical system, the governing parameter are attached to the system. For instance, in the present study, thermal and Solutal Rayleigh numbers, Permeability parameter and Gravity modulation parameter appear. The aim of the present investigation is to predict the cumulative effect of the permeability of the medium and the modulation parameter on the finite amplitude motions in a double-diffusive regime where the medium is densely packed.

Mathematical Formulation of the problem

The physical model consists of a *densely packed fluid saturated porous layer* confined between two horizontal plates of infinite horizontal extent, subject to the *destabilizing temperature gradient* and a *stabilizing concentration gradient*. The system is under *gravity modulation* and the boundaries are *stress free.*

The governing differential equations are:

The conservation of momentum

$$\frac{\partial \vec{q}}{\partial t} = -\frac{1}{\rho m}\nabla p + g.G(\alpha T - \beta s)\hat{k} - \frac{\gamma}{k}\vec{q} \qquad (1)$$

The conservation of heat

$$\frac{\partial T}{\partial t} = (\vec{q}.\nabla)T - W\frac{\Delta T}{d} = K\nabla^2 T \qquad (2)$$

The conservation of solute

$$\frac{\partial s}{\partial t}+(\underset{q}{\rho}.\nabla)s-W\frac{\Delta s}{d}=K_s\nabla^2 s \qquad (3)$$

Where the equation of state is

$$\rho=\rho_m(1-\alpha T+\beta s) \qquad (4)$$

Here,

$\underset{q}{\rho}=(u,w)$ is the fluid velocity

T is the time,

ρ ρ_m are the densities

P is the pressure

$\underset{g}{\rho}=g+g(t)=g\left(1+\frac{g(t)}{g}\right)=gG(\tau)$ is the gravity modulation

α,β are the thermal and solute expansion coefficients

$\hat{k}$ is the unit vector in the vertical direction,

γ is the kinematic viscosity,

k, is the permeability of the medium,

T,S are the temperature and concentration

$\Delta T,\Delta s$ are the differences in temperature and concentration

K,K_s are the kinematic diffusivity coefficients

Equation (1)-(3) are made dimensionless and the pressure is eliminated by cross-differentiating (1) and (2).

The resulting equations are:

$$\left(\frac{1}{\sigma}\frac{\partial}{\partial t}+\frac{1}{P_l}\right)\nabla^2\psi=-R\frac{\partial T}{\partial x}+R_s\frac{\partial s}{\partial x} \qquad (5)$$

$$\left(\frac{\partial}{\partial l}-\nabla^2\right)T+\frac{\partial\psi}{\partial x}=J(\psi,T) \qquad (6)$$

$$\left(\frac{\partial}{\partial t}-\tau\nabla^2\right)s+\frac{\partial\psi}{\partial x}=J(\psi,s) \qquad (7)$$

where

$$\underset{q}{\rho}=\underset{q}{\rho}'\frac{k}{d} \quad t=t'\frac{d^2}{k}\ ,(x,z)=d(x',z')$$

$$p'=\frac{pd^2}{\rho_m\gamma k}$$

$T'\Delta T$ $s=s'\Delta s$ $\psi=k\psi'$

are the scales for velocity, time, Apace, temp, concentration, pressure and stream function

$$u=\frac{\partial\psi}{\partial z} \qquad -\frac{\partial\psi}{\partial x} \qquad (8)$$

J is the Jacobian:

$$J(f,g)=\frac{\partial f}{\partial x}\frac{\partial g}{\partial z}-\frac{\partial f}{\partial z}\frac{\partial g}{\partial x}$$

The boundaries are assumed to be stress free

$$\psi=\frac{\partial^2\psi}{\partial z^2}=T=s=0 \quad @\ z=0,1 \qquad \text{——————(9a)}$$

The following are the dimensionless parameters

Ratio of diffusivities :

Prandtl number : $\tau=\frac{k_s}{k}$

Thermal Rayleigh number $R_s{}^*=\frac{R}{G(\tau)}=\frac{\alpha g\Delta T d^3}{\gamma k}$

Solnte Rayleigh number $R_s{}^*=\frac{R}{G(\tau)}=\frac{\beta g\Delta T d^3}{\gamma k}$

Permeability Parameter $P_L=\frac{d^2}{k}=\frac{1}{p_l}$ ——————(9b)

The physical variables ,T and S are expanded in terms of truncated Fourier series. Thus, let

ψ =A(t) sin ($\Pi\alpha$x)sin(α z)

T=B(t) cos($\Pi\alpha$x)sin(Πz) +C(t) sin(2Πz)

S=D(t) cos($\Pi\alpha$x) sin(Πz) +E(t) sin(2Πz) (10)

Where A,B,C,D and e are functions of time and is the horizontal wave number of the cell (is determined through linear theory)

Substituting (10) into (9) , we get the following

Equations for the amplitudes :

$$-\frac{1}{\sigma}A^*\Pi^2(\alpha^2+1)-P_L\Pi^2(\alpha^2+1)A=\Pi\alpha R^*B-\Pi\alpha R^*{}_sD \qquad (11)$$

$$B^*=-\Pi^2(\alpha^2+1)B-\Pi\alpha A-\Pi^2\alpha AC \qquad (12)$$

$$C^*=-4\Pi^2C+\frac{1}{2}\Pi^2\alpha AB \qquad (13)$$

$$D^*=-\tau\Pi^2(\alpha^2+1)D-\Pi\alpha A-\Pi^2\alpha AE \qquad (14)$$

$$E^*=-4\Pi^2E+\frac{1}{2}\Pi^2\alpha AD \qquad (15)$$

Setting the LHS to zero , we get

$$C=\frac{1}{8}\alpha AB \qquad (16)$$

$$E=\frac{1}{8\tau}\alpha AD \qquad (17)$$

Substituting (16) into (12) and (17) into (14) :

$$B=-\frac{\Pi\alpha A}{\Pi^2\left(\alpha^2+1+\frac{\alpha^2A^2}{8}\right)} \qquad (18)$$

$$D=-\frac{\Pi\alpha\tau A}{\Pi^2\left\{\tau^2(\alpha^2+1)+\frac{\alpha^2A^2}{8}\right\}} \qquad (19)$$

Now substituting the values of B and D in (11)

We get the quadratic equations

Equations for $A^2/8$:

$$\left(A^2/8\right)^2\left[\sigma P_L \Pi^2 \alpha^4\left(\alpha^2+1\right)\right]+\left(A^2/8\right)\left[\sigma P_L \Pi^2 \alpha^2\right.$$
$$\left.\left(\alpha^2+1\right)\left(1+\tau^2\right)+\sigma\alpha^4\left(\tau R_s^* - R^*\right)\right]+$$
$$\sigma\left(\alpha^2+1\right)\left[\Pi^2\left(\alpha^2+1\right)\tau^2 P_L+\alpha^2\left(\tau R_s^* - \tau^2 R^*\right)\right]=0 \quad (20)$$

The discriminant equated to zero yields after some simplification the following expression for the Rayleigh number corresponding to finite amplitude motions:

$$R_f^* = \left[\left(\tau R_s^*\right)^{1/2}+\frac{\delta^2}{\Pi\alpha}\sqrt{P_L\left(1-\tau^2\right)}\right]^2 \quad (21)$$

where $R_f^* = R_f^* G(\tau)\ \delta^2 = \Pi^2\left(\alpha^2+1\right)$

From (21), if it is very clear that for steady finite amplitude motion to occur, $\tau^2 < 1$ always. Equation (21) can be written as :

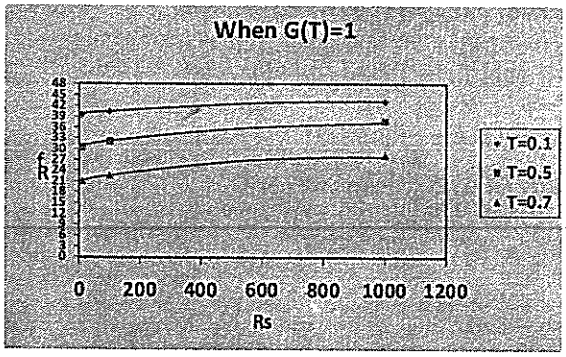
$$R_f = \left[\left(\tau R_s\right)^{1/2}+\frac{\delta^2}{\Pi\alpha}\sqrt{\frac{P_L\left(1-\tau^2\right)}{G(\tau)}}\right]^2 \quad (22)$$

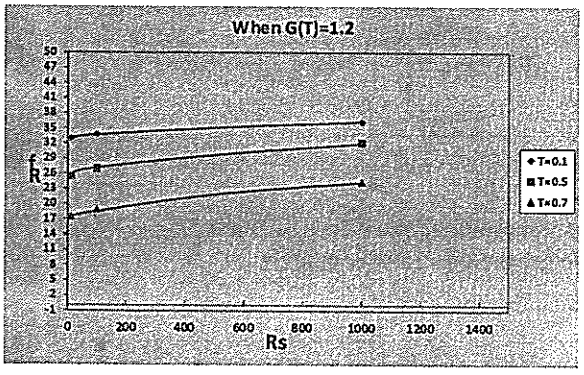
As long as $\tau^2 < 1, R_f$ is always positive for all values of the governing parameters and subcritical motions do exist.

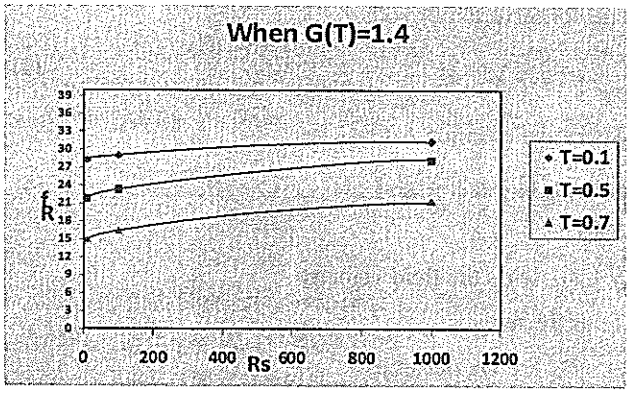
4. Results and Discussions

The results of the computation are presented through graphs. The influences of the double diffusive finite amplitude motions in a modulated environment are studied in detail. The results are compared with those of modulated cases and are found to be in excellent agreement. It is found that modulation enhances subcritical motions.

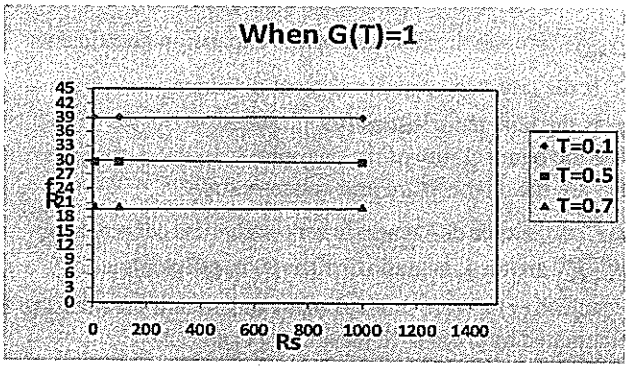
THE FOLOWING GRAPH IS: $WHEN\left(\frac{1}{P_L}\right)=10^3$

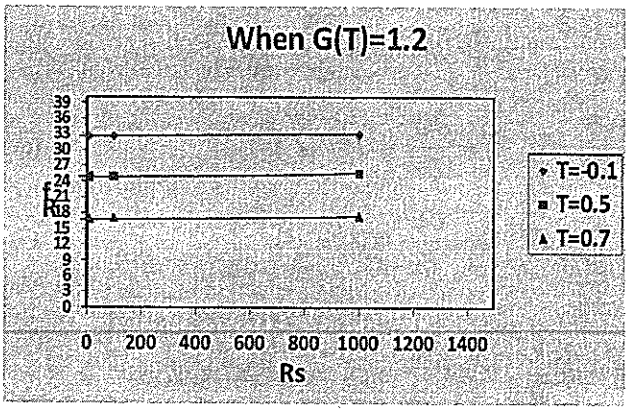


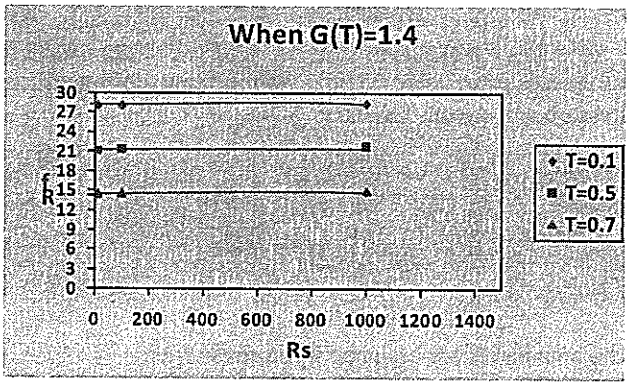




THE FOLOWING GRAPH IS $WHEN\left(\frac{1}{P_L}\right)=10^5$







THE ONSET OF BIOCONVECTION IN A MODULATED ENVIRONMENT IN A SUSPENSION OF GYROTACTIC MICRO ORGANISMS IN A FLUID LAYER OF FINITE DEPTH SUBJECT AN ADVERSE TEMPERATURE GRADIENT

Prof. Dr. P.K. Srimani & M.C. Roopa (Ph.D.),
Bangalore.

1. Introduction.

Bioconvection is a new area of fluid mechanics and it describes the phenomenon of spontaneous pattern formation in suspension of micro-organisms like Bacillus subtilis and algae (pedley and kesler 1987,1992). The term "bioconvection" refers to macroscopic convection induced in water by the collective motin of a large number of self propelled motile micro-organisms. To the best of authors knowledge the effect of gravity modulation on the interaction of bioconvection and natural convection has not been studied earlier. The direction of swimming micro-organisms is dictated by the different tactic nature of the micro-organisms. They may be gyrotactic, phototactic, chemotactic, ect. The present study deals with the linear stability analysis of a suspension of gyrotactic micro-organisms in a horizontal fluid layer of finite depth subject to adverse temperature gradient and gravity modulation.

The present study has several geophysical applications. For example, this problem is relevant to certain species of thermophilic micro-organisms that live in hot environment.

2. Mathematical Model:

Under the following major assumptions viz. (i) heating from below is sufficiently weak so that the micro-organisms will not be killed and they retain their gyrotactic nature (ii) due to the small flow velocity associated the phenomenon, the inertia terms in the Navier-Stoke's equations are neglected and (iii) the system is subject to gravity modulation (i.e. the gravity term includes a fluctuation part in addition to the constant part), the governing eqations are :

$$\rho_w \frac{\partial u}{\partial t} = -\frac{\partial p}{\partial x} + \mu\left(\frac{\partial^2 u}{\partial x^2} + \frac{\partial^2 u}{\partial y^2} + \frac{\partial^2 u}{\partial z^2}\right) \quad (1)$$

$$\rho_w \frac{\partial v}{\partial t} = -\frac{\partial p}{\partial y} + \mu\left(\frac{\partial^2 v}{\partial x^2} + \frac{\partial^2 v}{\partial y^2} + \frac{\partial^2 v}{\partial z^2}\right) \quad (2)$$

$$\rho_w \frac{\partial w}{\partial t} = \frac{\partial p}{\partial y} + \mu\left(\frac{\partial^2 w}{\partial x^2} + \frac{\partial^2 w}{\partial y^2} + \frac{\partial^2 w}{\partial z^2}\right) - n\theta\Delta\rho g + \rho_w g\beta(T - T_o) \quad (3)$$

$$\frac{\partial u}{\partial x} + \frac{\partial v}{\partial y} + \frac{\partial w}{\partial z} = 0 \quad (4)$$

$$c_{p^*w}\left[\frac{\partial T}{\partial t}\right] + u\left[\frac{\partial T}{\partial x}\right] + v\left[\frac{\partial T}{\partial y}\right] + w\left[\frac{\partial T}{\partial z}\right] = K\left[\frac{\partial^2 T}{\partial x^2} + \frac{\partial^2 T}{\partial y^2} + \frac{\partial^2 T}{\partial z^2}\right] \quad (5)$$

$$\frac{\partial n}{\partial t} = -div(j) \quad (6)$$

Where

$$j = nv + n W_c \hat{P} - D\nabla n \quad (7)$$

ρ_w the density of water

$\vec{v} = (u, v, w)$ the fluid convection velocity vector

t : the time

p : the excess pressure above the hydrostatic

$\hat{P}$ the unit vector in the direction of swimming of micro-organism

(x,y,z) :Cartesian co-ordinates (space variables)

μ the dynamic viscosity of the suspension

$W_c \hat{P}$ the vector of average swimming velocity relative to the fluid (Wc = constant)

β the volume expansion coefficient of water at constant pressure

$\Delta\rho$: $\rho_{\text{cell}} - \rho_w$ (the density difference)

j : the flux of micro-organisms due to microscopic convection of the fluid, self propelled swimming of micro-organisms and the diffusion of micro-organisms (further, it is assumed that all random motions of micro-organisms can be approximated by a diffusive process)

Cp the specific heat of water

D : the diffusivity of micro-organisms

Pg=g_o +g (t) the gravitational acceleration

$g_o G(*); [G(*) \hat{T} (1 \hat{G} g(t)/g_o)]$

k : the conductivity of water

n : the number density of motile organisms

Boundary Conditons

A horizontal fluid layer of depth H is considered. cartisian axes with the z-axis vertical are utilized, so that the layer is confined between z=0 and z=H. It is assumed that the layer is unbounded in the x and y directions.

At the bottom of the layer (assumed to be rigid), the following conditions are satisfied.

At z=0:u=v=w=0, T= $T_o + \Delta T$, $j.\hat{k} = 0$ (8)

Where $\hat{k}$ is the vertically upward unit vector.

The upper surface of the layer is assumed rigid as well because, according to Hill et.al. [2], even if it is open to the air, micro-organisms tend to collect at the surface forming what appears to be a packed layer, and it is unlikely that the upper boundary is ever fully stress free. Under this assumption that, the boundary conditions at upper surface of the layer are,

At z=H:u=v=w=0, T= T_o , $j.\hat{k} = 0$ (9)

3. Solution Procedure

Basic state

In the basic state the equation of continuity admits a steady state solution where the fluid is motionless and n_b the number density of the micro-organisms in the basic state, p_b the pressure in the basic state and T_b the temperature in the basic state, are functions of z only.

In this case equations (6) and (7) reduce to

$$n_b W_c = D\frac{\partial n_b}{\partial z} \tag{10}$$

The solution of this equation is

$$n_b(z) = \nu \exp\left(\frac{W_c z}{D}\right) \tag{11}$$

The integration constant ν, which represents the value of the basic number density at the bottom of the layer, is related to the average concentration

$$\bar{n} = \frac{1}{H}\int_0^H n_b(z)dz = \frac{\nu}{H}\int_0^H \exp\left(\frac{W_c z}{D}\right)dz \tag{12}$$

and so is given by,

$$\nu = \frac{\bar{n}Q}{\exp(Q)-1} \tag{13}$$

where the bioconvection Peclet number Q is defined by

$$Q = \frac{W_c H}{D} \tag{14}$$

From equations (5), (8), (9), the temperature distribution in the basic state is from (5)

$$C_p\rho_w(0) = K\left(\frac{\partial^2 T}{\partial z^2}\right)$$

$$K\left(\frac{\partial^2 T}{\partial z^2}\right) = 0$$

$$\left(\frac{\partial^2 T}{\partial z^2}\right) = 0$$

Integrating, $\frac{\partial T}{\partial z} = A$

Integrating again, T=Az+B

In the basic state at z=0, $T_0 + \Delta T = Az + B = 0 + B$

at z=H, $T_e = AH + B$

then $\Delta T = -AH i.e. A = -\frac{\Delta T}{H}$

and $B = T_0 + \Delta T$

$$T_b = -\frac{\Delta T}{H}Z + T_0 + \Delta T \tag{15}$$

From (3) the pressure distribution in the basic state is found from integrating the following equation

$$\frac{\partial p}{\partial z} = -\nu\theta\Delta\rho g \exp\left(\frac{W_c z}{D}\right) + \rho_w g\beta\Delta T\left(1 - \frac{z}{H}\right) \tag{16}$$

Assuming that $p = p_0$ at z=H, the pressure distribution in the basic state is Integrating (16) w.r.t z,

$$P = -\nu\theta\Delta\rho g \exp\left(\frac{W_c z}{D}\right)\frac{D}{w_c} + \rho_w g\beta\Delta T\left(z - \frac{z^2}{2H}\right) + C_1 (*)$$

When z=H, p=p_o

$$p_0 + \nu\theta\Delta\rho g \exp\left(\frac{W_c z}{D}\right)\frac{D}{w_c} - \rho_w g\beta\Delta T\left(H - \frac{H^2}{2H}\right) = C_1$$

From (*) $p_b - p_0 = \nu\theta\Delta\rho g\frac{D}{w_c}\left[\exp - \exp wc\frac{z}{D}\right] -$

$$\rho_w g\beta\Delta T\left[H - z - \frac{1}{2H}\left(H^2 - z^2\right)\right] \tag{17}$$

Linear stability analysis

The perturbations are introduced as follows:

$$n(t,x,y,z) = n_b(z) + \varepsilon n^*(t,x,y,z) \tag{18}$$

$$v(t,x,y,z) = \varepsilon v^*(t,x,y,z)$$

$$p(t,x,y,z) = p_b(z) + \varepsilon p^*(t,x,y,z)$$

$$T(t,x,y,z) = T_b(z) + \varepsilon T^*(t,x,y,z)$$

$$\hat{p}(t,x,y,z) = \hat{k} + \varepsilon\hat{p}^*(t,x,y,z) \quad (19),(20),(21)\text{and}(22)$$

Where * denotes a perturbation quantity and ε is the small perturbation amplitude. Substituting equations (18)-(22) into equations (1)-(7) and linearizing results in the following equations for perturbations

$$\rho_w\frac{\partial u^*}{\partial t} = -\frac{\partial p^*}{\partial x} + \mu\left(\frac{\partial^2 u^*}{\partial x^2} + \frac{\partial^2 u^*}{\partial y^2} + \frac{\partial^2 u^*}{\partial z^2}\right) \tag{23}$$

$$\rho_w - \frac{\partial u^*}{\partial t} = -\frac{\partial p^*}{\partial x} + \mu\left(\frac{\partial^2 v^*}{\partial x^2} + \frac{\partial^2 v^*}{\partial y^2} + \frac{\partial^2 v^*}{\partial z^2}\right) \tag{24}$$

$$\rho_w\frac{\partial w^*}{\partial t} = -\frac{\partial p^*}{\partial z} + \mu\left(\frac{\partial^2 w^*}{\partial x^2} + \frac{\partial^2 w^*}{\partial y^2} + \frac{\partial^2 w^*}{\partial z^2}\right) -$$

$$- n^*\theta\Delta\rho g + \rho_w g\beta T^* \tag{25}$$

$$\left(\frac{\partial^2 v^*}{\partial x^2} + \frac{\partial^2 v^*}{\partial y^2} + \frac{\partial^2 v^*}{\partial z^2}\right) = 0 \tag{26}$$

$$c_p\rho_w\left(\frac{\partial T^*}{\partial t} - w^*\frac{\Delta T}{H}\right) = k\left(\frac{\partial^2 T^*}{\partial x^2} + \frac{\partial^2 T^*}{\partial y^2} + \frac{\partial^2 T^*}{\partial z^2}\right) \tag{27}$$

$$\frac{\partial n^*}{\partial t} = -div\left[n_0\left(v^* + W_c\hat{p}^*\right) + n^* W_c\hat{k} - D\nabla n^*\right] \quad (28)$$

The elimination of u*,v*, and p* from Eqs. (23)-(26) results in:

$$\rho_w \frac{\partial}{\partial t}\left(\frac{\partial^2 w^*}{\partial x^2} + \frac{\partial^2 w^*}{\partial y^2} + \frac{\partial^2 w^*}{\partial z^2}\right)$$

$$= -\theta\Delta\rho g\left(\frac{\partial^2 n^*}{\partial x^2} + \frac{\partial^2 n^*}{\partial y^2}\right) + \rho_w g\beta\left(\frac{\partial^2 T^*}{\partial x^2} + \frac{\partial^2 T^*}{\partial y^2}\right)$$

$$+ \mu\left(\frac{\partial^4 w^*}{\partial x^4} + \frac{\partial^4 w^*}{\partial y^4} + \frac{\partial^4 w^*}{\partial z^4} + 2\frac{\partial^4 w^*}{\partial x^2\partial y^2} + 2\frac{\partial^4 w^*}{\partial x^2\partial z^2} + 2\frac{\partial^4 w^*}{\partial y^2\partial z^2}\right) \quad (29)$$

Since it is assumed that temperature variation within the fluid layer does not influence gyrotactic behavior of micro-organisms, according to Pedley et al.[1],for gyrotactic micro-organisms

$$\hat{p}^* = B(\eta, -\xi, 0) \quad (30)$$

where

$$\xi = (1-\alpha_0)\frac{\partial w^*}{\partial y} - (1+\alpha_0)\frac{\partial v^*}{\partial z} \quad (31)$$

$$\eta = -(1-\alpha_0)\frac{\partial w^*}{\partial y} + (1+\alpha_0)\frac{\partial u^*}{\partial z} \quad (32)$$

$$\alpha_0 = \frac{a^2 - b^2}{a^2 + b^2} \quad (33)$$

$$B = \frac{\alpha\perp\mu}{2h\rho g} \quad (34)$$

Where a and b are the semi-major and minor axis of the sphroidal cell, so α_0 is a measure of the cell eccentricity, B is the gyrotactic orientation parameter which was introduced by Pedley and Kessler[5] and which has dimension; $\alpha\perp$ is dimension less constant relating viscous torque to the relative angular velocity of the cell ; and h is the displacement of center of mass of the cell from the center of buoyancy.

Thus equation (28) can be written as follows;

$$\frac{\partial n^*}{\partial t} = -div[w_c n_0 B(\eta, -\xi, 0)] - w_c\frac{\partial n^*}{\partial z} + D\Delta^2 n^* - w^*\frac{\partial n_0}{\partial z}$$

$$\frac{\partial n^*}{\partial t} = -w^*\frac{\partial n^*}{\partial z} - w_c\frac{\partial n^*}{\partial z} - w_c Bn_0\left[\frac{\partial \eta}{\partial x} - \frac{\partial \xi}{\partial y}\right] + D\Delta^2 n^* \quad (35)$$

Accounting for equations (31) and (32) ,equations(35) can be recast as

$$\frac{\partial n^*}{\partial t} = -w^*\frac{\partial n_0}{\partial z} - w_c\frac{\partial n^*}{\partial z} + w_c Bn_0\left[(1-\alpha_0)\left(\frac{\partial^2 w^*}{\partial x^2} + \frac{\partial^2 w^*}{\partial y^2}\right) + (1+\alpha_0)\frac{\partial^2 w^*}{\partial z^2}\right] + D\Delta^2 n^* \quad (36)$$

A normal mode expansion is introduced in the following form;

$$[w^*, n^*, T^*] = [W(z), N(z), \Theta(z)] f(x,y)\exp(\sigma t) \quad (37)$$

The function f(x,y) satisfies the following equation;

$$\frac{\partial^2 f}{\partial x^2} + \frac{\partial^2 f}{\partial y^2} + -m^2 f \quad (38)$$

where m is the horizontal wave number (used as separation constant).

Substituting Eq. (37) into Eqs. (27), (29), (36) and accounting for Eq. (38), the following equations for the amplitudes W Θ and N, are obtained:

$$\theta\Delta\rho g m^2 N - (\mu m^4 + \rho_w\sigma m^2)W + \rho_w g\beta m^2\Theta + (2\mu m^2 + \rho_w\sigma)W''\mu W'''' = 0 \quad (39)$$

$$-c_p\Delta T\rho_w W + H[(km^2 + c_p\rho_w\sigma)\Theta - k\Theta''] = 0 \quad (40)$$

$$D(Dn^2 + \sigma)N + D(W''N - DN'') - \exp\left(\frac{Wz}{D}\right)W\nu \times [-(1+BDm^2(1-\alpha_0))W + BD(1+\alpha_0)W''] = 0 \quad (41)$$

Introducing the following dimensionless variables

$$\bar{z} = \frac{z}{H}, a = mH, \bar{W} = \frac{\nu\theta W_c H^2}{D^2}W, \bar{N} = N\theta, \bar{\Theta} = \beta\Theta$$

Eqs. (39)-(41) can be recast as:

$$-a^2 Rb Q\bar{N} - \left(a^4 + a^2\frac{\rho_w H^2}{\mu}\sigma\right)\bar{W} + a^2\frac{RbQ}{\omega}\bar{\Theta} + \left(2a^2 + \frac{\rho_w H^2}{\mu}\sigma\right)\bar{W}'' - \bar{W}'''' = 0 \quad (42)$$

$$-\frac{Ra}{Q}\frac{\omega}{Rb}\bar{W} + \left[\left(a^2 + \frac{H^2 c_p\rho_w}{k}\sigma\right)\bar{\Theta} - \bar{\Theta}''\right] = 0 \quad (43)$$

$$\left(a^2 + \frac{H^2}{D}\sigma\right)\bar{N} + (Q\bar{N}' - \bar{N}'') - \exp(Qz)\left[-(1+G(1-\alpha_0)a^2)\bar{W} + G(1+\alpha_0)\bar{W}''\right] = 0 \quad (44)$$

Where $Rb = \Delta\rho g\nu\theta H^3/(\mu D)$ is the bioconvection Rayleigh number, $\omega = \Delta\rho/\rho_w$ is the measure of density of micro-organisms, $Ra = g\beta\Delta T H^3\rho^2 w c_p/(\mu k)$ is the traditional Rayleigh number associated with natural convection, and $G = BD/H^2$ is the gyrotaxis number.

For the solution of this system, a simple Galerkin method is employed as follows:

Galerkin Procedure

We consider the boundary conditions and requirement set of functions which is symmetric about z=0. it can be represented as a power series in $\bar{z}$

$$\bar{W}(z,t) = \sum A(t)W(z)$$

$$\Theta(z,t) = \sum B(t)\Theta(z)$$

$$\bar{N}(z,t) = \sum N^*(t)N(z)$$

Using boundary conditions $z=0: \bar{W}=0, \bar{\Theta}=0, Q\bar{N} = \frac{d\bar{N}}{dz}$ (45)

$$z = H: \bar{W} = 0, \bar{\Theta} = 0, Q\bar{N} = \frac{d\bar{N}}{dz} \quad (46)$$

$$\bar{W} = z^4 - 2z^3 + z^4 \quad (47)$$

$$\bar{\Theta} = \bar{z} - \bar{z}^2 \quad (48)$$

$$\bar{N} = 2 - Q(1-2\bar{z}) - Q^2(\bar{z} - \bar{z}^2) \quad (49)$$

The important determinant that governs the stability of the bioconvective system is

$$|L| = \begin{vmatrix} f_2 & f_3 & f_4 \\ f_6 & f_7 & 0 \\ f_9 & 0 & f_{10} \end{vmatrix}$$

Where $f = \left[a \langle \overline{w}\,\overline{w} \rangle - 2a \langle \overline{w}'' w \rangle + \langle \overline{w}'\,\overline{w}' \rangle\right]$

$= 0.0015873a - 2a\,(-0.019048) + 0.7992$

$f = -a \frac{RbQ}{\omega} \langle \overline{\varpi}\,\overline{w} \rangle$

$= a\,(0.007143)$

$f = a\,RbQ \langle \overline{N}\,\overline{w} \rangle$

$= a\,RbQ(0.0665874)$

$f = \frac{Ra\omega}{QRb} \langle \overline{w}\,\overline{\varpi} \rangle$

$= Ra(0.007143)$

$f = -a \langle \overline{\varpi}\,\overline{\varpi} \rangle + \langle \overline{\varpi}'\,\overline{\varpi}' \rangle$

$= -a\,(0.0333) - 0.3333$

$f = G(1+\alpha) \langle e^{-} \overline{w}\,\overline{N} \rangle - (1 + G(1-\alpha))a \langle e^{-} \overline{w}\,\overline{N} \rangle$

$= 10(1.2)(-0.00187219) - 9a\,(0.069882949)$

$f = -a \langle \overline{N}\,\overline{N} \rangle - Q \langle \overline{N}'\overline{N} \rangle + \langle \overline{N}'\overline{N}' \rangle$

$= -a\,(3.9966453) - Q(0.399948) + 0.039967$

By using the recurrence relation

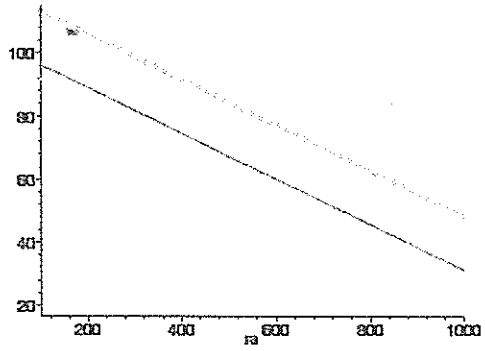
$$\partial(m,n) = \int z^{m} (1-z)^{n}\, dz$$

$$\frac{n}{m+n+1} \partial(m^*, n-1) \quad \text{where } m^* = m+2$$

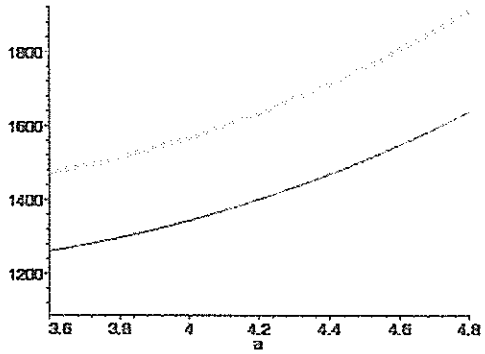
We compute all the terms. Extensive mathematical calculations and computations are involved. Finally the critical bioRayleigh number is computed for suitable values of the parameters and the results are presented through graphs.

6. Results And Discussion

1.figure



2.figure



The computed results are plotted in figures 1 and 2.

In figure 1, the graph of Rb v/s Ra is plotted for Q=0.1, a=4.3 and $G(\tau)$ =1.2, 1.4 and 1.6.The graph predicts that the bio-Rayleigh number for a particular value of the modulation parameter. Bio-convection is predominated for moderate values of Ra. Further, as $G(\tau)$ increases, the bio-Rayleigh number decreases for particular values of Ra. Accordingly,

$$Rb\big|_{G(\tau)=1} > Rb\big|_{G(\tau)>1}$$

In figure 2, the graph of Ra v/s a is plotted for Q=0.1, and $G(\tau)$1.2, 1.4 and 1.6 respectively. The figure reveals that Ra increases with a for a particular value of $G(\tau)$ and

$$Ra\big|_{G(\tau)>1} < Ra\big|_{G(\tau)=1}$$

Finally, it is concluded that, modulation has a strong influence on bio-convection.

"A MATHEMATICAL MODEL TO STUDY THE EFFECT OF GRAVITY MODULATION ON BIOCONVECTION "

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1. Introduction

The spontaneous formation of patterns in suspensions of swimming microorganisms due to their tactic nature viz.,.oxytactic, gyrotactic, cheryotactic, phototactic etc., is termed as bioconvection.It is a complex phenomenon.

The microorganisms exhibiting bioconvection have the following key features:
(i)They are denser than water (ii) they swim upwards due to their tactic nature. This leads to an unstable situation in the system and thus an overturning instability develops leading to pattern formation. Also gravity modu-

lation has a strong influence on the system in many real time situations.

Experiments on bioconvection containing suspensions of bacteria (Bascillus Subtilis) have revealed the formation of falling plumes when the system becomes unstable. The study of such a phenomenon has a variety of applications in biological and physiological problems.

Some literature pertaining to bioconvection in deep chambers are (Hillesdon et al 1995; Hillesdon and Pedley 1996; Metcalfe and Pedley 1998, 2001). Further chemotaxis and oxygen consumption are important in setting up the basic state and soon after the resulting plumes are entirely buoyancy driven and the cells are merely advected. In such cases, the velocity would vary across the plume (Yih, 1951). In this paper, we are investigating plumes where chemotaxis and oxygen consumption are important in the plume itself. No literature is available in this direction. The solutions are obtained by FCT.

2. Mathematical Formulation

The bacterial suspension (Bacillus Subtilis) contained in a deep chamber reveal the development of a thin upper boundary layer of cell-rich saturated fluids which becomes unstable, leading to the formation of falling plumes (Hillesdon et al 1995).This is used as a basis for our mathematical model.

The dimensionless governing equations are :
The equation of cell conservation,

$$\frac{\partial N}{\partial t} = \nabla.[H(\theta)\nabla N - UN - H(\theta)\gamma N \nabla \theta] \quad (1)$$

The equation of oxygen concentration,

$$\frac{\partial \theta}{\partial t} = \nabla.(\delta \nabla \theta - U\theta) - H(\theta)\delta\beta N \quad (2)$$

The Navier – Stokes equation (with Boussinesq approximation)

$$Sc^{-1} = \left[\frac{\partial U}{\partial t} + (U.\nabla)U\right] = -\nabla P_e + \nabla^2 U + \Gamma N - P_L U \quad (3)$$

The conservation of mass,

$$\nabla .U = 0 \quad (4)$$

Scale :

$$\nabla = \frac{1}{h}\nabla, \tilde{N} = NN_0, T = \frac{th^2}{DN_0}, \tilde{U} = \frac{UDN_0}{h}$$

where,

h : depth of the chamber,
N_0 : initial cell concentration,
U : the saturated fluid velocity,
D_N : the cell diffusivity,
θ : the oxygen concentration,
H(θ) : the step function,
T : the time .

Dimensionless Parameters

$$\beta = \frac{K_0 N_0 h^2}{D_c (C_0 - C_{min})}, \gamma = \frac{bV_c}{DN_0}, \delta = \frac{D_c}{DN_0}, \Gamma^* = \frac{UN_0 g_0 G(r) h^3 (\rho_c - \rho_w)}{\nu D_{N0} \rho_w}, Sc = \frac{\nu}{D_{N0}}$$

where, β is strength of oxygen consumption relaive to its diffusion.

γ meansures the relative strengths of directional and random swimming.

δ ratio of oxygen diffusivity to cell diffusivity.

Γ* modulated bio-rayleigh number.

Sc Schmidth number.

where v : volume of a cell ,
ρ_c , ρ_w : densities of cell and water ,
g_0 : acceleration due to gravity ,
k : the permeability of the medium ,
ν : the kinematic viscosity (b has the dimension of length).

Boundary Conditions

(i) No slip condition at Z = 1 (bottom of the chamber).
(ii) Stress free condition at the upper surface of the chamber , i.e., at Z = 0.
(iii) The vertical components of velocity vanish at both the boundaries.
(iv) Zero cell – flux at both the boundaries.
(v) Zero oxygen flux at the bottom surface and C = C_0 at the free surface .

Mathematically , at Z = 0,

$$U.\dot{Z} = 0, \frac{\partial^2}{\partial Z^2}\left(U.\dot{Z}\right) = 0, \theta = 1, H(\theta)\frac{\partial N}{\partial Z} - \gamma N H(\theta)\frac{\partial \theta}{\partial Z} = 0,$$

at Z = 1,

$$U.\dot{Z} = 0, U \times \dot{Z} = 0, \frac{\partial \theta}{\partial Z} = 0, \frac{\partial N}{\partial Z} = 0 \quad (5)$$

Steady state solution for the deep chamber, (0 = Z = Z_c) is

$$n_0 = \frac{2A_1^2}{\beta\gamma}\sec^2\left[A_1(z_c - Z)\right], \quad (6)$$

$$\theta_0 = 1 - \frac{2}{\gamma}\log\left[\frac{\cos\left[A_1(z_c - Z)\right]}{\cos A_1 z_c}\right] \quad (7)$$

where

$$A_1 z_c = \tan^{-1}\sigma, \alpha_c = \left(\frac{2\sigma}{\beta\gamma z_c}\right)\tan^{-1}\sigma, \sigma^2 = e\gamma - 1.$$

In our forthcoming analysis we take, $\theta > 0$, implies $0 < Z < z_c$; scale for Z is hz_c (the depth of the upper region where $\theta > 0$) and h is replaced by hz_c. Hence (6) and (7) in the dimensionless form

$$n_0 = \frac{2A^2}{\beta\gamma}\sec^2\left[A(1 - z)\right],$$
$$\theta_0 = 1 - \frac{2}{\gamma}\log\left[\frac{\cos\left[A_1(1 - Z)\right]}{\cos A}\right] \quad (8)$$

where

$$A = \tan^{-1}\sigma, A < \frac{1}{2}\Pi, \alpha_c = \left(\frac{2\sigma}{\beta\gamma}\right)\tan^{-1}\sigma, \alpha_c = \int_0^1 n_0\, dZ$$

3. Axisymmetric upper boundary lay for βγ >> 1

Physically $\beta\gamma >> 1$ means that the consumption of oxygen by the bacteria is larger when compared to oxygen diffusion from the free surface (large β). But as we are concerned with only the cell – rich narrow upper boundary layer , we consider $\beta\gamma >> 1$ (assuming that the upper boundary layer feeds cells into a narrow falling plume).

Now by using the following :

$$\lambda = \frac{2}{\beta\gamma}, Z = \lambda z, N = \frac{n}{\lambda}, \theta = 1 + \frac{2}{\gamma}C, U = U_B u, W = \lambda U_B w, P = P_B p \quad (9)$$

where U_B and P_B are the unknown scaling factors.

–Using (9) the axisymmetric governing equations are :

$$\lambda^2 U_B\left[u\frac{\partial n}{\partial R} + w\frac{\partial n}{\partial z}\right] + 2n\frac{\partial^2 C}{\partial z^2} + 2\frac{\partial n}{\partial n}\frac{\partial C}{\partial z} + 2\lambda^2\left[\frac{n}{R}\frac{\partial C}{\partial R} + n\frac{\partial^2 C}{\partial R^2} + \frac{\partial n}{\partial r}\frac{\partial C}{\partial R}\right] - \frac{\partial^2 n}{\partial z^2} - \lambda^2\left[\frac{1}{R}\frac{\partial n}{\partial R} + \frac{\partial^2 n}{\partial R^2}\right] = 0 \quad (10)$$

$$\frac{\partial^2 C}{\partial z^2} - n + \lambda^2\left[\frac{1}{R}\frac{\partial C}{\partial R} + \frac{\partial^2 C}{\partial R^2}\right] - \frac{\lambda^2}{\delta}U_B\left[u\frac{\partial C}{\partial R} + w\frac{\partial C}{\partial z}\right] = 0 \quad (11)$$

$$\frac{u}{R} + \frac{\partial u}{\partial R} + \frac{\partial w}{\partial z} = 0 \quad (12)$$

$$\lambda^2 U_B Sc^{-1}\left[u\frac{\partial u}{\partial R} + w\frac{\partial u}{\partial z}\right] = -\lambda^2\frac{P_B}{U_B}\frac{\partial p}{\partial R} + \frac{\partial^2 u}{\partial z^2} + \lambda^2\left[\frac{1}{R}\frac{\partial u}{\partial R} + \frac{\partial^2 u}{\partial R^2}\right] \quad (13a)$$

$$\lambda^2 U_B Sc^{-1}\left[u\frac{\partial w}{\partial R} + w\frac{\partial w}{\partial z}\right] = -\frac{P_B}{U_B}\frac{\partial p}{\partial z} + \frac{\partial^2 w}{\partial z^2} + \lambda^2\left[\frac{1}{R}\frac{\partial w}{\partial R} + \frac{\partial^2 w}{\partial R^2}\right] + \frac{\Gamma^*}{U_B}n \quad (13b)$$

The boundary conditions at z =0 are

$$w = C = \frac{\partial u}{\partial z} = \frac{\partial p}{\partial R} = 0 \quad (14)$$

$$\frac{\partial n}{\partial z} - 2n\frac{\partial C}{\partial z} = 0 \quad (15)$$

We now expand the variables n , C , u and p in powers of λ :

$$n = n_0 + \lambda n_1 + \ldots..$$
$$C = c_0 + \lambda C_1 + \ldots..$$
$$u = u_0 + \lambda u_1 + \ldots..$$
$$p = p_0 + \lambda p_1 + \ldots.. \quad (16)$$

With the assumption that $\lambda^2 U_B << 1$, which means that (i) Advection is unimportant at leading order and diffusion is balanced by directional cell swimming and (ii) Oxygen diffusion is balanced by oxygen consumption. Now , the leading order terms in (10) and (11) are

$$2n_0\frac{\partial^2 c_0}{\partial z^2} + 2\frac{\partial n_0}{\partial z}\frac{\partial c_0}{\partial z} - \frac{\partial^2 n_0}{\partial z^2} = 0 \quad (17)$$

$$\frac{\partial^2 c_0}{\partial z^2} - n_0 = 0 \quad (18)$$

The solutions are :

$$n = n_0 = \frac{1}{(a+z)^2}, C = c_0 = -\log\left(\frac{a+z}{a}\right) \text{ with } a = a(R) \quad (19)$$

We now have the following cases :

Case (i) : If $U_B\lambda^2 Sc^{-1} << 1$ then fluid momentum can be neglected so that from (13a) and (13b) :

$$\frac{\lambda^2}{U_B}P_B\frac{\partial p_0}{\partial R} + \frac{\partial^2 u_0}{\partial z^2} = 0 \quad (20)$$

$$\frac{-P_B}{U_B}\frac{\partial p_0}{\partial z} + \frac{\partial^2 w_0}{\partial z^2} + \frac{\Gamma^*}{U_B}n_0 = 0 \quad (21)$$

Case (ii) : Further if $\frac{\Gamma^*}{U_B} >> \lambda^{-2}$, then (21) requires $P_B = O(\Gamma^*)$ so that pressure term balances with the buoyancy term.then from (20) :

$$\frac{\partial p_0}{\partial R} = 0 \quad (22)$$

Differntiating (21) w.r.t R and using (22) we get

$$\frac{\partial n_0}{\partial R} = 0 \quad (23)$$

Case (iii) $\frac{\Gamma^*}{U_B} = O(\lambda^{-2})$ again we scale $P_B = O(\Gamma^*)$ in which case the pressure and diffusion terms balance in (20) so that

$$\frac{\partial^2 u_0}{\partial z^2} = \frac{\partial p_0}{\partial R} \quad (24)$$

We now differentiate (21) w.r.t R and using (19) and (24):

$$\frac{\partial^3 u_0}{\partial z^3} = \frac{-2a'}{(a+z)^3} \quad (25)$$

where $a' = \frac{\partial a}{\partial R}$ Integrating w.r.t z and applying the boundary conditions or $\frac{\partial p_0}{\partial R}$ and $\frac{\partial u_0}{\partial z}$ at z = 0 ,

we have

$$u_0 = -a' \log(a+z) + \frac{a'}{(a+z)^2} - \frac{a'(a^2+6)}{a^4}\frac{z^2}{2} + \frac{a'(a^2+2)}{a^3} z + f(R) \quad (26)$$

Finally , when $1 << \frac{\Gamma^*}{U_B} << \lambda^{-2}$, we have $P_B = O(\Gamma^*)$ In this case , the diffusion term dominates in (20) , so that $\frac{\partial^2 u_0}{\partial z^2} = 0$ (27)

Integrating this twice w.r.t. z and applying the boundary conditions on $\frac{\partial u}{\partial z}$ at z = 0 yields

u = u_0(R) and a = a(R).

In order to find u_0(R) , the solutions are to be matched at the outer zone , C .

4. Axisymmetric Plumes in BPC

In the plume , the radial coordinate is scaled as

$$R = \varepsilon r, 0 < \varepsilon << 1 \quad (28)$$

Rescaling :

$$N = N_A n, \theta = 1 + C_A C, W = W_A w, U = \varepsilon W_A u, P = P_A p \quad (29)$$

Where where N_A, C_A , W_A, and P_A are scale factors.Then the axisymmetric governing equations of BPC (neglecting O(å²) terms) are ,

$$\frac{1}{r}\frac{\partial n}{\partial R} + \frac{\partial^2 n}{\partial r^2} = \varepsilon^2 W_A \left[u\frac{\partial n}{\partial r} + w\frac{\partial n}{\partial z}\right] + \gamma C_A \left[\frac{\partial n}{\partial r}\frac{\partial C}{\partial r} + \frac{n}{r}\frac{\partial C}{\partial r} + n\frac{\partial^2 C}{\partial r^2}\right] \quad (30)$$

$$\frac{\varepsilon^2 W_A}{\delta}\left[u\frac{\partial C}{\partial r} + w\frac{\partial C}{\partial Z}\right] + \frac{\varepsilon^2 \beta N_A n}{C_A} = \frac{\partial^2 C}{\partial r^2} + \frac{1}{r}\frac{\partial C}{\partial r} \quad (31)$$

$$\frac{u}{r} + \frac{\partial u}{\partial r} + \frac{\partial w}{\partial Z} = 0 \quad (32)$$

$$\varepsilon W Sc^{-} \left[u\frac{\partial u}{\partial} + w\frac{\partial u}{\partial Z}\right] = \frac{-P}{W}\frac{\partial p}{\partial r} + \frac{\partial u}{\partial r} + \frac{1}{r}\frac{\partial u}{\partial r} \quad (33)$$

$$\varepsilon W Sc^{-} \left[u\frac{\partial w}{\partial r} + w\frac{\partial w}{\partial Z}\right] = -\varepsilon \frac{P}{W}\frac{\partial p}{\partial Z} + \varepsilon \frac{N}{W}\Gamma^* n + \frac{\partial w}{\partial r} + \frac{1}{r}\frac{\partial w}{\partial r} \quad (34)$$

Here,

W_A = å² (to retain advection terms)

C_A = 2/ã (to retain chemotaxis term)

N_A =ë/å² (to retain oxygen consumption term in (310))

Ã = O(ë⁻¹ å⁻²) (to retain the buoyancy term in (343))

P_A = å⁴ (to retain the pressure term in (343))

This leads to ?p = 0 hence p = p(Z).

?r

suituting for C_A , W_A and N_A in (30) and (31) :

$$u\frac{\partial n}{\partial r} + w\frac{\partial n}{\partial Z} + 2\frac{\partial n}{\partial r}\frac{\partial C}{\partial r} + 2\frac{n}{r}\frac{\partial C}{\partial r} + 2n\frac{\partial^2 C}{\partial r^2} - \frac{1}{r}\frac{\partial n}{\partial r} - \frac{\partial^2 n}{\partial r^2} = 0 \quad (35)$$

$$\frac{1}{\delta}\left[u\frac{\partial C}{\partial r} + w\frac{\partial C}{\partial Z}\right] + n\left[\frac{1}{r}\frac{\partial C}{\partial r} + \frac{\partial^2 C}{\partial r^2}\right] = 0 \quad (36)$$

Differentiating (343) w.r.t. r and substituting for N_A, W_A and Ã :

$$Sc^{-1}\frac{\partial u}{\partial r}\frac{\partial w}{\partial r} + u\frac{\partial^2 w}{\partial r^2} + \frac{\partial w}{\partial r}\frac{\partial w}{\partial Z} + w\frac{\partial^2 w}{\partial r \partial Z} = \Gamma^*\frac{\partial n}{\partial r} + \frac{\partial^3 w}{\partial r^3} + \frac{1}{r}\frac{\partial^2 w}{\partial r^2} - \frac{1}{r^2}\frac{\partial w}{\partial r} - \Gamma^*\frac{\lambda}{U_B}\frac{\partial n}{\partial r} \quad (37)$$

Now , we impose the boundary conditions :

$$\frac{\partial n}{\partial r} = 0, \frac{\partial C}{\partial r} = 0, u = 0, \frac{\partial w}{\partial r} = 0 \quad (38)$$

$$Also, r \to \infty, n \to 0, \frac{\partial C}{\partial r} \to 0, w \to 0. \quad (39)$$

Similarity solution for axisymmetric BPC

In order to obtain a similarity solution for (35), (36), (37), we pose a solution of the for

$$h :: Z^a, w :: Z^b, n :: Z^c, C :: Z^d, u :: Z^{a+b+1} \quad (40)$$

(h : width of the plume)

(a = ½ , b = 0 , c = -1 , d = 0)

Since h :: $Z^{1/2}$, the similarity varia

ble ç = r

$Z^{1/2}$

Assuming the solution in the form :

$$n = Z^{-1}H(\eta), C = G(\eta), \psi = ZF(\eta), u = Z^{\frac{-1}{2}}\left(\frac{F}{\eta} - \frac{F'}{2}\right), w = \frac{-F'}{\eta} \quad (41)$$

(ø : Streamfunction , Primes denote differentiation w.r.tç. Substituting these into (35) and integrating once w.r.t. ç with the boundary conditions at ç = 0 , we get ,

$$HF + 2\eta HG' - \eta H' = 0 \qquad (42)$$

Now From (36) ;

$$\eta G'' + G' - \frac{1}{\delta} G' F - \eta H = 0 \qquad (43)$$

Now From (37)

$$\frac{1}{\eta} F''' - \frac{1}{\eta^2} F'' + \frac{1}{\eta^3} F' + Sc^{-1}\left[\frac{1}{\eta^3} FF' - \frac{1}{\eta^2} FF''\right] -$$

$$-\dot{\Gamma}^{*} H + \frac{\dot{\Gamma}}{\eta} F' = 0 \qquad (44)$$

(Here (38) is integrated once w.r.t. ç and the boundary condition at ç ? 8 is used)

Finally , the boundary conditions are ,

At $\eta = 0$:

$$H' = G' = \frac{F}{\eta} - \frac{F'}{2} = \frac{F'}{\eta} - \frac{F''}{\eta} = 0 \qquad (45)$$

At $\eta \to \infty$:

$$H \to 0, G' \to 0, \frac{F'}{\eta} \to 0 \qquad (46)$$

6. Solution :

For ã ? 0 , CFD technique is employed. However for ã = 0 (i.e., when the chemotaxis is unimportant in the plume) analytical solutions are possible with â = O (1) , C_o = 1 , N_o = å$^{-2}$ and Ã* = å$^{-2}$, P_L = O (å^{4}) .Some of the cases are:

$$Sc=1,\delta=1: F = \frac{-6A\eta^2}{1+A\eta^3}, H = \frac{96A^2}{\Gamma(1+A\eta^3)}, G = \frac{48\beta A^2\eta}{\Gamma(1+A\eta^3)}$$

$$Sc=1,\delta=\frac{3}{4}: F = \frac{-6A\eta^2}{1+A\eta^3}, H = \frac{96A^2}{\Gamma(1+A\eta^3)}, G = \frac{24\beta A^2\eta(A\eta^3+2\eta)}{\Gamma(1+A\eta^3)^2}$$

$$Sc=2,\delta=1: F = \frac{-8A\eta^2}{1+A\eta^3}, H = \frac{128A^2}{\Gamma(1+A\eta^3)}, G = \frac{64\beta A^2\eta}{\Gamma(1+A\eta^3)^2}$$

$$Sc=2,\delta=2: F = \frac{-8A\eta^2}{1+A\eta^3}, H = \frac{128A^2}{\Gamma(1+A\eta^3)}, G = \frac{64\beta A^2\eta}{\Gamma(1+A\eta^3)}$$

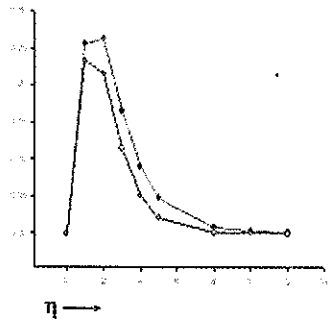
The solutions satisfy the boundary conditions at ç = 0 and ç ? 8 . Also

$$A = \left\{ A^2 = \frac{Q\Gamma^2}{144} \quad \text{for Sc = 1, } \delta = 1 \text{ or } \frac{3}{4}, \Gamma^2 = 1.2 \right.$$

$$A = \left\{ A^2 = \frac{5Q\Gamma^2}{1024} \quad \text{for Sc = 2 , } \delta = 1 \text{ or 2, } \Gamma^2 = 1.2 \right.$$

$$\text{since} \left[\int_0^{\infty} HF' d\eta = -Q \right]$$

The graphs are presented in figures (i), (ii) & (iii)

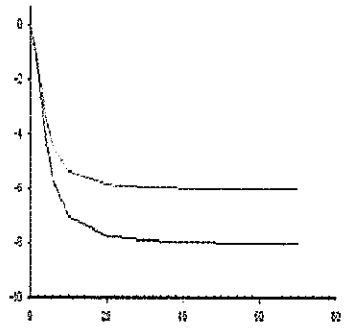


	G
0	0
1	0.262
2	0.281
3	0.186
4	0.104
5	0.056
8	0.010
10	0.004
12	0.001

	G
0	0
1	0.191
2	0.223
3	0.162
4	0.096
5	0.056
8	0.011
10	0.004
12	0.002

η

Fig(i)

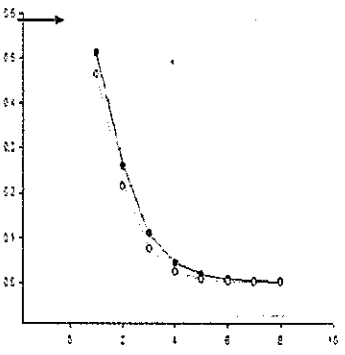


	F
0	0
10	-5.357
20	-5.825
30	-5.92
40	-5.96
50	-5.97
60	-5.98
70	-5.985

	F
0	0
10	-6.998
20	-7.724
30	-7.875
40	-7.930
50	-7.955
60	-7.970
70	-7.977

η

Fig(ii)



	H
0	0
1	0.383
2	0.223
3	0.108
4	0.049
5	0.022
6	0.010
7	0.004
8	0.002
9	0.001
10	0.000

	H
0	0
1	0.524
2	0.280
3	0.124
4	0.053
5	0.023
6	0.010
7	0.005
8	0.002
9	0.001
10	0.000

η

Fig(iii)

Here

Red : Sc = 1, ä = 1

Blue : Sc = 2, ä = 1

7. Results The results of the present investigation are presented through graphs (Figures 1 – 3).In Fig.1 , the graph of G´ vs ç is plotted for Sc = 1 , 2 ; ? =1 ; Q =1 ; Ã* = 1 .It is found that the gradient of oxygen concentration is maximum at ç = 2 and for ç > 10 , G´ is atmost a constant. Further as Sc increases G´ decreases for a fixed ç.

In Fig.2 , the graph of F vs ç is drawn for the data specified . In this case the influence of Sc is large when compared to that on G´ . Also F decreases with ç and the decrease is more predominant in the range 0 < ç < 30. For ç > 30 , it almost remains constant .

In Fig.3 , the graph of H vs ç is drawn for the data speci-

fied . It is found that , H decreases with η and for η ? 10 , it is almost zero.The results are in excellent agreement with the fluid case .

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"MICROCONVECTION IN A ROTATING BINARY SYSTEM"

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1. Introduction

The development of natural convection at low gravity conditions may be considerably affected by small variations in the thermo-physical properties of the medium, which is not true under ground conditions. Theoretically, temperature-induced density variations of a liquid or gaseous medium can induce motion in a closed volume, even when the gravity is absent.

In recent years , the attention of researchers has been attracted to the case of an isothermally incompressible fluid, in which the dependence of the fluid properties on the pressure may be neglected.

In this paper, microconvection in a nonisothermal binary liquid mixture in the presence of the Soret effect and rotational constraint is considered. It is important to recall that Microconvective flows are characterized by a non-solenoidal velocity field.

2. Mathematical Formulation

The physical configuration constitutes a Newtonian isotropic liquid consisting of two non-reacting components in an external force field. The whole system is rotating about the vertical axis with an angular velocity Ω The state of the system is characterized by the following fields:

$\rho(x,t)$- total density

$\underset{v(x,t)}{\overset{r}{\longrightarrow}}$ (v_1, v_2, v_3) velocity of the liquid-element mass center

$p(x,t)$- pressure

$\theta(x,t)$-absolute temperature

$c(x,t)$-mass concentration of one of the components

with

$$\rho = \rho_1 + \rho_2,\ \overset{r}{v} = \frac{\rho_1 v_1 + \rho_2 v_2}{\rho},\ c = \frac{\rho_1}{\rho}$$

Assumptions

(i) The concentrations of the components and the mixture temperature vary slightly.

(ii) All the physical properties of the liquid except the density are constant.

(iii) The heat flux and the mass diffusion flux are linear functions of ∇c and $\nabla\theta$ and the coefficients in these functions are constant, so that

where

$$\overrightarrow{J_c} = -k_c(\nabla c - \alpha\nabla\theta)$$

k_c : diffusion coefficient

α : thermodiffusion coefficient

$\frac{k_c}{\rho}$: the molecular diffusion coefficient

(iv) It is important to note that Micrconvective flows characterized by the velocities of the order $10\,\mu m/s$ and less may be modelled as subsonic flows with arbitrary density variations . (Navier-Stokes and Heat Transfer equations with Mach number and the hydrostatic compressibility parameter -0)

(v) The thermodynamic component of the pressure i.e., pt is constant. (This is realized in physical situations where the region occupied by the liquid is open to the atmosphere or, the total normal heat flux across the impermeable solid walls of the closed vessel containing the fluid is zero).

The governing equations are

$$\frac{\partial\rho}{\partial t} + \overset{r}{v}\nabla\rho + \rho\nabla\overset{r}{v} = 0 \qquad \rightarrow(1)$$

$$\rho\left(\frac{\partial c}{\partial t} + \overset{r}{v}\nabla c\right) = k_c\left(\nabla^2 c + \alpha\nabla^2\theta\right) \qquad \rightarrow(2)$$

$$\rho c_p\left(\frac{\partial\theta}{\partial t} + \overset{r}{v}\nabla\theta\right) = k\left(\nabla^2\theta + \alpha'\nabla^2 c\right) \qquad \rightarrow(3)$$

$$\rho\left(\frac{\partial\overset{r}{v}}{\partial t} + \overset{r}{v}\overset{r}{\nabla}\overset{r}{v} + 2\overset{ur}{\Omega\hat{k}}\times\overset{r}{v}\right) = -\nabla p' + \eta\nabla T + (\rho - \rho_0)g\hat{k} \rightarrow(4)$$

$$\rho = \rho(\theta, c),\ p' = p - \rho_0 g k x,\ T_{ik} = \left(\frac{\partial v_i}{\partial x_k} + \frac{\partial v_k}{\partial x_j} - \frac{2}{3}\delta_{ik}\overset{r}{\nabla}\overset{r}{v}\right)$$

where

η : the shear viscosity

k: the thermal conductivity

k_c: the molecular diffusion

α, α': characterize the cross-effects i.e., the thermodiffusion and the Dufour effect

c_p : the specific heat at constant pressure

g : the gravitational acceleration

$\hat{k}$: the unit vector in the vertical direction

T : T_{ik} a Cartesian tensor

δ_{ik}: the unit tensor

(The bulk viscosity is assumed to be zero)

The equation of state:

$$\rho=\rho_0\left(1+\beta T+\gamma C\right)^{-1},\ T=\theta-\theta_0,\ C=c-c_0 \quad \rightarrow(5)$$

where

ρ_0, θ_0, c_0 : mean values ,

β, γ : temperature and concentration density coefficients

The convection equations for a non-isothermal binary mixture are given by

$$\nabla \overset{\text{ur}}{v}=\left(\beta\chi+\gamma\delta\alpha\right)\nabla^2 T+\left(\gamma\delta+\beta\chi\alpha'\right)\nabla^2 C \quad \rightarrow(6)$$

$$v_t+\overset{\text{r}}{v}\nabla\overset{\text{r}}{v}+\left(2\overset{\text{ur}}{\Omega}\hat{k}\times\overset{\text{r}}{v}\right)=\left(1+\beta T+\gamma C\right)\left\{-\frac{\nabla p''}{\rho_0}+\nu\nabla^2\overset{\text{r}}{v}\right\}-$$

$$\cdot g\left(\beta T+\gamma C\right)\hat{k} \rightarrow(7)$$

$$T_t+\overset{\text{r}}{v}\nabla T=\chi\left(1+\beta T+\gamma C\right)\left(\nabla^2 T+\alpha\nabla^2 C\right) \quad \rightarrow(8)$$

$$C_t+\overset{\text{r}}{v}\nabla C=\delta\left(1+\beta T+\gamma C\right)\left(\nabla^2 C+\alpha\nabla^2 T\right) \quad \rightarrow(9)$$

$$p''=p'-\left(\frac{\eta}{3}\right)\nabla\overset{\text{r}}{v} \quad \rightarrow(10)$$

The microconvection model is characterized by the following non-dimensional parameters:

The Boussinesk parameter, $\in=\beta T^*$

The Rayleigh number, $R=\dfrac{\in gd^3}{(\nu\chi)}$

The ratio of the characteristic accelerations of the buoyancy forces induced by concentration and temperature nonuniformities, $\xi=\gamma C^*\left(\beta T^*\right)^{-1}$

The Prandtl number, $\mathrm{Pr}=\dfrac{\nu}{\chi}$

The Lewis number, $Le=\dfrac{\delta}{\chi}$

The separation ratio, $\sigma=\dfrac{-\alpha\gamma}{\beta}$ and

The Galileo number, $G=\dfrac{r}{\in}=\dfrac{gd^3}{\nu\chi}$

where

$\chi=\dfrac{k}{\left(\rho_0 c_p\right)}$: the thermal diffusivity

$\delta=\dfrac{k_c}{\rho_0}$: the diffusion coefficient

$\nu=\dfrac{\eta}{\rho_0}$: the kinematic viscosity

The system given by (6)-(10) is of non-Cauchy- Kovalevskaya type.

3. Rayleigh-Bénard and Bénard-Marangoni long-wave instabilities (induced by Soret effect)

In the case of a binary-liquid layer instability associated with a fairly strong Soret effect, an interesting class of microconvection problems arises. For example, in the Rayleigh - Bénard instability, the Rayleigh number tends to zero as the separation ratio σ characterizing the influence of the Soret effect increases and the critical wave number tends to zero when the walls are impermeable . A similar phenomenon occurs in the case of Bénard-Marangoni instability.

In this paper, we consider the effect of small density variations on the conditions of onset of long-wave instability induced by the Soret effect at small Rayleigh numbers and at different rotation rates.

In the following analysis, an infinite plane horizontal layer of binary liquid with thickness 'd' bounded by two solid impermeable walls on which the normal heat flux is specified. The system is placed in a constant uniform gravity field. (only 2D-steady state is considered).

Consider the system of equations (6)-(10).

Introducing the scales

$$V^*=\frac{\beta T^*\chi}{d}$$

$$C^*=\frac{\beta T^*}{\gamma}$$

$$p''=\frac{\rho_0 V^*\nu}{d}$$

We get the following governing equations with the boundary conditions:

$$\left.\begin{aligned}
&\nabla\overset{\text{r}}{v}=S\nabla^2 T+Le\nabla^2 C\\
&\left(\mathrm{Pr}\right)^{-1}\in\overset{\text{r}}{v}\nabla\overset{\text{r}}{v}+T_N[\hat{k}\times\overset{\text{r}}{v}]-\in T_N[\hat{k}\times\overset{\text{r}}{v}]=-\\
&\qquad\nabla p''+\nabla^2\overset{\text{r}}{v}-\frac{G\left(T+C\right)\hat{k}}{1+\in\left(T+C\right)}\\
&\in\overset{\text{r}}{v}\nabla T=\nabla^2 T\\
&\in\overset{\text{r}}{v}\nabla C=Le\nabla^2\left(C-\sigma T\right)
\end{aligned}\right\}(11)$$

Boundary Conditions :

$$\left.\begin{aligned} u = w = 0 \\ T_z = -1 \\ C_z = \sigma T_z \\ S = 1 - Le\sigma \end{aligned}\right\} at \quad z = 0,1 \qquad \rightarrow (12)$$

Basic State Solution

Here, $u_0 = w_0 = 0, \; T_{0z} = -1, \; C_{0z} = -\sigma \qquad \rightarrow (13)$

We now linearize the system (11) and introduce the perturbations as

$$(u, v, T, C) = (u_0, v_0, T_0, C_0) + (u', v', T', C') \qquad \rightarrow (14)$$

We introduce the stream function ψ' as

$$\left.\begin{aligned} u' &= \psi_z' + ST_x' + LeC_x' \\ w' &= -\psi_x' + ST_z' + LeC_z' \end{aligned}\right\} (15)$$

The normal disturbances have the form

$$(\psi', T', C') = (\psi'(z), T'(z), C'(z)) e^{-i\alpha x} \qquad \rightarrow (16)$$

Finally, we obtain the following system of equations:

$$\left.\begin{aligned} &\left[(D^2 - \alpha^2)^2 + T_N^{*2}\right]\left[D^2\psi' - i\alpha(SDT' + LeDC')\right] + (D^2 - \alpha^2) \\ &\left[\alpha^2\psi' + i\alpha(SDT' + LeDC')\right] + (D^2 - \alpha^2)(-i\alpha)\left[G'(T' + C')\right] = 0 \\ &-\in (i\alpha\psi' + SDT' + LeDC') = (D^2 - \alpha^2)T' \\ &\in \sigma(i\alpha\psi' + SDT' + LeDC') = Le(D^2 - \alpha^2)(C' - \sigma T') \\ &z = 0,1: \quad D\psi' = i\alpha(ST' + LeC'), \quad \psi' = DT' = DC' = 0 \\ &D = \frac{d}{dz}, \quad G' = \frac{G}{1 + \in (T_0 + C_0)^2} \end{aligned}\right\} (17)$$

The stability limits are determined by using the regular-perturbation method. Here, the wave number α is assumed to be small and the solution we seek is of the form:

$$(\psi, T, C) = (\psi^{(0)}, T^{(0)}, C^{(0)}) + \alpha(\psi^{(1)}, T^{(1)}, C^{(1)}) + ... \qquad \rightarrow (18)$$

The terms of order O(1) and O(α) are presented below (for small rotation rates):

$$T^{(0)}, C^{(0)} = const, \quad \psi^{(0)} \approx 0, \quad T^{(1)}, C^{(1)} = const$$

$$\psi^{(1)} = i\left(ST^{(0)} + LeC^{(0)}\right)z - i\left(\frac{G'\left(T^{(0)} + C^{(0)}\right)}{24} + 3\left(ST^{(0)} + LeC^{(0)}\right)\right)z^2 + i\left(\frac{G'\left(T^{(0)} + C^{(0)}\right)}{12} + 2\left(ST^{(0)} + LeC^{(0)}\right)\right)z^3 + i\frac{G'\left(T^{(0)} + C^{(0)}\right)}{24}z^4 + \theta(T_N)$$

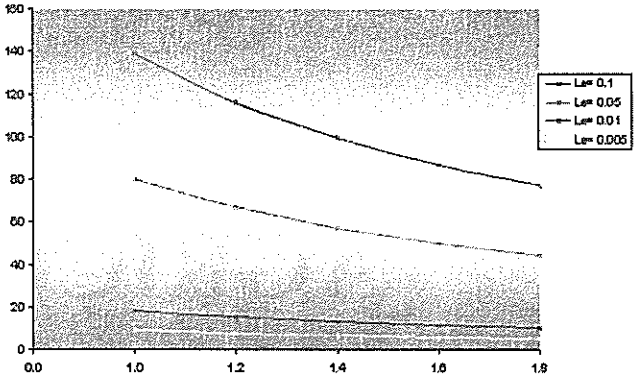
The critical Rayleigh number for the monotonic instability mode is computed both for the modulated and unmodulated cases:

$$R_c(G(\tau)) = \frac{Le}{\sigma + Le + \sigma Le}\left(720 + \frac{36}{7}(\in(1+\sigma))^2 + O\left((\in(1+\sigma))^3\right)\right) + \theta(T_N) \qquad \rightarrow (19)$$

where

$$G(\tau) = g\left(\frac{1 + g(t)}{g}\right)$$

R_c vs $G(\tau)$



4. Results and Discussion

The computed results are presented through the graph. In the figure R_c vs. $G(\tau)$ curves are drawn for various values of Le (Le = 0.005, 0.01, 0.05, 0.1), $\sigma = 0.38$ and $\in = 7.5 \times 10^{-3}$. The figure predicts the following features:

(i) The critical Rayleigh number decreases with the modulation for a particular value of the Lewis number. That is, the system becomes more unstable in a modulated environment.

(ii) The critical Rayleigh number increases with the Lewis number. In other words, with the increase of diffusion coefficient, the system becomes more stable. Finally, it is concluded that, the microconvection can be suppressed or enhanced by a proper choice of $G(\tau)$ and Le. The work is in progress.

AGRICULTURAL, FORESTRY, FISHERY AND VETERINARY SCIENCES

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STUDENT OPINIONS ABOUT THE VETERINARY PROFESSION

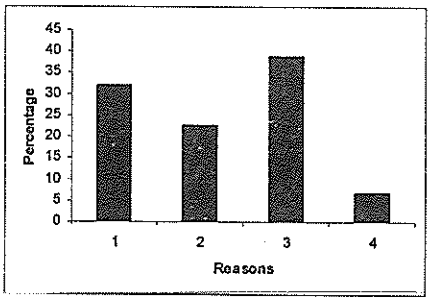
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In India, unlike in other countries more often the students join the professional courses and pursue their career with the help of parents and relatives. Whether such decisions of parents benefit the students in their profession or planning their future have not been studied. Hence the following study was conducted to find out this the views in students about building up of their career is satisfactory or not.

A total of 45 students (30 girls and 15 boys) studying Veterinary science at the veterinary college were given student attitude test. The student attitude test questionnaire was prepared which included 15 questions pertaining to their profession of choice, study performance and future plans after the degree of completion.

The parameters included in the study are Reason for joining Veterinary Science, Future plans after completing the degree programme. their Views on the profession , Preference of alternate professions , Gender suitability to Veterinary profession , their contributions to the Indian society , the best place preferred for vets to be trained and the preference of places to work after completion of degree and their opinions towards the change of the career. The questionnaire contained multiple choice questions. Their views/ opinions were collected and analyzed.

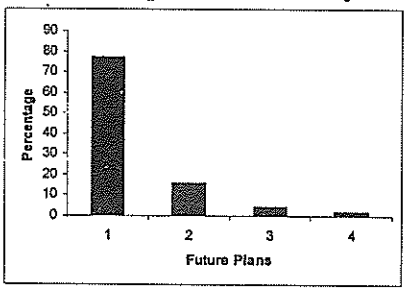
Fig1 .Reason for joining the Vet Course



Reasons
1.Others proposed
2.Better Employment
3. Love for animals
4. Could not get seat in other profession

Fig1 indicates that 40% of the students opined that they had love for animals 30% of them expressed that they joined because others like parents/relatives proposed, 20% of them expressed that they joined to get better employment after the degree and about 10% opted for any this profession because they did not get admission for other profession.

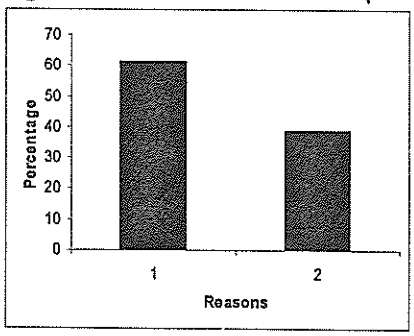
Fig2 . Future plans of Veterinary students



Future Plans
1.Higher studies
2.Government job
3.Private practice
4.Any other specify

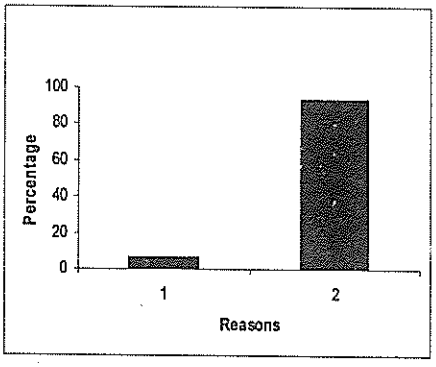
When the students were asked about the future plans after completing the degree about 80% of both girls and boys opined that they wish to go for higher studies, further only 20% of them wished to join for the jobs and among them 10% of the students opted for government jobs and lesser than 5% opted for private practice which is reflected in fig2.

Fig3. Views on the Profession(Study performance)



Reasons
1.Good
2.Average

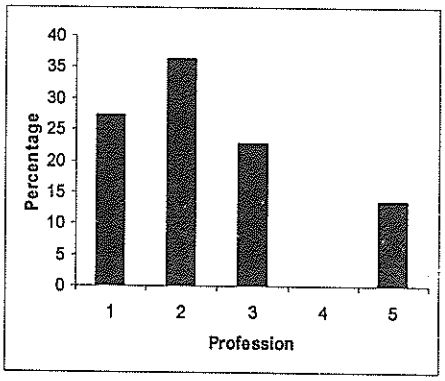
Fig4. Views on the Profession(course change)



Reasons
1.Yes
2.No

As shown in the fig3&4 the students expressed that Compared to medical science, veterinary science is much more difficult as veterinary student has to gain knowledge on all domestic and wild animals. When students were asked about their performances in studies about 60% of students expressed that their performance is quite good and about 30% of them expressed that their performance is average.

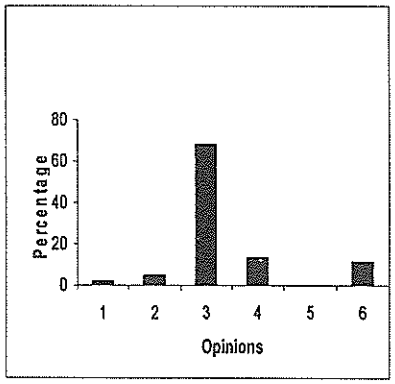
Fig5.Alternate profession preferred by Veterinary Students



Profession
1.Medical / Dental
2.Engineering
3.Basic science/ pure science
4 . C o u r s e s related to arts
5.Other.

As detailed in fig5. When students were tested for their preference to join alternate profession if they could not get entry into Veterinary profession that about 35% of the students expressed that they would have opted for engineering and about 25% would have joined sister professions like medical and dental and 20% expressed that they would have opted for basic sciences and strangely no body opted for arts. This may be because they are basically from science background might have opted for science subjects than arts.

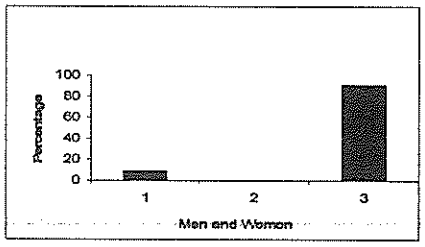
Fig6. Opinion about Veterinary profession



Opinions
1.Veterinary means wild life Science Conservation
2.Veterinary means Pet Care
3. Veterinary is all about animals
4.Domestic animals like Cattle, Pigs, Horse, Sheep, Goats
5.Research
6.No idea!

When students were asked what idea they had about veterinary profession before joining – it was observed that – nearly 70% of students expressed that the Veterinary study includes wild animals, pet animals and domestic animals and not any one of the category of animal groups (fig6.)

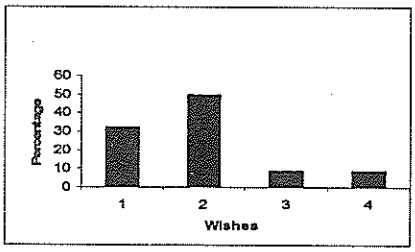
Fig7. Choice of Veterinary Profession



Men and Women
1.Men
2.Women
3.Both

Generally in India the public opinion is that Veterinary profession meant only for boys. So a choice was given to the students to express the opinion whatever it is only for boys or only for girls or both. About 85% of the students expressed that Veterinary profession can be taken up by both boys and girls. Less than 20% expressed that it is better for only boys and none expressed that it is only for girls (fig7.)

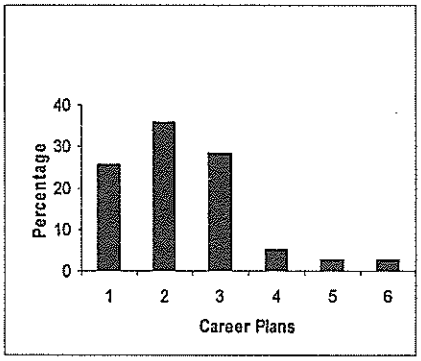
Fig8. What you wish to do for Indian Society



Wishes
1.Save animals
2.To make India domestic country
3.Depends on the job I take up
4.Improving dairy breeds ,poultry improvement

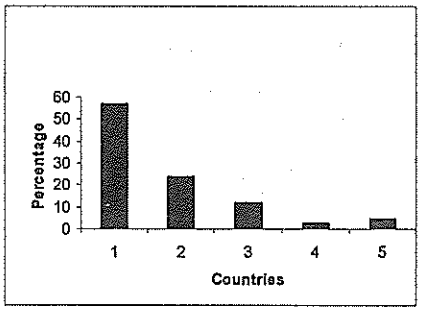
To find out the type of jobs the students wish to taken up after completion of degree programme, the students were given tour choices. It appears that about 40% of the students felt that whichever field they choose they wish to work as best Veterinarian .About 25% of them preferred to work in rural areas and 25% of them prefer to go for higher education and 3-5% of them expressed that they are still planning about the future job.

Fig9: Future Career plans



Career plans
1.Higher education
2.To be one of the best Veterinarian
3.Working in rural areas
4.Wish to study abroad
5.Still planning
6.Good Pathologist

Fig10.Countries preferred for Veterinary Education

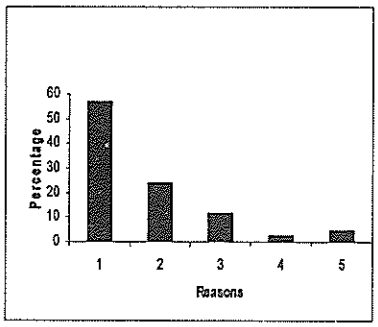


Countries
1.India
2.Australia
3.US
4.UK
5.Other

In the past majority of graduated Veterinarians opted to go abroad as better facilities are available in developed countries compared to India. With this view the present day students were asked which developed country is better compared to India for specialization in Veterinary profession..

In fig 9&10 it reveals that about 55% of students expressed that India is the best country for Veterinary than developed countries. About 20% of girls and 40% of the boys expressed Australia would be better country as 20% girls only prefer U.S.A and none of the boys preferred U.S.A. would be better country .

Fig11. Why do you think so



Reasons
1.I love my country
2.Good facilities
3.More importance is given to the Vet.
4.Economical,Scope for learning aspects
5.I don't know about other country

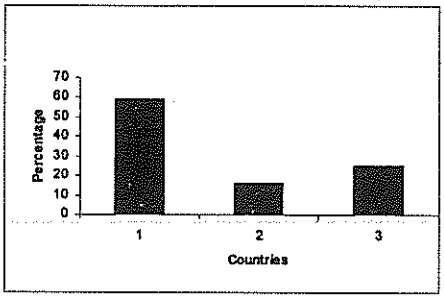
Since majority of the students expressed that India would be the better country for training of Veterinarians – the reason behind their opinion was enquired.

About 60% of the students expressed that studying here in India as they are patriotic and economical and there is more scope for learning.

About 20% of their 35% of boys expressed that developed countries like US, Australia are better as they have many technical facilities and infra structure for training veterinary compared to India which is still a developing country.

When students were asked to rank the countries for better training of Veterinarians majority of the students expressed that India would be the better country for training of Veterinarians – the reason behind their opinion was enquired. About 60% of the students expressed that studying here in India because they are born and brought up in this country so they are patriotic and it is also economical compared to other developed countries. About 20% of the girls and 35% of boys expressed that developed countries like US, Australia are better as they have many technical facilities and infra structure for training veterinary students compared to India.

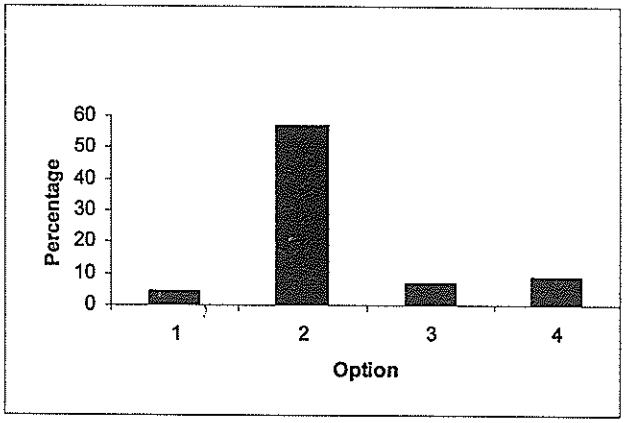
Fig12. Preference of the country for work



Countries

1. India
2. Abroad
3. In rural areas

Fig13. Change of carrier



Options

1.Yes
2.No
3.May be
4.Not given a thought

Given a chance to work in India or abroad after the completion of degree 65% of girls, 40% of boys expressed that they prefer to work only in India and only few percentage of students (10% of girls , 30% of boys) preferred to take up job in other countries. Either during the study or after completion of job 60% of students expressed that they wish to continue in same profession and do not wish to jump into other professions as shown in fig12&13.

To summaries the opinions of the students studying in veterinary college, The students have chosen veterinary profession due their passion for loving animals and enjoy studying their profession however, the subject poses difficulty. Many students are happy and satisfied to study in India and also work in rural areas of India which shows their patriotism.

ASSESSING THE EFFICIENCY OF IMPROVED SICKLE IN REDUCING THE DRUDGERY OF FARM WOMEN

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Small and marginal farm holders who constitute 79 percent of total farmers possessing only 32 percent of holdings characterize Indian agriculture.Average size of farm holdings is about 1.6ha which is further divided, resulting into very small plot sizes. Thus, low income, low investment capacity,reluctance to change traditionalm methods and lack of mechanical aptitude is the major constraints. The crop related constraints for the harvesting equipments include uneven ripening, severe lodging and high moisture content of grain and soil in some crop varieties and low shattering tendency of some crop varieties and low grain straw ratio of certain crops. The guiding principle in mechanizing Indian agriculture has been to maintain a practical mix of labour, draught animal power and mechanical power.

The Krishi vigyan has adopted Gadikusnoor, Janwad, Kouta village in Bidar district Karnataka state implementing the On-Farm Testing in farmers field. Paddy is cultivated in the village. Preliminary survey was conducted in the village revealed

that the drudgery involved during harvesting of crops by the farmwomen and laborers is one of the major problems in the rice based cropping system.

Assessing the efficiency of improved sickle

Harvesting of crops is one of the important agricultural operations, which demands considerable amount of labour and drudgery. Harvesting of crops is traditionally done by manual methods. It is estimated that harvesting and threshing of crops consumes about 33 per cent of the total production system. Timely harvest of crops is vital to achieve quality produce at educed loss. The timely harvest also helps in deriving maximum benefits due to appropriate marketing of produce. The use of appropriate machinery helps in reducing the drudgery involved in manual harvesting system. The shortage of labour during harvesting season and vagaries of the weather cause high losses to the farmers. The traditional harvesting is mostly done manually by sickles, which involves 18-25 man days per hectare. When the scientific agriculture is practiced and farm labour is paid in cash, the cost of operations is high. The cost also depends upon the availablity of the labour.

In view of the local sickles consuming more time and resulting in drudgery, 100 numbers of Bhopal serrated sickles were purchased from Central Institute of Agricultura Engineering, Bhopal, Madhya Pradesh and distributed to 140 farm families. The verification trial of the same was conducted with that of local sickles used by farmers. The Bhopal serrated blade sickle suitable for harvesting rice,wheat and grasses. The wooden handle has a bend at the rear for better grip and to avoid hand injury during operation. The labor requirement and field capacity are 80 man- hour and 0.018 ha per hour respectively. It saves 26 percent labor and operating time and 27 percent cost of operation compared by local sickle. The dimension of the sickle is 260mm length, 33mm width, and 17mm height. The weight is 0.257 kilogram. The length of cutting edge is 225mm and radius of curvature is 260mm. The number of teeth per centimeter is 5 and diameter of handle is 40mm.

Farmers felt that Bhopal serrated sickle have better serrated edges that what they have. The serrated edges lead to easy harvest and due to lengthy curvature it can hold more number of bundles. It can harvest 3 to 4 hills at a stretch. They are light in weight and save 25 percent of time of harvesting compared to local sickles. The time consumed to harvest one cent (40 square meter) of paddy land is 5 minutes in local sikles and 3 minutes in the case of Bhopal sickles were of very good quality and desirable and it can be repaired locally. These sickles reduced the drudgery of farm labourers. Operational efficiency of farm laborers, who got the practice of using Bhopal sickles, is remarkably good.The feedback obtained from farmers was shared with research.

Farmer's Perception

The perceptions of farmers regarding the use of drudgery alleviating agricultural tools were recorded from 140 sickle users during the month of January 2005. They are as below.

Table : Perception of farmers (n = 140)

Particulars	No.of farmers who expressed feedback	percentage
Low cost technology	136	97.14
Easy for adoption and maintenance	127	90.71
Drudgery reduction	119	85.00
Higher use efficiency	112	80.00
Women friendly farm implement	104	72.29

Conclusion :

The constraints encountered by farm women have to be properly identified by employing Preliminary survey and they can be facilitated to solve the production and post – harvest related problems through appropriate technological interventions. The critical inputs which limit the production efficiency of crops need to be made available to the all cultivars including farm women in the country.

Reference :

K. Ponnusamy, Assesing the Efficiency of Improved sickle and Coconut De-huskers in Reducing the Drudgery of Farm women. Agricultural Extension Review. Sept- Oct, 2005

PRE COLUMBIAN TRANS-OCEANIC CONTACTS BETWEEN INDIA AND SOUTH AMERICA

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World history has been distorted. An example of this is the "common knowledge" that Columbus discovered America and some say he didn't, nor were any other Europeans the first to touch America's shores. There is good reason to reexamine the history of the world and the new world in particular. An unbiased look into the Indology and archeology is essential at this juncture to resurrect the distorted steps in history...

There are quite number of studies to show that even before Columbus' visit to America, Asians had traveled to South America and this is indicated by the diverse agricultural common crops, chicken and cultural practices that exist in both Asian and south American countries. For example sweet potato, a crop of South America was found to be cultivated around 700AD in all the Polynesian islands. Brown, John Macmillan (1918) reports that a small percentage of Quichua (Mayan) words in Polynesian as well as in Japanese, along

with grammatical similarities.Asian chicken were found to be widespread even before the Spaniards reached South America. Recovery of chicken bones at El Arenal near Arauco Province, Chile provides Oceanic contact between Asia and America. Chickens originated in southern Asia and the Araucana species of Chile was thought to have been brought by the Spaniards around 1500; however, the bones found in Chile were radiocarbon-dated to between 1304AD and 1424AD, well before the documented arrival of the Spanish. DNA sequences taken were exact matches to those of chickens from the same period in Polynesian islands and differs from any breed of European chicken. The chicken bone is the first solid evidence that confirmed the Polynesian trans-oceanic contact in Pre-Columbus time. (Carter George 1971)

Carter George (1976) reports the Pre Columbian contacts between China and Peru was that in a remote village of Peru, the villagers were able to easily understand Chinese. .Yupa Indians of Venezuela also have a high proportion of a blood transferrin protein only found in the Chinese (Arends and Gallango, 1964).

Ibarra (1982) reports that there were migrations from 3000BC from Indonesia to Mexico transferring the knowledge of astronomical, calendar concepts, a geocentric view of the universe, 20-unit counting system, etc which continued till 500AD then onwards there was reverse migrations from South America to India and Chinese countries. At this time American culture of Mayan origin etc, reached Indochina carrying especially the false arch, tri-foliate-form portals, knowledge of zero, and other cultural traits which then diffused on to India and to Europe.

Pre-Columbian Maize in south India

Carl L. Johannessen and Anne Z. Parker (1989) reported that stone carvings of maize ears exist in at least three pre-Columbian Hoysala stone temples near Mysore, Karnataka state, India. Different varieties of the corn cob [Zea mays Linn.] are extensively sculpted but only on the Hindu and Jain temples of Karnataka. Various deities are shown as carrying a corn cob in their hands as on the Chenna Kesava temple, Belur. The straight rows of the corn grains can be easily identified. In the Lakshmi Narasimha temple, Nuggehalli, the eight-armed dancing Vishnu in his female form of Mohini is holding a corn cob in one of her left hands and the other hands hold the usual emblems of Vishnu In the Trikuta basti, Mukhamandapa, Sravanbelgola, Karnataka, a 12th century A.D. sculpture of Ambika Kushmandini sitting on a lotus seat under a canopy of mangoes holds in her left hand, a corn cob (fig 1 and fig 2).

* The common belief is that maize originated in Mexico and came to India after Columbus visit to America during 15th century. Maize was introduced to Europe after 15th century and later it might have diffused to India during 16th and 17th century. But the Hoyasala temples were built during 11th-12th century even before Columbus discovered America. Therefore Indologists conclude that by the time these temples were constructed, maize would have been fairly common in India and may be as one of the important agricultural crop grown in south India... Gupta(1976) does not stop with maize, but goes on to identify that even sunflower, pineapple, cashew, custard apple and monstera, all new world species exist in pre-Columbian temple art in India.

New Evidence of Maize in China

Uchibayashi (2005) reports an illustration of maize in a 1505 Chinese herbal entitled Bencao Pinhui Jingyao. He interprets that it is unlikely that maize could have diffused all the way to China in just 13 years after 1492, and hence interprets this as "clear evidence" that maize must have been in China "at least a few decades before 1505."

Uchibayashi also reports the use of the word yumi (maize) in the poem Youwu zashu, written by Xie Yingfan circa 1368AD. Two additional references, to yumai-zi or corn-silk, appear in works dating to the 15th century, though it could not be ascertained that these were not later additions to the original works.

Maize is Indian origin?

Despite the "common belief" (evidently Johannessen and Parker's) that maize was brought to India from Mexico prior to the construction of the Hoysala temples. Veena and Shigamani (1993) argue that the maize like structures though artistically resemble maize but do not represent maize instead it represents custard apple or jaina kalpa vruksha and Gupta (1996) argues that the similar but distinctly squatter objects that appear in earlier sculptures are not maize but rather Citron (Citrus medica var. Limonum of Watt.) or Lemon (Citrus limon [Linn.]), both Old World plants (Yaksha in an 8th century A.D.) A citron looks like a large lemon with its skin and does not simulate maize kernels of maize ear.

Gupta (1979) finds Sunflower (Helianthus annuus Linn.), a native of Central and South America in the Rani Gumpha cave, Udaigiri, 2nd century B.C. Johannessen independently reports sunflower in his article, "Pre-Columbian American Sunflower and Maize Images in Indian Temples (fig 3).

Sunflower common in India and South America

The history of the sunflower begins in Americas, the land to which it is indigenous. The native Indian cultures revered the sunflower – the Incan sunflower which was used as a symbol for their sun god and Olmec (Ancient Mexicans) sunflower rituals and temple sculptures are well documented, but perhaps the greatest use of the sunflower was by the Native American Indians 3000 years ago the Native Americans started cultivating sunflowers as a source of food.

Archeological evidence has shown that the Native Americans considered the sunflower a special crop and used it abundantly as far back as 2300BC. To the Native Americans, the sunflower symbolized strength and endurance, and was a prominent feature in their ceremonies. The Lakota Indians during their Sun Dance Ceremony, would wear medallions in the shape of a sunflower head as they danced during the ceremonial event. The Hopi put sunflowers in their hair and commemorated their ceremonies by drawing pictures of sunflowers in their lodges and kivas.

Sunflowers played an important part in the Inca Empire in Peru. In 1532 Francisco Pizarro was reported to have seen the natives of the Inca Empire worshiping a giant sunflower. Incan priestesses were also said to have worn garments with large sunflower disks made of gold. Sunflowers are important in many places of the world.

When the first Europeans came to America, they completely disregarded the sunflower - preferring traditional crops such as corn, wheat and rye to the sunflower – terming the sunflower as too difficult to harvest when compared to the standard fare, thus leading to gardening books largely ignoring the sunflower.

Other South American plants in Indian temples

Pineapple (Ananas cosmosus [Linn.] Merrill), a plant indigenous to Brazil is, according to Gupta, "clearly depicted" in Udayagiri cave temple, Madhya Pradesh circa 5th century A.D. Cashew (Anacardium occidentale Linn.), a native of Brazil, is depicted in a Bharhut stupa balustrade relief, circa 2nd century B.C. Gupta (1996) finds custard apple (Annona Squamosa Linn.) sculpted at Bharhut, circa 2nd century B.C., and at Kakatiya, Karnataka (12th century A.D). According to the Encyclopaedia Britannica, this plant is native to the New World tropics and Florida. And finally, monster (Monster delicious Liam.), also known as split leaf philodendron, a large evergreen climber native to Central America, appears in Hindu and Jain temples in Gujarat and Rajasthan from the 11th to 13th centuries. According to Gupta (1971), the chili pepper (Capsicum annuum Linn.) is mentioned in the Siva and Varmana Puranas, circa 6-8th centuries A.D. The naga lingham, the flower of the South American and West Indian cannonball tree (Couroupita guaianensis Aubl.), was, according to Gupta, "cultivated in India from very early times." In her time frame, this would mean very early pre-Columbian times.

The existence of cotton in Asia, Africa and India is another evidence to show that there was oceanic contact between these countries.

Summary

To summerise there were more or less regular contacts between south East Asia and South America from the second to the ninth or tenth century as depicted by the existence of agricultural crops, cultural practices common between the two countries.

Indian sailors could learn about America from the Chinese in Southeast Asia, whose Trans-Pacific voyages continued, during which time the Hindus colonized Southeast Asia. It is likely that the technological capacity for transoceanic voyaging has been available at a number of possible departure points in the Old World. It seems to us both plausible and probable that numerous voyages did cross the oceans and in several places. Furthermore, available evidence from cultural, botanical, linguistic studies supports this.

Archeological evidences in Indian temples provide the presence of south American plants such as maize, sunflower were known to Indians even before Columbus visited America suggest that there was transoceanic contact between India and South America

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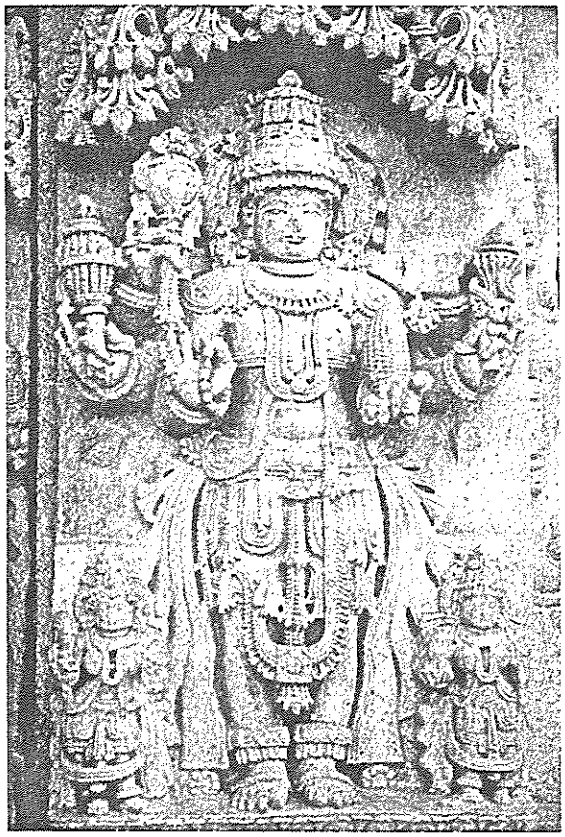
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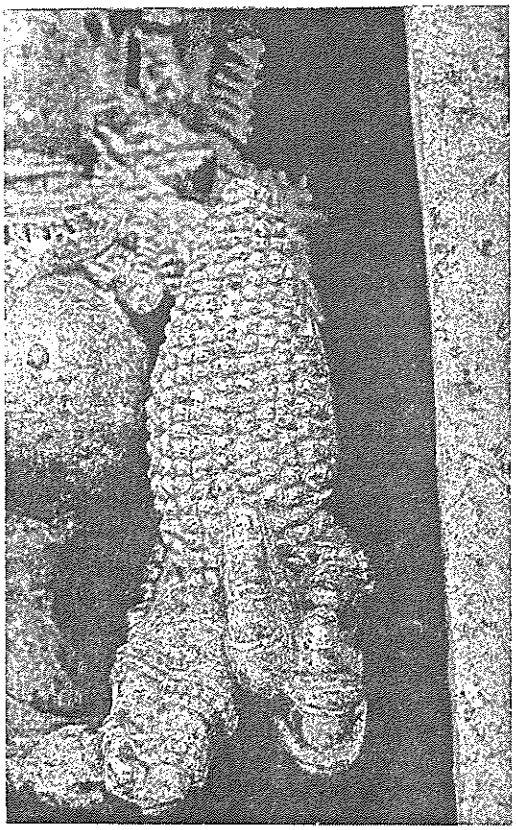
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Figures 1 and 2 Maize like sculptures in Hoyasala temples of south Karnataka

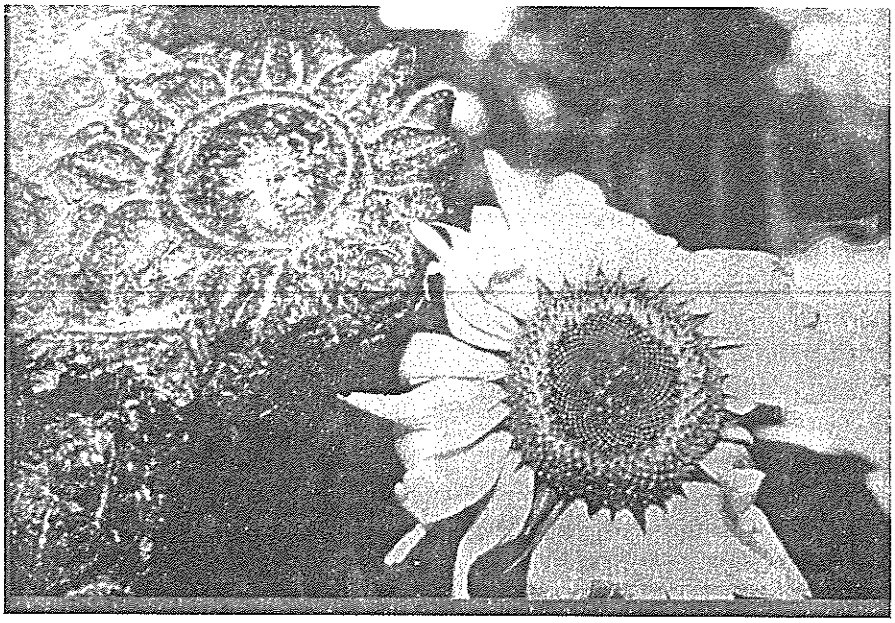


Figure 3 Sunflower in Udayagiri cave temple (2nd century)

IMPACT OF IMPROVED TECHNOLOGIES IN DRUDGERY REDUCTION OF FARM WOMEN

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Introduction:

Women form 50 percent of population and constitute 60 percent work force but earn only 10 percent of income. Women in Indian villages shoulder a larger part of the agricultural labour and household drudgeries. They contribute substantially in the physical aspect of farming, live stock management, post harvest and allied activities. They do the most tedious and back-breaking tasks in agricultural, animal husbandry and homes. Therefore drudgery of farm women is an important aspect that has attracted wide attention of researchers today. Women are involved in more strenuous activities as compared to men. Many such activities are drudgery prone to varying degrees. Even women suffer from different health problems which adversely affect their working efficiency and family welfare. Unfortunately, data on the extent to which women are affected in the working environment and the effect on their work output are not available. Hence a study was carried out to relieve the farm women of drudgery by providing time and labour saving technologies in 3 villages of Bijapur taluk, Karnataka with the following objectives.

Objectives:

1. To test the percentage increase in work efficiency by using the improved technologies.
2. To popularize the technologies.

Methodology:

Three villages namely Hitnalli, Kumte and Shirknalli were selected for the study. The drudgery reducing technologies like improved sickle, tubular maize sheller, and groundnut decorticator were selected for the study. The sample comprised of 10 women for improved sickle, 15 women each for maize sheller and groundnut decorticator respectively . Comparison was made between the use of local sickle and improved sickle, maize shelling by hand and rotary maize sheller, decortication of groundnut by hand and by using groundnut decorticator . Suitable statistical analysis was used to analyse the data.

Results and discussion:

The results revealed 20 percent increase in work efficiency by using improved sickle compared to the local sickle (Table 1). Also there was no need to apply more pressure in cutting the wheat crop as the improved sickle has serrations and is light in weight. The women could harvest a larger area in a shorter span of time compared to the local sickle which has no serrations and is heavy in weight. The results of the study are in line with the findings by Singh et. al (2007) and Sunita et.al (2008).

Similarly, the results revealed a higher percentage i.e 33 percent increase in work efficiency by using the rotary maize sheller compared to the traditional method of shelling the maize by hand (Table-2). The rotary maize sheller is very useful to the poor farmers who have smaller land holdings.

Further, groundnut decorticator was given to 15 women. The results revealed 82 percent increase in decortication of groundnut by using the decorticator compared to decortication by using hand (Table -3). The groundnut decorticator is very much useful for farm women during sowing season. It saves time and energy. Also this can be taken up as an entrepreneurial activity by carrying out the decortication work on payment basis.

Conclusion:

To conclude, the positive impact of using these improve technologies is that work efficiency is more, time an energy are saved and the drudgery caused to farm women is reduced.

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Table-1: Comparison between harvesting of wheat by improved sickle and local sickle

Data on the performance indicators of the technology assessed		Efficiency
Area covered by local sickle in ½ hour (Sqft)	Area covered by improved sickle in ½ hour (Sqft)	
560	800	20 % increase in efficiency
440	720	
560	720	
480	640	
560	680	
400	720	
480	760	
440	760	
520	720	
440	720	
488	760	
Total 5368	**8000**	
Average 488	**727.27**	

Table-2: Comparison between shelling of maize by maize sheller and by hand

Data on the performance indicators of the technology assessed		
Quantity of maize shelled in ½ hour using maize sheller (Kg)	Quantity of maize shelled in ½ hour by hand (Kg)	Efficiency
4.0	2.0	33 % increase in efficiency
5.0	2.5	
4.0	2.25	
4.5	2.75	
4.75	2.5	
4.0	2.0	
4.5	2.0	
5.0	2.5	
4.5	2.0	
4.75	2.5	
5.0	2.75	
4.25	2.0	
3.80	2.0	
4.20	2.0	
5.0	2.0	
4.48	2.25	
Total 71.73	36.00	
Average 4.78	2.4	

Table-3: Comparison between decortication of groundnut by groundnut decorticator and by hand

Data on the performance indicators of the technology assessed		
Quantity of Groundnut decorticated in 1 hour using Hand (Kg)	Quantity of Groundnut decorticated in 1 hour using Groun nut decortica tor (Kg)	Efficiency
2.5	9.0	82 % increase in efficiency
1.0	7.0	
1.2	8.0	
1.3	9.0	
2.0	7.0	
1.0	7.5	
1.5	8.0	
1.0	7.0	
1.2	7.5	
1.5	9.0	
1.2	7.5	
1.0	8.0	
1.1	7.0	
1.3	7.0	
1.0	7.0	
Total 19.8	115.5	
Average 1.32	7.7	

GOAT REARING FOR RURAL WOMEN FOLK –A CASE STUDY

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Introduction:

Goat is a multi functional animal and plays a significant role in the economy and nutrition of landless, small and marginal farmers in the country. Goats can efficiently survive on available shrubs and trees in adverse harsh environment in low fertility lands where no other crop can be grown and they serve as an insurance against natural disaster. Hence rearing of goats has been a traditional occupation in both the rural and urban situations.

Our country has 124 million goats as per 2003 livestock census. Karnataka State has 4.4million goats which are non-descript types and produce 20.55 million tonnes of goat meat through organized production systems in Karnataka. The demand for goat meat seems to be on the increasing trend. But we see that the goat rearing is mostly in the hands of poor and land less labourers and this sector seems to be unorganized as compared to other animal husbandry practices like the Dairy, Sheep and Poultry. In order to get a picture of the present scenario and the dependency of the small farmers on goat rearing for their livelihood a pilot study was undertaken in selected villages of Karnataka.

Objective:

1. To study whether the farm women were able to sustain their livelihood on goat rearing. Their dependency on other sources for maintaining their family,
2. Rearing practices and the marketing methods.

Methodology:

Area of study: Selected villages of Bhadravathi Taluk, Shimoga District Karnataka.

Type of climate and agricultural practice: The villages selected were situated in the Bhadra command area where in the major channel from the Bhadra reservoir inundates. The farmers practice cultivation of paddy, sugarcane and Areca plantations. Small farmers preferably sustain their livelihood through animal rearing apart from working as farm labours. The climate is quite humid through out the year and the temperature ranges from 23° C to 28° C through out the year and the South West monsoon brings ample rains between the months of June and October.

Name of villages where the study was undertaken: Kudligere and its hamlets, Arekere and its hamlets, certain villages at-

tached to Bhadravathi Taluk Head quarters.

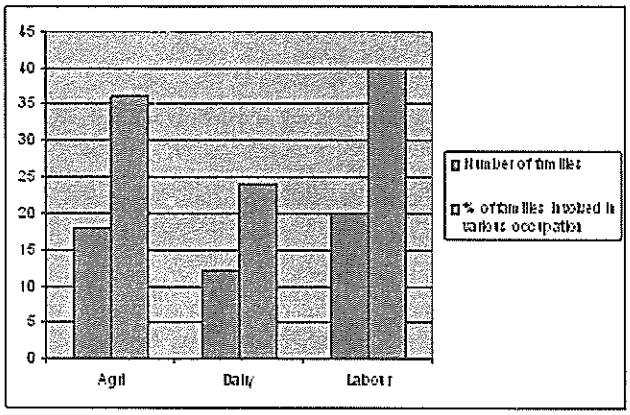
Type of families studied:

Fifty families rearing goats were taken for the study. Detail list of the families with their subsidiary occupation was recorded. The goats owned by each family was categorized and the marketing methods were also recorded and the data was analyzed. The fifty families taken into the study had a minimum of 20 goats in different age groups. The data were collected by personal interview schedule. The primary data were collected on the socio economic conditions of the sample farmers like land holdings, size of the family, number of goats reared, age group of animals and details of marketing and their dependence on other occupation to sustain their living. The data were tabulated and analyzed by the conventional analysis in the form of averages and percentages.

Results & Discussion:

Percentage of people rearing goats as subsidiary enterprise:

Table:1



Occupation	No of families	% of families
Agriculture	18	36
Dairy	12	24
Labour	20	40

Out of the fifty families studied 36 % were agriculturist and were rearing goats to supplement the income. 40% of the labour class invariably had goats to sustain their livelihood.24% of the families studied who were landless dairy farmers also reared goats to supplement their income. These farmers were found to possess one or two buffaloes each. Hence the income from goats substituted their income in case if their dairy animals were pregnant or dry.

Family size and size of goat flock:

The data collected was classified depending upon their family size to see their dependence on goat husbandry.

Table :2

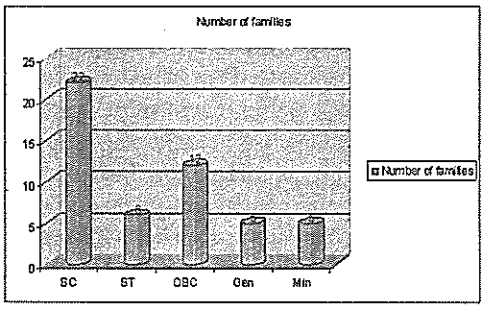
Family members	*No. of families*	*No of goats reared*	*% goats possessed*
<5 members	*11*	*309*	*19.23*
5-8 members	*22*	*684*	*42.56*
>8 members	*17*	*614*	*38.21*
	50	*1607*	*100*

It was observed that large family size with 5-8 memebers and >8 members in a family possessed 42.56 and 38.21% respectively. This shows that family labour is being utilized for rearing more number of goats. On an average these big families were seem to possess 30-35 goats in various age groups.

Percentage of goat rearing among various caste groups

Table : 3

	No of Families	No of goats	% involved in rearing goats	% of goats among various castes
SC	22	719	44	44.91
ST	6	207	12	12.93
OBC	12	103	24	6.43
General	5	435	10	27.17
Minorities	5	137	10	8.56
Total	50	1601	100	100

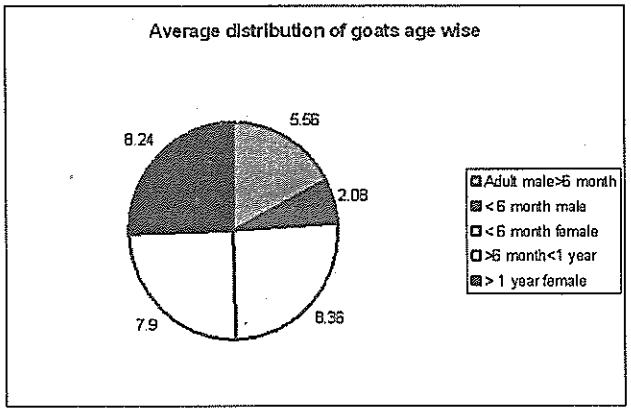


As per this observation in the study 44 % of goats were reared by the people belonging to scheduled caste and they also possessed highest number of goats. Only 10 % of the families belonging to general category possessed goats but still number of goats possessed was higher with 27 % of goats owned by them. The minorities possessed 8 % percent of the total goats studied though only 10 % of them were involved in this occupation.

Age wise distribution of goat population and their management in this study:

Table :4

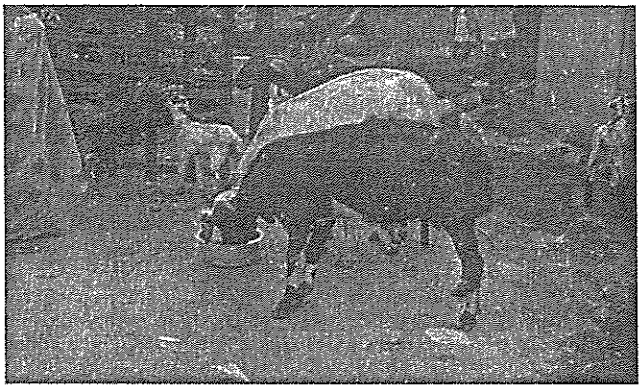
Age group	No. of goats	Average	%
Adult male> 6 month	278	5.56	17.30
< 6 month male	104	2.08	6.47
< 6 month female	418	8.36	26.01
>6 month<1 year	395	7.9	24.58
> 1 year female	412	8.24	25.64
	1607		
Total Male	**382**		**23.77**
Total Female	**1225**		**76.23**

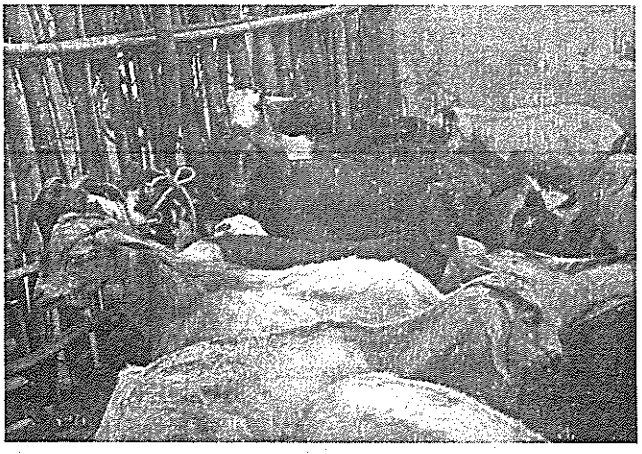


Nearly 75% of the flocks maintained were in the age group of 6 months to one year. This shows that the goats were breeding properly and the sex ratio of 5:1 was maintained in all the flocks. These goats were accommodated in semi Kutcha sheds and most of them were attached to the human dwellings. It was found that these temporary shelters were constructed with locally available materials and the flooring was also mud and some farmers have adopted the slatted floor at a height of 3-4feet to avoid water logging. These animals are taken care by all the family members for grazing. Besides grazing the animals were fed with supplementary feed on tree leaves (Soobabul, Jackfruit and some forest trees and shrubs) and concentrate mixture containing oilcake, Rice bran and salt. On some occasions with the advice of the local veterinarian the pregnant and nursing animals are fed with mineral mixture. All these goats are de wormed twice in a year with the medicine supplied by the local Veterinary services. Since the past 8 years all the goats were vaccinated for FMD, Enterotoxaemia, PPR and Hemorrhagic septicemia vaccines. The recurring expenditure on Veterinary was bear minimal as the major share was supplemented by the Government Veterinary Hospital. On an average each farmer is found to be selling 20-25 goats in one year and the price fluctuated depending upon the seasonal demand. It ranges from 1800-3000 per goat. The goat manure valuing about 6000-8000 is being sold locally to the agriculturist. On an average their annual income ranges from 30,000 to 55,000/year from a unit of 25 goats. The total expenditure on feed supplements and medical expenditure was upto an average of Rs 500/ per goat in a year. Though the flock strength was found to be increasing the flock strength was maintained around 20-25 numbers in most of the houses for want of space for shelter. These farmers were found to sell their goats as live animals to local slaughter houses or neighboring shandies. It was found that the true were not getting the full benefit as many middle men were involved in marketing and ultimately the consumers were found to pay 75% higher than the original cost. This shows that there exist a large gap between the producer and consumer.

Conclusion & summary:

Based on this study it was understood that goat rearing was a sustainable occupation for rural women and as well it was found that further studies on this species is required to improve upon the species by selective breeding practices. For this lot of genetic studies should be undertaken to improve upon the breedable groups so as improve the future generations in terms of body weight gain. The rearing of goats provides a regular income through out the year and hence can be recommended as an allied enterprise to agriculture. It does suit well to the self help groups who can think of rearing the flocks in groups. This will in turn help to improve upon the goat market in the form of co-operatives to have organized mechanized slaughter house and thus reduce the gap between the producer and consumer





SCOPE AND POTENTIAL OF ETHNOVETERINARY MEDICINE

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Introduction

India is a country with rich livestock population. Although several governmental and non-governmental services exist to prevent, control or eradicate major livestock diseases, farmers still have to cope with many animal diseases and other problems like low fertility and productivity of their animals. Veterinary services on a regular basis are not able to cater to the farmers whose habitations are too far away from the main towns and even if they are available they cannot afford to pay for veterinary services. Even with increasing number of veterinary graduates in India, the delivery of veterinary services to the majority of farmers is declining in many areas. If primary animal healthcare services are ever to reach a majority of the farmers livestock, then as WHO recognized for human patients nearly two decades ago it is necessary to tap all possible practitioner resources, including traditional healers and localized paraprofessionals. Traditionally, veterinarians and "science" in general have tried to discourage traditional medicines in favor of the modern medicine in which they were trained. Researchers simply have not seen hard evidence to prove or disapprove its existence and value. This is partly because healers seldom record their accomplishments in writing, rarely write papers on their discoveries and do not attach their names and patents to their inventions.

Like scientific veterinary medicine, ethnoveterinary practices have been developed through trial-and-error and deliberate experimentation. But ethnoveterinary medicine is developed by farmers in fields and barns, rather than by scientists in laboratories and clinics. It is less systematic and less formalized, and is usually transferred by word of mouth rather than in writing. 'Modern' medicines are economically often unrealistic to those in the low-income groups and those living in remote areas. Ethno veterinary remedies on the other hand are often freely available and are already part of the existing culture and are relatively easy to administer (Lans, 2001). This paper discusses the scope and potential of ethnoveterinary knowledge which can be used as an alternative source of treatment and recommendations to prevent the loss of valuable indigenous information.

Scope and Potential

Ethnoveterinary medicine remains as an ethnoscientific resource that is yet to be tapped and has a far reaching implication on the economic development and enhancement of veterinary health of particularly rural poor communities, which do not have access to modern medical services. Throughout the world, it has been recognized that for this dream to be positively realized and benefit these communities, there is a need for official safeguards to be installed in the process to avoid abuse and misuse of ethnoveterinary knowledge, as identification and standardization for safety and validity of this knowledge continues putting more emphasis on proven universal remedies. However, identification of beneficial and appropriate ethnoveterinary interventions is really a great challenge to the advocates of ethnoveterinary research and development in the 21st Century. There is also a need to facilitate a multilateral dialogue between local communities, NGOs, governments, donors, civil society and the private sector with the ultimate objective of mainstreaming indigenous/traditional knowledge into the activities of development partners and to optimize the benefits of development assistance, especially to the poor. However, this may be adversely affected by the multiplicity of factors determining the application, form and the amount of ethnoveterinary knowledge

Ravindra and Rao (1997) have suggested the establishment of a central apex body for the formulation of policies & programmes and identification of educational and training needs to popularize ethnoveterinary medicine in India, setting up of regional work stations for the collection and documentation of information on prevailing ethnoveterinary practices and imparting education and training for the people who are interested in ethnoveterinary medicine, standardization of ethnoveterinary techniques and the dissemination of standardized techniques into areas with similar agro-climatic conditions through a well designed extension system, identification of critical states in which the ethnoveterinary system would have to play a lead role with appropriate infrastructure facilities and related incentives, translation of information in vernacular languages and development of database systems. An indigenous animal health care system could be included in the curricula of veterinary college and universities. This integration of animal health care widens the spectrum of available choices to farmers, veterinarians and extension workers and is one way of making services for local conditions both more appropriate and more cost effective. While the use of ethnoveterinary medicine is recommended as a worthwhile and cost effective alternative to orthodox veterinary medicine, it is important to note that local farmers should also be taught that traditional herbs are generally ineffective in the case of epidemics such as foot and mouth disease and are not a solution for all diseases affecting animal health. The significance of ethnoveterinary knowledge is gaining increasing recognition even among representatives of mainstream animal science. If sufficient attention is paid to these alternative medical traditions during veterinary training, it may go a long way toward preparing students practice as well as fostering the sustainable use of natural resources available within their local communities (Matekaire and Bwakura, 2004).

Recommendations and Conclusions

1. Documentation and Scientific validation of Ethnoveterinary knowledge
2. Education and training to the people who are interested in ethnoveterinary medicine.
3. Standardization of ethnoveterinary techniques and dissemination of standardized techniques.
4. Translation of information in vernacular languages and development of database systems.
5. An indigenous animal health care system could be included in the curricula of veterinary college and universities
6. Conservation of medicinal plants and development of standard specifications for herbal medicines by indicating the ingredients, the amount and range of the active principles, their therapeutic properties.

Ethnoveterinary information is in danger of extinction because of the current rapid changes in communities all over the world. Parallel use of the two knowledge systems is suggested as important for several reasons, i.e., to bring about a reduction in the dependency on expensive imported veterinary drugs and supplied, the possibility of discovering new drugs, the increase in manpower at a lower cost, the improvement in communications and contacts between livestock owners and veterinarians, the use of more natural drugs, which do not have the toxic effects on animals which are sometimes experienced with synthetic drugs.

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ರೇಷ್ಮೆ ಕೃಷಿಯಲ್ಲಿ ಮಹಿಳೆಯ ಪಾತ್ರ ಆಕೆ ಎದುರಿಸುವ ಸಮಸ್ಯೆಗಳಿಗೆ ತಾಂತ್ರಿಕತೆಗಳು ಹಾಗೂ ಸಲಹೆಗಳು

ಶ್ರೀಲತಾ.,

ವಿಜ್ಞಾನಿ–ಸಿ, ಕೇಂದ್ರ ರೇಷ್ಮೆ ಸಂಶೋಧನೆ ಮತ್ತು ತರಬೇತಿ ಸಂಸ್ಥೆ, ಮೈಸೂರು

ಭಾರತದಲ್ಲಿ ರೇಷ್ಮೆ ಕೃಷಿಯು ದೇಶೀಯ ಕೃಷಿ ಪದ್ಧತಿಯಲ್ಲದೆ ನಮ್ಮ ಸಂಸ್ಕೃತಿಯೂ ಹೌದು. ಇದು ಕೃಷಿ ಹಾಗೂ ಕೈಗಾರಿಕೆ ಎರಡನ್ನು ಒಳಗೊಂಡಿರುವುದರಿಂದ ಗ್ರಾಮಾಂತರ ಪ್ರದೇಶದ ಜನರಿಗೆ ಉದ್ಯೋಗಾವಕಾಶವನ್ನು ಒದಗಿಸುವುದಲ್ಲದೆ ಭೂಮಿ ಮತ್ತು ಸ್ವತ್ತಿಲ್ಲದೆ ಇರುವ ಬಡವರಿಗೆ ಹಾಗೂ ಮಹಿಳೆಯರಿಗೆ ಆದಾಯ ಒದಗಿಸುವ ಮಾರ್ಗವಾಗಿದೆ, ರೇಷ್ಮೆ ಕೃಷಿಯಲ್ಲಿ ಉದ್ಯೋಗಾವಕಾಶಗಳು ವಿಪುಲವಾಗಿರುವುದರಿಂದ ಅದನ್ನು ಉತ್ತಮ ಗುಡಿಕೈಗಾರಿಕೆ ಎನ್ನಲಾಗಿದೆ. ಇತರೆ ಬೆಳೆಗಳಿಗೆ ಹೋಲಿಸಿದರೆ ರೇಷ್ಮೆ ಕೃಷಿಯಲ್ಲಿ ಅಧಿಕ ಹಾಗೂ ನಿರಂತರ ಆದಾಯ ಹಾಗೂ ರೇಷ್ಮೆ ಉತ್ಪನ್ನದ ರಫ್ತಿನಿಂದ ಆದಾಯದಾಯಕ.

ರೇಷ್ಮೆ ಕೃಷಿಯಂತಹ ಸುಲಭ ಗುಡಿ ಕೈಗಾರಿಕೆಯು ಮಹಿಳೆಗೆ ಸೂಕ್ತವಾಗಲು ಕಾರಣ, (1) ಕುಟುಂಬದಲ್ಲಿ ಮಹಿಳೆ ರೇಷ್ಮೆ ಕೃಷಿಯಲ್ಲಿ ತೊಡಗಿದಾಗ ಹೆಚ್ಚಿನ ಆದಾಯ (2) ಅಧಿಕ ಬಂಡವಾಳ ಬಯಸದ ರೇಷ್ಮೆ ಕೃಷಿ ಮಹಿಳೆಯರಿಗೆ ಕೈಗೊಳ್ಳಲು ಸುಲಭ (3) ರೇಷ್ಮೆ ಕೃಷಿಯು ಹೆಚ್ಚು ದೈಹಿಕ ಶ್ರಮ ಬಯಸದ ಕಾರಣ ಮಹಿಳೆಗೆ ಸೂಕ್ತ. (4) ಮನೆಯ ಕೆಲಸ ಕಾರ್ಯಗಳೊಂದಿಗೆ ಸರಿದೂಗಿಸಿಕೊಂಡು ಹೋಗುವ ಕೃಷಿಯೂ ಇದಾಗಿದೆ (5) ಹುಳು ಸಾಕಾಣಿಕೆಯ ಪ್ರಕ್ರಿಯೆಯ ತಾಯ್ತನದ ಮಧುರ ನಡವಳಿಕೆಯನ್ನು ಸದುಪಯೋಗ ಪಡಿಸಿಕೊಳ್ಳುತ್ತದೆ.

ಜಗತ್ತಿನ ವಿವಿಧ ಬಗೆಯ ನೂಲಿನ ಉತ್ಪಾದನೆಯಲ್ಲಿ ರೇಷ್ಮೆಯ ಉತ್ಪಾದನೆ ಶೇ 0.2 ರಷ್ಟಿದ್ದರೂ ಸಹ ರೇಷ್ಮೆ ಇಂದಿಗೂ ಸಹ ವಸ್ತ್ರಗಳ ರಾಣಿ ಎಂದೇ ಪರಿಗಣಿಸಲ್ಪಟ್ಟಿದೆ. ರೇಷ್ಮೆ ಆವಿಷ್ಕಾರಗೊಂಡಿದ್ದು ಹೆಣ್ಣಿನಿಂದಲೇ ಎನ್ನುವುದು ನಿಮಗೆ ತಿಳಿದಿದೆಯೇ? ಚೀನಾ ದೇಶದ ರಾಜಕುಮಾರಿ ಸಿಲಿಂಗ್‌ಶಿ ಎನ್ನುವವಳು ಕ್ರಿ.ಪೂ 2600 ಇಸವಿಯಲ್ಲಿ ಹಿಪ್ಪುನೇರಳೆ ಮೊದೆಯ ಕೆಳಗೆ ಕುಳಿತು ಬಿಸಿ ಚಹ ಹೀರುತ್ತಿರುವಾಗ ಬಟ್ಟಲಿನೊಳಗೆ ರೇಷ್ಮೆ ಗೂಡೊಂದು ಬಿದ್ದಿತು. ಅದನ್ನು ಎತ್ತೆಸೆಯುವ ಪ್ರಯತ್ನದಲ್ಲಿದಾಗಲೇ ರೇಷ್ಮೆ ಆವಿಷ್ಕಾರವಾಯಿತು. ರೇಷ್ಮೆ ಕೃಷಿಯಲ್ಲಿನ ಕಾರ್ಯ ಚಟುವಟಿಕೆಗಳನ್ನ ಐದು ವಿಭಾಗಗಳಾಗಿ ವಿಂಗಡಿಸಬಹುದು.

1. ರೇಷ್ಮೆ ಬೀಜೋತ್ಪಾದನಾ ಘಟಕ.
2. ಹಿಪ್ಪುನೇರಳೆ ಬೇಸಾಯ ಘಟಕ.
3. ಚಾಕಿಹುಳು ಸಾಕಾಣಿಕೆ ಘಟಕ.
4. ಬೆಳೆದ ಹುಳು ಸಾಕಾಣಿಕೆ ಘಟಕ.
5. ನೂಲು ಬಿಚ್ಚಾಣಿಕೆ ಮತ್ತು ವಸ್ತ್ರ ತಯಾರಿಕೆ.

ವಿಧಾನಗಳು

ರೇಷ್ಮೆ ಕೃಷಿ ಚಟುವಟಿಕೆಗಳಲ್ಲಿ ಮಹಿಳೆಯ ಶೇಕಡವಾರು ಭಾಗವಹಿಸುವಿಕೆಯನ್ನು ಕೆಳಕಂಡ ಕೋಷ್ಟಕದಲ್ಲಿ ನೀಡಲಾಗಿದೆ.

ಕೋಷ್ಟಕ–1 ಬೀಜೋತ್ಪಾದನ ಘಟಕದಲ್ಲಿ ಮಹಿಳೆಯರು

ಕಾರ್ಯ ಚಟುವಟಿಕೆ	ಭಾಗವಹಿಸುವಿಕೆಯ ಶೇಖಡವಾರು
ಗೂಡು ಸ್ವಚ್ಛತೆ ಹಾಗೂ ಸಂರಕ್ಷಣೆ	78%
ಕೋಶದ ಲಿಂಗ ವಿಂಗಡಣೆ	92%
ತಾಯಿ ಚಿಟ್ಟೆ ಪರೀಕ್ಷೆ	47%
ಮೊಟ್ಟೆ ಪರಿಷ್ಕರಣೆ	61%
ಬಿತ್ತನೆ ಕೋಠಿ ಸ್ವಚ್ಛತೆ, ನೈರ್ಮಲ್ಯತೆ	75%

ರೇಷ್ಮೆ ಬೀಕೋತ್ಪಾದನೆ ಮಾಡುವ ಕಾರ್ಯ ಸ್ಥಳವನ್ನ ಬಿತ್ತನೆ ಕೋಠಿ ಎನ್ನುತ್ತಾರೆ. ಇಲ್ಲಿ ಅನೇಕ ಕಾರ್ಯಗಳನ್ನ ನಡೆಸಲಾಗುತ್ತದೆ. ಮೊದಲಿಗೆ ಬಿತ್ತನೆ ಗೂಡುಗಳು ಮಾರುಕಟ್ಟೆಗಳಿಂದ ಆಗಮಿಸಿದಾಗ ಅವುಗಳ ವಿಂಗಡಣೆ ಹಾಗೂ ಸಂರಕ್ಷಣೆ (78%) ನಂತರದ ದಿನಗಳಲ್ಲಿಸಂರಕ್ಷಿಸಿಟ್ಟ ಗೂಡುಗಳನ್ನು ತೆಗೆದು ಅವುಗಳ ಗುಂಜು ಬಿಡಿಸಿ ಗೂಡು ಕತ್ತರಿಸುವ ಕಾರ್ಯ ಗೂಡಿನೊಳಗಿರುವ ಕೋಶಗಳನ್ನು ಸೂಕ್ಷ್ಮವಾಗಿ ಗಮನಿಸಿ ಅವುಗಳ ಲಿಂಗ ವಿಂಗಡಣೆ ಮಾಡಿ ಪ್ರತ್ಯೇಕವಾಗಿ ಸಂಗ್ರಹಿಸಿಡುವುದು (92%) ಈ ಕೋಶಗಳಿಂದ ಚಿಟ್ಟೆಗಳು ಹೊರಬರುವುದು ಸಾಮಾನ್ಯವಾಗಿ ರಾತ್ರಿ 1/2 ಘಂಟೆ (ಗಂಡು ಗೂಡು) ಹಾಗೂ 3/4 ಘಂಟೆ (ಹೆಣ್ಣು ಗೂಡು) ಯಾಗಿರುವುದರಿಂದ ಸಾಮಾನ್ಯವಾಗಿ ರಾತ್ರಿ ಪಾಳಿಯಲ್ಲಿ ಮಹಿಳೆಯರು ಕೆಲಸಕ್ಕೆ ಹಾಜರಾಗದ ಕಾರಣ ಈ ಒಂದು ಕಾರ್ಯದಲ್ಲಿ ಪೂರ್ಣ ಪ್ರಮಾಣದಲ್ಲಿ ಪುರುಷರೇ ಭಾಗವಹಿಸುತ್ತಾರೆ. ಆದರೆ ಮಾರನೇ ಬೆಳಿಗ್ಗೆ ಕೆಲಸಕ್ಕೆ ಹಾಜರಾಗುವ ಮಹಿಳೆಯರು ಚಿಟ್ಟೆಗಳ ಬೇರ್ಪಡಿಸುವಿಕೆ, ಮೊಟ್ಟೆ ಇರಿಸುವಿಕೆ ಕಾರ್ಯ ಕೈಗೊಳ್ಳುತ್ತಾರೆ. ಮೊಟ್ಟೆ ಇಟ್ಟ ತಾಯಿ ಚಿಟ್ಟೆಗಳ ಸಂಗ್ರಹ ಹಾಗೂ ಅವುಗಳ ಪರೀಕ್ಷಿಸಿ (ಸೂಕ್ಷ್ಮ ದರ್ಶಕದಲ್ಲಿ) ರೋಗ ಇಲ್ಲವೆಂದು ದೃಢಪಡಿಸುವುದು (47%) ನಂತರ ಮೊಟ್ಟೆಗಳನ್ನು ಮೇಲೆ ಸೋಂಕು ನಿವಾರಣೆ ಹಾಗೂ ತೊಳೆದು ಒಣಗಿಸುವಿಕೆ, ಮೊಟ್ಟೆಗಳ ಆಮ್ಲ ಪರಿಷ್ಕರಣೆ ಹಾಗೂ ಮಾರಾಟಕ್ಕೆ ಸಿದ್ಧ ಪಡಿಸುವುದು (61%) ಬಿತ್ತನೆ ಕೋಠಿಯಲ್ಲಿ ಸ್ವಚ್ಛತೆ ಹಾಗೂ ನೈರ್ಮಲ್ಯತೆ ನಿರ್ವಹಣೆ ಹಾಗೂ ಉಪಕರಣಗಳ ಸೋಂಕು ನಿವಾರಣೆ ಹಾಗೂ ಮೊಟ್ಟೆಗಳ ಮಾರಾಟ ಈ ಎಲ್ಲ ಕೆಲಸಗಳನ್ನು ಬಿತ್ತನೆ ಕೋಠಿಗಳಲ್ಲಿ ಶೇಕಡ 75% ರಷ್ಟು ಕೆಲಸ ಕಾರ್ಯಗಳಲ್ಲಿ ಪಾಲ್ಗೊಳ್ಳುತ್ತಾಳೆ.

ಕೋಷ್ಟಕ–2 ಹಿಪ್ಪು ನೇರಳೆ ಬೇಸಾಯ ಘಟಕದಲ್ಲಿ ಮಹಿಳೆಯರು

ಕಾರ್ಯಚಟುವಟಿಕೆ	ಶೇಕಡವಾರು ಭಾಗವಹಿಸುವಿಕೆ
ಕಳೆಕೀಳಲು	100%
ರಸ್ತೆಗೊಬ್ಬರ ಹಾಕಲು	60%
ಸೊಪ್ಪು ಕೀಳಲು	60%
ಕೊಟ್ಟಿಗೆ ಗೊಬ್ಬರ ಹಾಕಲು	70%
ರೆಂಬೆ ಕತ್ತರಿಸಲು	50%
ಅಂತರ ಬೇಸಾಯ	10%

ಕೋಷ್ಟಕ 2ರಲ್ಲಿ ಕಂಡು ಬಂದಂತೆ ಮಹಿಳೆಯರು ತೋಟದಲ್ಲಿನ ಕಳೆಕೀಳಲು ಶೇಕಡ 100% ಭಾಗವಹಿಸುತ್ತಾರೆ. ನಂತರ ರಸಗೊಬ್ಬರ ಹಾಕಲು ಹಾಗೂ ಸೊಪ್ಪು ಬಿಡಿಸುವ ಕಾರ್ಯದಲ್ಲಿ ಶೇಕಡ 60% ರಷ್ಟು ಪಾಲ್ಗೊಳ್ಳುತ್ತಾಳೆ. ನಂತರ ಕೊಟ್ಟಿಗೆ ಗೊಬ್ಬರ ಹಾಕುವ ಕಾರ್ಯದಲ್ಲಿ ಶೇಕಡ 70% ರಷ್ಟು ಪಾಲ್ಗೊಳ್ಳುತ್ತಾಳೆ. ರಂಬೆಗಳನ್ನು ಕತ್ತರಿಸಲು ಶೇಕಡ 50% ರಷ್ಟು ಭಾಗವಹಿಸುತ್ತಾಳೆ. ಭೂಮಿ ಮಟ್ಟ ಮಾಡಲು ಅಗೆದು ಅಂತರ ಬೇಸಾಯ ಕೈಗೊಳ್ಳಲು 10% ಹಾಗೂ ನಾಟಿ ಕಡ್ಡಿ ನೆಡಲು ಆಕೆ ಕನಿಷ್ಟವಾಗಿ ಪಾಲ್ಗೊಳ್ಳುತ್ತಾಳೆ.

ಕೋಷ್ಟಕ–3 ರೇಷ್ಮೆ ಹುಳುಸಾಕಾಣಿಕೆ ಘಟಕದಲ್ಲಿ ಮಹಿಳೆಯರು

ಕಾರ್ಯಚಟುವಟಿಕೆ	ಶೇಕಡವಾರು ಭಾಗವಹಿಸುವಿಕೆ
ಸೋಂಕು ನಿವಾರಣೆ ಮತ್ತು ಸ್ವಚ್ಛತೆ	69%
ಚಾಕಿಗೆ ಸೊಪ್ಪು ಹಾಕಿ ಸ್ವಚ್ಛಗೊಳಿಸುವುದು	82%
ರೆಂಬೆ ಪದ್ಧತಿ ಪಾಲಿಸುವುದು	65%
ಹಣ್ಣುಳಗಳನ್ನು ಆರಿಸುವುದು	78%
ಗೂಡುಗಳನ್ನು ಸಂಗ್ರಹಿಸುವುದು	95%

ರೇಷ್ಮೆ ಸಾಕಾಣಿಕೆಯ ಕೋಷ್ಟಕದಲ್ಲಿ ಕಂಡು ಬಂದಂತೆ ಸೋಂಕು ನಿವಾರಣೆ ಹಾಗೂ ಉಪಕರಣ ಸ್ವಚ್ಚಗೊಳಿಸುವ ಕಾರ್ಯದಲ್ಲಿ ಶೇ 69% ರಷ್ಟು ಪಾಲ್ಗೊಂಡರೆ ಚಾಕಿ ಹುಳು ಸಾಕಣಿಕೆ ಸೊಪ್ಪು ಹಾಕುವುದು ಹಾಸಿಗೆ ಸ್ವಚ್ಚಗೊಳಿಸುವ ಕಾರ್ಯದಲ್ಲಿ ಶೇಕಡ 82% ರಷ್ಟು ಭಾಗವಹಿಸುತ್ತಾಳೆ. ಬೆಳೆದ ಹುಳು ಸಾಕಾಣಿಕೆಯಲ್ಲಿ ರೆಂಬೆಗಳನ್ನು ತೋಟದಿಂದ ತಂದು ಹುಳಗಳ ಹಾಸಿಗೆಯ ಮೇಲೆ ಒದಗಿಸಲು ಶೇಕಡ 65% ರಷ್ಟು ಪಾಲ್ಗೊಂಡರೆ ಹಣ್ಣುಳಗಳನ್ನು ಆರಿಸಿ ಚಂದ್ರಿಕೆಗೆ ಹಾಕಲು ಹಾಗೂ ಗೂಡುಗಳನ್ನು ಬಿಡಿಸಿ ಸಂಗ್ರಹಿಸುವಲ್ಲಿ ಶೇಕಡ 65% ರಷ್ಟು ಪಾಲ್ಗೊಳ್ಳುತ್ತಾಳೆ.

ಕೋಷ್ಟಕ – 4 ರೇಷ್ಮೆ ನೂಲು ಬಿಚ್ಚಾಣಿಕೆ ಕಾರ್ಯದಲ್ಲಿ ಮಹಿಳೆಯ ಪಾತ್ರ

ಚಟುವಟಿಕೆ	ಮಹಿಳೆಯ ಭಾಗವಹಿಸುವಿಕೆಯ ಶೇಕಡವಾರು
ನೂಲು ಬಿಚ್ಚಾಣಿಕೆ	80%
ನೂಲು ತಿರುಗಿಸುವಿಕೆ	60%
ನೇಯ್ಗೆ ಮಾಡುವಿಕೆ	40%
ಅಚ್ಚು ಹೊತ್ತುವ ಕಾರ್ಯ ಬಣ್ಣ ಹಾಕುವ ಕಾರ್ಯ ಇನ್ನಿತರೆ	40%

ಕೋಷ್ಟಕ 4 ರಲ್ಲಿ ಕಂಡು ಬಂದಂತೆ, ರೇಷ್ಮೆ ನೂಲು ಬಿಚ್ಚಾಣಿಕೆ ಕಾರ್ಯದಲ್ಲಿ ಮಹಿಳೆಯ ಭಾಗವಹಿಸುವಿಕೆಯನ್ನ ಶೇಕಡವಾರಿನಲ್ಲಿ ನೀಡಲಾಗಿದೆ. ಗೂಡುಗಳನ್ನು ಬಿಸಿ ನೀರಿನಲ್ಲಿ ಬೇಯಿಸಿ, ಗುಂಜುತೆಗೆದು ಬಿಚ್ಚಾಣಿಕೆ ಯಂತ್ರಕ್ಕೆ ಕಾರ್ಯ ಪ್ರಾರಂಭಿಸಿದಾಗ ಅದರ ಮುಂದೆ ಕುಳಿತು ಪ್ರತಿಗೂಡಿನ ನೂಲನ್ನು ತೆಗೆದು ಯಂತ್ರಕ್ಕೆ ಅಳವಡಿಸುವ ಕಾರ್ಯದಲ್ಲಿ ಶೇ 80% ರಷ್ಟು ಮಹಿಳೆಯರು ಪಾಲ್ಗೊಳ್ಳುತ್ತಾರೆ. ಮುಂದೆ ಈ ತೆಳು ದಾರವನ್ನು ಹುರಿ ಮಾಡಲು ತಿರುಗಿಸುವಿಕೆ ಕಾರ್ಯ ಕೈಗೊಂಡಾಗ ಶೇ 60% ರಷ್ಟು ಮಹಿಳೆಯರು ಪಾಲ್ಗೊಳ್ಳುತ್ತಾರೆ. ರೇಷ್ಮೆ ಬಟ್ಟೆ ನೇಯುವ ಕಾರ್ಯದಲ್ಲಿ ಶೇ 40% ರಷ್ಟು ಸ್ತ್ರೀಯರು ಭಾಗವಹಿಸಿದರೆ ನೂಲಿಗೆ ಬಣ್ಣ ಹಾಕುವ ಕಾರ್ಯ ದಲ್ಲಿ ಹಾಗೂ ಬಟ್ಟೆ ಮೇಲೆ ಅಚ್ಚು ಹೊತ್ತುವ ಕೆಲಸದಲ್ಲಿ ಶೇ 40% ರಷ್ಟು ಮಹಿಳೆಯರು ಭಾಗವಹಿಸುತ್ತಾರೆ.

ಕೋಷ್ಟಕ 5ರಲ್ಲಿ ತಿಳಿಸಿರುವಂತೆ ರೇಷ್ಮೆ ಕೃಷಿಯಲ್ಲಿನ ಇನ್ನಿತರ ಕಾರ್ಯಗಳಲ್ಲಿ ಮಹಿಳೆಯರ ಪಾತ್ರ ತಿಳಿಸುವುದಾದರೆ ರೇಷ್ಮೆ ಕೃಷಿಯ ಉಪಕರಣಗಳ ತಯಾರಿಕೆ ಕಾರ್ಯಾದಲ್ಲಿ (ಪ್ಲಾಸ್ಟಿಕ್ ತಟ್ಟೆಗಳು, ನೈಲಾನ್ ಬಲೆಗಳು, ಚಂದ್ರಿಕೆಗಳ ತಟ್ಟೆಗಳು ಇತ್ಯಾದಿ) ಶೇ 40% ರಷ್ಟು ಮಹಿಳೆಯರು ಭಾಗವಹಿಸಿದರೆ ರೇಷ್ಮೆ ಕೃಷಿಯ ಉಪಉತ್ಪನ್ನಗಳ ಉತ್ಪಾದನೆಯಲ್ಲಿ ಶೇಕಡ 78% ರಷ್ಟು ಮಹಿಳೆಯರೇ ಭಾಗವಹಿಸುತ್ತಾರೆ. (ಎರೆ ಗೊಬ್ಬರ, ಗೂಡಿನಿಂದ, ಕರಕುಶಲ ವಸ್ತುಗಳು, ಜೂಟಿನಿಂದ ಕಾರ್ಪೆಟ್ ತಯಾರಿಕೆ, ಹಿಪ್ಪು ನೆರಳೆ ಹಣ್ಣಿನಿಂದ ಜಾಮ್, ಪಾನೀಯ, ಉಪ್ಪಿನಕಾಯಿ ಎಲೆಗಳಿಂದ ಟೀ ಪುಡಿ ಇತ್ಯಾದಿ) ರೇಷ್ಮೆ ಕೃಷಿಯ ವಿಸ್ತರಣಾಸಿಬ್ಬಂದಿ ಕಾರ್ಯಕರ್ತರಾಗಿ (ತಾಂತ್ರಿಕ ಸಿಬ್ಬಂದಿ, ಮಾಧ್ಯಮ ಮೂಲಕ ವಿಸ್ತರಣಾ ಕಾರ್ಯ,

ಪ್ರದರ್ಶಕರು, ತರಬೇತಿದಾರರು) ಶೇ 40% ರಷ್ಟು ಭಾಗವಹಿಸುತ್ತಾರೆ.

ಕೋಷ್ಟಕ – ೨ ರೇಷ್ಮೆ ಕೃಷಿಯಲ್ಲಿನ ಇನ್ನಿತರ ಕಾರ್ಯದಲ್ಲಿ ಮಹಿಳೆಯ ಪಾತ್ರ

ಚಟುವಟಿಕೆ	ಮಹಿಳೆಯ ಭಾಗವಹಿಸುವಿಕೆಯ ಶೇಕಡವಾರು
ರೇಷ್ಮೆ ಕೃಷಿಯ ಉಪಕರಣಗಳ ತಯಾರಿಕೆ ಕಾರ್ಯ	40%
ಸೋಂಕು ನಿವಾರಕ (ಪುಡಿ)ಗಳ ತಯಾರಿಕೆ ಕಾರ್ಯ	60%
ರೇಷ್ಮೆ ಉಪಉತ್ಪನ್ನಗಳ ತಯಾರಿಕೆ	78%

ಹಾಗೆಯೇ ರೇಷ್ಮೆ ಕೃಷಿ ವಿಜ್ಞಾನಿಗಳು ಹೊಸ ಹಿಪ್ಪು ನೇರಳೆ ತಳಿಗಳು ಮಳೆ ಆಶ್ರಿತ ಪ್ರದೇಶಕ್ಕೆ, ನೀರಾವರಿಗೆ, ವಿವಿಧ ರೀತಿಯ ಮಣ್ಣಿಗೆ ಅನುಗುಣವಾಗಿ ತಳಿಗಳ ಸಂಶೋಧನೆ, ರೇಷ್ಮೆ ಹುಳುಗಳಿಗೆ ಕೃತಕ ಆಹಾರ, ಒಂದೇ ಸಮ ಗೂಡು ಕಟ್ಟಲು ಸಸ್ಯ ಪ್ರಚೋದಕಗಳ ಆವಿಷ್ಕಾರ ವಿಸ್ತರಣಾ ಕಾರ್ಯಕ್ಕಾಗಿ ನೂತನ ತಂತ್ರಜ್ಞಾನ ಇನ್ನಿತರ ಸಂಶೋಧನ ಕಾರ್ಯದಲ್ಲಿ ಶೇ 45% ರಷ್ಟು ಪಾಲ್ಗೊಳ್ಳುತ್ತಾರೆ. ಆದರೆ ರೇಷ್ಮೆಕೃಷಿ ಕ್ಷೇತ್ರದಲ್ಲಿ ಗುರುತಿಸಿಕೊಳ್ಳುವುದು ಪುರುಷರೇ ಹೆಚ್ಚು ಏಕೆಂದರೆ ದೊಡ್ಡ ಹುದ್ದೆಗಳನ್ನು ಅಲಂಕರಿಸುವ ಪುರುಷರಿಗೆ ಪ್ರಶಸ್ತಿಗಳು ಮೀಸಲಾಗಿರುತ್ತವೆ. ಆದರೆ ಮಹಿಳೆಯರೇ ಉಡುವುದರಿಂದ ಸೀರೆಗಳನ್ನು ಒಟ್ಟು ಪ್ರದರ್ಶಿಸಲು ಮತ್ತೆ ಮಹಿಳೆಯರೇ ಜಾಹಿರಾತಿಗಾಗಿ ಬೇಕಾಗುತ್ತಾರೆ. ಆದ್ದರಿಂದ 100% ಮಹಿಳೆಯರ ಪಾತ್ರವೇ ಆಗಿರುತ್ತದೆ. ರೇಷ್ಮೆ ಸೀರೆಗಳನ್ನು ಮಾರಾಟ ಮಾಡುವಾಗಲೂ ಶೇ 50% ರಷ್ಟು ಮಹಿಳೆಯರನ್ನೇ ಕಾಣುತ್ತೇವೆ ಹಾಗೂ ಅಂತ್ಯವಾಗಿ ರೇಷ್ಮೆ ವಸ್ತುಗಳ ಬಳಕೆಯಲ್ಲಿ ಸಹ ಶೇ 90% ರಷ್ಟು ಮಹಿಳೆಯರನ್ನೇ ಕಾಣುತ್ತೇವೆ.

ರೇಷ್ಮೆ ಕೃಷಿಯಲ್ಲಿ ಮಹಿಳೆಯರ ಸಮಸ್ಯೆಗಳು ಹಾಗೂ ಪರಿಹಾರಗಳು

ರೇಷ್ಮೆ ಕೃಷಿಯಲ್ಲಿ ತೊಡಗಿರುವ ಮಹಿಳೆಯರನ್ನು ಮೂರು ವಿಭಾಗಗಳಲ್ಲಿ ಕಾಣಬಹುದು. ದಿನಗೂಲಿ ಸೌಕರರು, ಭೂ ರಹಿತ ರೇಷ್ಮೆ ಬೆಳೆಗಾರರು ಹಾಗೂ ಭೂ ಒಡೆಯ ರೇಷ್ಮೆ ಬೆಳೆಗಾರರು ಈ ಮೂರು ವಿಭಾಗಗಳಲ್ಲಿ ನಾವು ಮಹಿಳೆಯರ ಪಾತ್ರವನ್ನ ಗಮನಿಸುತ್ತೇವೆ. ರೇಷ್ಮೆ ಕೃಷಿಯಲ್ಲಿ ಮಹಿಳೆಯರನ್ನೇ ಆಳುಗಳನ್ನಾಗಿ ಹೆಚ್ಚಿ ಆಯ್ಕೆ ಮಾಡಿಕೊಳ್ಳಲು ಕಾರಣವೇನೆಂದರೆ ಮಹಿಳೆ ಶ್ರಮ ಜೀವಿ ಅಕೆಗೆ ತಾಳ್ಮೆ ಇದೆ, ಹೆಚ್ಚು ಹೊತ್ತು ಒಂದೆಡೆ ಕುಳಿತು ಅಚ್ಚುಕಟ್ಟಾಗಿ ಕೆಲಸ ನಿರ್ವಹಿಸಬಲ್ಲಳು ಮಹಿಳೆಯನ್ನು ಕಾರ್ಮಿಕಳಾಗಿ ನಿರ್ವಹಿಸುವುದು ತುಂಬ ಸುಲಭ, ಆಕೆ ತನ್ನ ಕಾರ್ಯದಲ್ಲಿ ದಕ್ಷತೆಯಿಂದ ಕಾರ್ಯ ಮಗ್ನಳಾಗುತ್ತಾಳೆ ಹಾಗೂ ಇಷ್ಟೆ ಕೆಲಸ ಮಾಡುವೆನೆಂದು ಗಡಿ ಹಾಕುವುದಿಲ್ಲ. ಒಡೆಯರೊಡನೆ ಹೆಚ್ಚು ಆದಾಯಕ್ಕಾಗಿ ವದಕ್ಕಿಳಿಯುವುದಿಲ್ಲ. ಸಾಲವನ್ನು ಪಡೆದು ವಿದೇಯಳಾಗಿ ಹಿಂದಿರುಗಿಸುತ್ತಾಳೆ.

ಮಹಿಳೆಯ ಶ್ರಮ ತಗ್ಗಿಸುವ ತಾಂತ್ರಿಕತೆಗಳು

ಬೀಜೋತ್ಪಾದನೆಯ ಕ್ಷೇತ್ರದಲ್ಲಿ ಗೂಡುಗಳ ವಿಂಗಡಣೆಗಾಗಿ ಬೆಳಕಿನ ಮೇಜಿದೆ ಇದರ ಮೇಲೆ ಗೂಡುಗಳ ವಿಂಗಡಣೆ ಸುಲಭವಾಗುತ್ತದೆ. ಪ್ರತಿಯೊಂದು ಗೂಡನ್ನು ಕೈಯಲ್ಲಿ ಹಿಡಿದು ಅದರ ಗುಂಜು ಬಿಡಿಸುವ ಅಗತ್ಯವಿಲ್ಲ. ಒಟ್ಟಾಗಿ ಕಚ್ಚ ರೇಷ್ಮೆ ಗೂಡುಗಳನ್ನು ಗುಂಜು ಬಿಡಿಸುವ ಯಂತ್ರದಲ್ಲಿ ಹಾಕಿದರೆ ಸಾಕು ಗುಂಜು ರಹಿತ ಗೂಡುಗಳು ದೊರಕುತ್ತವೆ. ಇದೇ ರೀತಿ ಪ್ರತಿಯೊಂದು ಗೂಡನ್ನ ಕೈಲಿ ಹಿಡಿದು ಬೂಪಾದ ಚಾಕು / ಬ್ಲೇಡ್‌ನಿಂದ ಕತ್ತರಿಸುವಾಗ ಬೆರಳುಗಳಿಗೆ ಗಾಯವಾಗಿ ರಕ್ತ ಸೋರುತಲಿತ್ತು. ಇತೀಚೆಗೆ ಗೂಡು ಕತ್ತರಿಸಲು ಯಂತ್ರ ಇರುವುದರಿಂದ ಅದು ಗೂಡು ಕತ್ತರಿಸಿ ಕೋಶ ಹಾಗೂ ಕವಚವನ್ನ ಬೇರ್ಪಡಿಸುತ್ತದೆ. ಗೂಡಿನ ತೂಕದ ಆಧಾರದ ಮೇಲೆ ಕೋಶಗಳ ಲಿಂಗ ವಿಂಗಡಣೆಯನ್ನು ಮಾಡಬಹುದು. ತಾಯಿ ಚಿಟ್ಟೆಯನ್ನ ಅರೆದು ಪರೀಕ್ಷಿಸುವಾಗಿನ ಬೆನ್ನು ನೋವು ಈಗಿಲ್ಲ ಚಿಟ್ಟೆಗಳ ಮಾದರಿಯನ್ನ ತಿರುಗುವ ಯಂತ್ರದಲ್ಲಿ ಇಟ್ಟು ಸ್ವಿಚ್ ಅದುಮಿದರೆ ನಿಮಿಷಕ್ಕೆ 3000 ಬಾರಿ ಸುತ್ತುತ್ತದೆ. ನಂತರ ಸಿಗುವ ಲಸಿಕೆಯನ್ನು ಸೂಕ್ಷ್ಮ ದರ್ಶಕದಲ್ಲಿ ಗಮನಿಸಿದರೆ ಗಂಟು ರೋಗದ ರೋಗಾಣುಗಳು ಕಾಣಸಿಗುತ್ತವೆ. ಇದರಿಂದ ಬೀಜೋತ್ಪಾದನೆ ಕೆಲಸ ಸುಲಭ ಬಿಡಿ ಮೊಟ್ಟೆಗಳ ಕಾಗದವನ್ನ ಪರೀಕ್ಷಿಸಿ ಲೆಕ್ಕ ಹಾಕುವ ಅಗತ್ಯವಿಲ್ಲ.

ಚಾಕಿ ಸಾಕಾಣಿಕೆ ಕೇಂದ್ರಗಳಲ್ಲಿ ಸಾಕಾಣಿಕೆ ಮನೆಯ ಸೋಂಕು ನಿವಾರಣೆಗೆ ವಿದ್ಯುತ್ ಸಿಂಪರಕದಿಂದಾಗಿ ಮಹಿಳೆ ಕೂಡ ಸುಲಭವಾಗಿ ಸೋಂಕು ನಿವಾರಣೆ ಕಾರ್ಯ ನಿರ್ವಹಿಸಬಹುದು. ಸಾಕಾಣಿಕೆಗೆ ಬೇಕಾದ ತಟ್ಟೆಗಳನ್ನು ತೊಳೆಯುವ ಯಂತ್ರದ ಆವಿಷ್ಕಾರದಿಂದಾಗಿ ಘಂಟೆಗೆ 40–50 ತಟ್ಟೆಗಳನ್ನ ತೊಳೆಯಬಹುದು. ಚಾಕಿ ಸೊಪ್ಪು ಕತ್ತರಿಸಲು ಬೆರಳಿಗೆ ಗಾಯವಾಗುವ ಅಪಾಯವಿಲ್ಲ ಸೊಪ್ಪು ಕತ್ತರಿಸುವ ಯಂತ್ರದಲ್ಲಿ ಘಂಟೆಗೆ 200 ಕಿ.ಗ್ರಾಂ ರಷ್ಟು ಸೊಪ್ಪನ್ನು ಕತ್ತರಿಸಬಹುದು. ಸಾಕಾಣಿಕೆ ತಟ್ಟೆಗಳಲ್ಲಿ ಕಸದಿಂದ ಹುಳುಗಳನ್ನು ಬೇರ್ಪಡಿಸಲು ಬಲೆಗಳನ್ನು ಬಳಸಿ ಸ್ವಚ್ಚತ್ತಾ ಕಾರ್ಯವನ್ನ ಸುಲಭವಾಗಿ ನೆರವೇರಿಸುತ್ತಾರೆ. ಮಹಿಳೆಯರು ಸಾಕಾಣಿಕೆ ಮನೆಗಳಲ್ಲಿ ಉಷ್ಣಾಂಶ ಹೆಚ್ಚಿಸಲು ಒಲೆಗಳನ್ನು ತಂದು ಮೂಲೆಗಳಲ್ಲಿಟ್ಟು ಕೆಂಡವನ್ನು ಉರಿಸಿ ಕೋಣೆ ಬೆಚ್ಚಗಾಗಿಸುತ್ತಿದ್ದರು ಬಾಗಿಲು ಕಿಟಕಿಗಳಲ್ಲಿ ಗೋಡೆಗಳಿಗೆ ನೀರೆರಚಿ ತಣ್ಣಗಾಗಿಸುತ್ತಿದ್ದರು ಆದರೀಗ ಉಷ್ಣವಾಹಕ ಹಾಗೂ ಶೈತ್ಯಾಂಶ ನಿರ್ವಾಹಕಗಳಿಂದಾಗಿ ವಾತಾವರಣದ ನಿಯಂತ್ರಣ ಸುಲಭ.

ಬೆಳೆದ ಹುಳು ಸಾಕಾಣಿಕೆಯಲ್ಲಿ, ರೆಂಬೆಗಳನ್ನ ಕತ್ತರಿಸಲು ಪುರುಷರಿಗಾಗಿ ಕಾಯುವ ಅಗತ್ಯವಿಲ್ಲ. ಸೊಂಟಕ್ಕೆ ಬೆಲ್ಟ್‌ನ್ನು ಕಟ್ಟಿ ಗರಗಸ ಹೊಂದಿದ ಯಂತ್ರವನ್ನ ಒಂದು ಸಾಲಿನಿಂದ ಹಿಡಿದು ಮುಂದುವರಿದರೆ ಸಾಕು $^{2}/_{3}$ ನಿಮಿಷಗಳಲ್ಲಿ ರೆಂಬೆಗಳೆಲ್ಲ (ಕಾಂಡ) ಕೆಳಗುರುಳಿ ಬೀಳುತ್ತವೆ. ರೆಂಬೆಗಳನ್ನು ಸಾಕಾಣಿಕೆ ಹಾಸಿಗೆ ಮೇಲೆ ಜೋಡಿಸುವ ಕಾರ್ಯಕ್ಕೆ ಸಹಾಯ ಬೇಕಿಲ್ಲ ಸೋಂಕು ನಿವಾರಕಗಳ ಧೂಳೀಕರಣ ಮಾಡುವಾಗ ಅದರ ಘಾಟಿಗೆ ನೆಗಡಿ, ಕೆಮ್ಮು, ಶ್ವಾಸಕೋಶದ ತೊಂದರೆಗೊಳಗಾಗುತ್ತಿದ್ದರಿಂದ ಸಸ್ಯ ಮೂಲದ ಹಾಸಿಗೆ ಸೋಂಕು ನಿವಾರಕವನ್ನ ಆವಿಷ್ಕರಿಸಿ ಉಪಯೋಗಿಸಲಾಗಿದೆ. ಹಣ್ಣುಳಗಳನ್ನು ಸೊಪ್ಪಿನಿಂದ ಬೇರ್ಪಡಿಸುವ ಯಂತ್ರವನ್ನ ಬಳಸಿ ದೈಹಿಕ ಶ್ರಮ (ಬೆನ್ನು ನೋವು) ವನ್ನ ತಗ್ಗಿಸಲಾಗಿದೆ. ಕೆಲವರಿಗೆ ಹೊಸ ಸೀರೆಯ ಬಣ್ಣದಿಂದಾಗಿ ತುರಿಕೆ ಅಂತಹವರಿಗೆ ಸ್ವಯಂ ನೈಸರ್ಗಿಕ ವರ್ಣದ ಹೊಸ ರೇಷ್ಮೆ ತಳಿಗಳನ್ನು ಆವಿಷ್ಕರಿಸಲಾಗಿದೆ.

ಮಹಿಳೆಯ ಆರೋಗ್ಯ ಸುಧಾರಣೆಗೆ ಆರೋಗ್ಯ ವಿಮೆ ಸೌಲಭ್ಯ

ರೇಷ್ಮೆ ಕೃಷಿಯಲ್ಲಿ ತೊಡಗಿರುವ ಮಹಿಳೆಯರಿಗೆ ನಾನಾ ರೀತಿಯ ಆರೋಗ್ಯ ಸಮಸ್ಯೆಗಳು ಕಾಣಿಸಿಕೊಳ್ಳುತ್ತವೆ. ಕೆಲವು

ಉದಾಹರಣೆಗಳು ಈ ಕೆಳಕಂಡತಿವೆ.

1. ಹಿಪ್ಪುನೇರಳೆ ತೋಟಗಳಲ್ಲಿ ಸೊಪ್ಪು ಬಿಡಿಸಲು ಕಳೆ ಕೀಳಲು ಕಡ್ಡಿ ಕತ್ತರಿಸಲು ಕೆಲಸ ನಿರ್ವಹಿಸುವ ಮಹಿಳೆಯರಿಗೆ ಚರ್ಮದಲ್ಲಿ ತುರಿಕೆ ಹಾಗೂ ದೈಹಿಕವಾಗಿ ಉಷ್ಣಾಂಶ ಹೆಚ್ಚಿರುವುದು ಕಂಡು ಬಂದಿದೆ.

2. ಹುಳು ಸಾಕಾಣಿಕೆ ಮಾಡುವಾಗ ಪದೇ ಪದೇ ಬ್ಲೀಚಿಂಗ್ ಪುಡಿ, ಸುಣ್ಣದ ಪುಡಿಯಲ್ಲಿ ಸಲಕರಣೆಗಳನ್ನು ತೊಳೆದು ಮನೆ ತೊಳೆಯುವುದರಿಂದ ಮಹಿಳೆಯರು ಶ್ವಾಸಕೋಶದ ತೊಂದರೆಗಳನ್ನು ಹಾಗೂ ಕೈಬೆರಳುಗಳಲ್ಲಿ ಚರ್ಮ ಸೂಲಿಕೆಯನ್ನ ಅನುಭವಿಸುತ್ತಾರೆ.

3. ಹಣ್ಣುಳಗಳನ್ನು ಮುಟ್ಟಿದ ಸಂದರ್ಭಗಳಲ್ಲಿ ಅವರಿಗೂ ದೈಹಿಕವಾಗಿ ಉಷ್ಣಾಂಶ ಹೆಚ್ಚಿ ಮುಟ್ಟಿನ ತೊಂದರೆ ಎದುರಿಸುತ್ತಾರೆ.

4. ಗೂಡುಗಳನ್ನು ವಿಲೇವಾರಿ ಮಾಡುವಾಗ ಶ್ವಾಸಕೋಶದ ತೊಂದರೆಗಳು ಎದುರಿಸುತ್ತಾರೆ.

5. ಸಾಕಾಣಿಕೆಯ ಸೋಂಕು ನಿವಾರಕಗಳಿಂದ ಶ್ವಾಸಕೋಶದ ತೊಂದರೆ.

6. ನೂಲು ಬಿಚ್ಚಾಣಿಕೆಯ ವಲಯದಲ್ಲಿ ಗೂಡುಗಳನ್ನು ನೀರಿನಲ್ಲಿ ಬೇಯಿಸಲು ಹಾಗೂ ಫಿಲೇಚರ್‌ಗಳಲ್ಲಿ ಕೆಲಸ ಮಾಡುವಾಗ ನಿರಂತರವಾಗಿ ಬಿಸಿ ನೀರಿನಲ್ಲಿ ಕೈ ಬೆರಳುಗಳನ್ನು ಅದ್ದುವುದರಿಂದ ಬೊಬ್ಬೆಗಳು ಕಾಣಿಸಿಕೊಳ್ಳುತ್ತವೆ. ಜೊತೆಗೆ ಎದೆ ನೋವು ಹಾಗೂ ಉಸಿರಾಟದ ತೊಂದರೆ ಅನುಭವಿಸುತ್ತಾರೆ.

7. ಅಪೂರ್ಣ ಆಹಾರ ಬಳಕೆ ವಿಟಮಿನ್ ರಹಿತ ಆಹಾರದ ಬಳಕೆಯಿಂದಾಗಿ ಈ ಮಹಿಳೆಯರಿಗೆ ಚರ್ಮದ ಕಾಯಿಲೆಗಳು ಅಸ್ತಮಾ ಕಾಯಿಲೆಗಳು ಸಾಮಾನ್ಯವಾಗಿ ಕಂಡು ಬರುತ್ತದೆ.

ಕೇಂದ್ರ ರೇಷ್ಮೆ ಮಂಡಳಿಯು ಶೀಘ್ರ ಅಭಿವೃದ್ದಿ ಕಾರ್ಯಕ್ರಮದಡಿ ಮಹಿಳೆಯರಿಗಾಗಿ ಆರೋಗ್ಯ ವಿಮೆಯನ್ನು ಜಾರಿಗೊಳಿಸಿದೆ, ಇದರ ಪ್ರಕಾರ ವಿಮೆಯ ಶೇಕಡ 75% ರಷ್ಟು ಹಣವನ್ನ ಕೇಂದ್ರ ರೇಷ್ಮೆ ಮಂಡಳಿ ಭರಿಸಿದರೆ ಶೇಕಡ 25% ರಷ್ಟನ್ನು ರಾಜ್ಯ ರೇಷ್ಮೆ ಇಲಾಖೆ ಭರಿಸುತ್ತದೆ. ಅಂದರೆ ವರ್ಷಕ್ಕೆ 628/- ರೂಗಳನ್ನು ಕೇಂದ್ರ ರೇಷ್ಮೆ ಮಂಡಳಿಹಾಗೂ ವರ್ಷಕ್ಕೆ 83/- ರೂಗಳನ್ನು ರಾಜ್ಯ ರೇಷ್ಮೆ ಇಲಾಖೆ ಭರಿಸಿದರೆ ಫಲಾನುಭವಿ ಮಹಿಳೆಯು ಕೇವಲ ವರ್ಷಕ್ಕೆ 55/- ರೂಗಳನ್ನು ಮಾತ್ರ ನೀಡಿದರೆ ಸಾಕು ಆರೋಗ್ಯ ವಿಮೆಯ ಸೌಲಭ್ಯವನ್ನ ತನಗೆ, ಪತಿಗೆ ಹಾಗೂ ಇಬ್ಬರು ಮಕ್ಕಳಿಗೆ ಪಡೆದುಕೊಳ್ಳ ಬಹುದು.

ರೇಷ್ಮೆ ಕೃಷಿಯಲ್ಲ ಮಹಿಳೆಯರಿಗಾಗಿ ತರಬೇತಿ ಕಾರ್ಯಕ್ರಮಗಳು

ರೇಷ್ಮೆ ಕೃಷಿಯಲ್ಲಿ ಶೇಕಡ 60% ರಷ್ಟು ಮಹಿಳೆಯರೇ ತೊಡಗಿಕೊಂಡಿದ್ದರೂ ಸಹ ಆಕೆ ರೇಷ್ಮೆ ಕೃಷಿಯಲ್ಲಿ ಪೂರ್ಣ ಹಿಡಿತ ಸಾಧಿಸಿಲ್ಲ ಇದಕ್ಕೆ ಕಾರಣ ಭೂಮಿ ಆಕೆಯ ಹೆಸರಲ್ಲಿ ಇಲ್ಲದಿರುವುದು ಬ್ಯಾಂಕಿನಲ್ಲಿ ಆಕೆಗೆ ಹಣದ ಸಹಾಯ ಇಲ್ಲದಿರುವುದು ಹಾಗೂ ತರಬೇತಿ ಕಾರ್ಯಕ್ರಮಗಳಿಗೆ ಆಕೆ ಬಾರದೇ ಇರುವುದರಿಂದ ತಾಂತ್ರಿಕತೆಗಳ ಬಗ್ಗೆ ಆಕೆಗೆ ಪೂರ್ಣ ಜ್ಞಾನ (ಅದರ ಮಹತ್ವದ ಬಗ್ಗೆ) ಇಲ್ಲದಿರುವುದು ಇದರಿಂದಾಗಿ ಇಂದಿಗೂ ಆಕೆ ಮನೆಯಲ್ಲಿ ನಿರ್ಧಾರಗಳನ್ನ ತೆಗೆದುಕೊಳ್ಳಲು ಅಸಮರ್ಥಳಾಗಿದ್ದಾಳೆ. ಆದ್ದರಿಂದ ನಮ್ಮ ಸಂಸ್ಥೆಯೂ ಹಾಗೂ ಇನ್ನಿತರ ತರಬೇತಿ ಕೇಂದ್ರಗಳಲ್ಲಿ ಮಹಿಳೆಯರಿಗಾಗಿ ಉಚಿತವಾಗಿ (ಊಟ ಮತ್ತು ವಸತಿ) ನಮ್ಮ ಸಂಸ್ಥೆಯ ರೇಷ್ಮೆ ಕೃಷಿ ಮಹಿಳಾ ಸಮುಚ್ಚಯ ಕೇಂದ್ರ ಕೆಲವು ತರಗತಿಗಳನ್ನು ನಡೆಸಲಾಗುತ್ತದೆ.

1. ಹಿಪ್ಪುನೇರಳೆ ಬೇಸಾಯದಲ್ಲಿ ಪರಿಸರ ಸ್ನೇಹಿ, ಸಮಗ್ರ ಪೋಷಕಾಂಶ ನಿರ್ವಹಣೆ ಹಾಗೂ ರೋಗ ನಿರ್ವಹಣೆ – 6 ದಿನಗಳ ತರಬೇತಿ ಕಾರ್ಯಕ್ರಮ

2. ಚಾಕಿ ಸಾಕಾಣಿಕೆಗಾಗಿ ವೈಜ್ಞಾನಿಕ ತರಬೇತಿ – 8 ದಿನಗಳು

3. ದ್ವಿತಳಿ ರೇಷ್ಮೆಹುಳು ಸಾಕಾಣಿಕೆ – 35 ದಿನಗಳು

4. ಸಸ್ಯ ಮೂಲದ ಜೈವಿಕ ಪೀಡೆನಾಶಕ ಹಾಗೂ ಶಿಲೀಂಧ್ರ ನಾಶಕಗಳನ್ನು ಬಳಸಿ ಸಮಗ್ರ ರೋಗ ನಿರ್ವಹಣಾ ಕ್ರಮಗಳು – 10 ದಿನಗಳ ತರಬೇತಿ

5. ರೇಷ್ಮೆ ಮೊಟ್ಟೆ ಉತ್ಪಾದನ ಕ್ರಮಗಳು – 6 ದಿನಗಳು

6. ರೇಷ್ಮೆ ಕೃಷಿಯಲ್ಲಿ ದೊರೆಯುವ ಸಂಪನ್ಮೂಲ ಬಳಸಿ ಮೌಲ್ಯ ವರ್ಧಿತ ಉತ್ಪನ್ನಗಳ ಉತ್ಪಾದನೆ – 6 ದಿನಗಳು.

ರೇಷ್ಮೆ ಕೃಷಿಯಲ್ಲಿ ಮಹಿಳೆಯರನ್ನ ಸಬಲೀಕರಣಗೊಳಿಸಲು ಈ ಕೆಳಕಂಡ ಅಂಶಗಳನ್ನ ಸರ್ಕಾರ ಜಾರಿಗೆ ತಂದಿದೆ.

1. ರೇಷ್ಮೆ ವರದಾನ ಯೋಜನೆ ಅಡಿಯಲ್ಲಿ ಸರ್ಕಾರವು 1 ಎಕರೆ ಜಮೀನಿನಲ್ಲಿ ಹಿಪ್ಪುನೇರಳೆ ಗಿಡಗಳನ್ನು ನಾಟಿ ಮಾಡಿದರೆ 5,000/- ರೂಗಳ ವರದಾನ ನೀಡುತ್ತ್ತದೆ.

2. ಮಹಿಳೆ ತನ್ನ ಜಮೀನಿನಲ್ಲಿ ಹನಿ ನೀರಾವರಿ ಅಳವಡಿಸಿಕೊಳ್ಳಲು ಶೇಕಡ 50% ರಷ್ಟು ಸಹಾಯ ಧನ ದೊರೆಯುತ್ತದೆ. ಪರಿಶಿಷ್ಟ ಜಾತಿ/ಪಂಗಡಕ್ಕೆ ಸೇರಿದ ಮಹಿಳೆಯಾದರೆ ಶೇಕಡ 60% ರಷ್ಟು ಸಹಾಯ ಧನ ದೊರೆಯುತ್ತದೆ.

3. ರೇಷ್ಮೆ ಬೆಳೆಯ ಉತ್ಪಾದನ ಖರ್ಚಿನ ಶೇಕಡ 60% ರಷ್ಟನ್ನು ಗ್ರಾಮೀಣಾ ಬ್ಯಾಂಕುಗಳಿಂದ ಸುಲಭವಾಗಿ ಮಹಿಳೆ ಸಾಲವನ್ನು ಪಡೆದುಕೊಳ್ಳಬಹುದು.

4. 300 ಚದರ ಅಡಿ ರೇಷ್ಮೆ ಹುಳು ಸಾಕಾಣಿಕೆ ಮನೆ ಕಟ್ಟಲು 25,000/- ರೂಗಳು, 600 ಚದರ ಅಡಿ ಹುಳು ಸಾಕಾಣಿಕೆ ಮನೆ ಕಟ್ಟಲು 50,000/- ರೂಗಳು ಹಾಗೂ 1,000 ಚದರ ಅಡಿ ಹುಳು ಸಾಕಾಣಿಕೆ ಮನೆ ಕಟ್ಟಲು 75,000/- ರೂಗಳನ್ನು ಸಹಾಯ ಧನವಾಗಿ ಪಡೆದುಕೊಳ್ಳಬಹುದು.

5. ರೇಷ್ಮೆ ಗೂಡಿನ ಮಾರುಕಟ್ಟೆಗಳಲ್ಲಿ ಮಹಿಳೆಯರಿಗಾಗಿ ವಿಶೇಷ ಹಜಾರಗಳು, ಶೌಚಾಲಯಗಳು, ಉಳಿದುಕೊಳ್ಳಲು ಕೊಠಡಿಗಳ ಸೌಲಭ್ಯಗಳನ್ನು ಸರ್ಕಾರ ಒದಗಿಸಿದೆ.

ಫಲಿತಾಂಶ

ಇಷ್ಟೆಲ್ಲ ಸಹಾಯಗಳನ್ನು ಸರ್ಕಾರ ನೀಡಿದ್ದರೂ ಸಹ ಮಹಿಳೆಗೆ ಮತ್ತಷ್ಟು ಸವಲತ್ತುಗಳ ಅವಶ್ಯಕತೆ ಈ ಕೆಳಕಂಡಂತಿವೆ.

1. ಮಹಿಳೆಯರ ಹೆಸರಲ್ಲಿ ಹಿಪ್ಪುನೇರಳೆ ತೋಟಗಳಿದ್ದರೆ ಅಂತಹವರಿಗೆ ಉಚಿತ ನೀರಾವರಿ ಅಳವಡಿಕೆ ಕಡ್ಡಿನೆಡಲು ಸಹಾಯಧನ, ಹೊಸ ತೋಟ ಸ್ಥಾಪಿಸಲು ಧನ ಸಹಾಯ ನೀಡುವ ಯೋಜನೆಯನ್ನು ಜಾರಿಗೆ ತರಬೇಕು.

2. ತೋಟದಲ್ಲಿ ಉಳಿಯಲು ಕಳೆ ಕೀಳಲು ಬೇಕಾದ ಯಂತ್ರಗಳನ್ನ ರಿಯಾಯಿತಿ ದರದಲ್ಲಿ ಮಹಿಳೆಯರು ಭೂ ಒಡೆಯರಾದರೆ ನೀಡುವುದರ ಕಾನೂನು ಜಾರಿಗೆ ತರಬೇಕು.

3. ಮಹಿಳೆಯರು ಕೃಷಿ ಬೆಳೆಗಾರರಾಗಿ ಅನುಭವವಿದ್ದರೆ ಅಂತಹವರಿಗೆ ಶೇ 90% ರಷ್ಟು ಮನೆ ಕಟ್ಟಲು ಸಹಾಯ ಧನ ಹಾಗೂ ಅತ್ಯವಶ್ಯಕ ಸಲಕರಣೆಗಳಿಗೆ ರಿಯಾಯಿತಿ ದರದಲ್ಲಿ ಸಾಲ ಸೌಲಭ್ಯ.

4. ಸ್ತ್ರೀ ಶಕ್ತಿ ಗುಂಪುಗಳು / ಸ್ವಸಹಾಯಕ ಮಹಿಳಾ ಗುಂಪುಗಳಿಗೆ ಉತ್ತೇಜನ ನೀಡಲು ಸ್ವಯಂ ಉದ್ಯೋಗ ಸ್ಥಾಪಿಸಲು ಆ ಸಂಘದ ಮೂಲಕ ಚಾಕಿ ಸಾಕಾಣಿಕೆ ಕ್ಷೇತ್ರ ತೆರೆಯಲು ಧನ ಸಹಾಯ ಹಾಗೂ ಉಪಕರಣಗಳ ಸರಬರಾಜು.

5. ಪ್ರತಿ ತಾಂತ್ರಿಕ ಸೇವಾ ಕೇಂದ್ರಗಳಲ್ಲಿ ಮಹಿಳೆಯ ನೇಮಕಾತಿಯನ್ನ ಕಡ್ಡಾಯ ಮಾಡಿದಾಗ ಆ ಕ್ಷೇತ್ರದ ಮಹಿಳಾ ರೇಷ್ಮೆ ಬೆಳೆಗಾರರ ಸಮಸ್ಯೆಯನ್ನ ಅರಿಯಬಹುದಾಗಿದೆ.

6. ತಾಂತ್ರಿಕತೆಗಳಲ್ಲಿ ರೋಗ ನಿರ್ವಹಣೆ ಗೊಬ್ಬರಗಳ ಪ್ರಮಾಣ ಹಾಗೂ ಸೋಂಕು ನಿವಾರಣೆ ಮಾಡುವಾಗ ಲೆಕ್ಕಾಚಾರ ಇವುಗಳ ಬಗ್ಗೆ ತರಬೇತಿ ನೀಡಿದರೆ ಆತ್ಮವಿಶ್ವಾದಿಂದ ರೇಷ್ಮೆ ಕೃಷಿ ಕೈಗೊಳ್ಳುತ್ತಾರೆ.

7. ಮಹಿಳಾ ರೇಷ್ಮೆ ಕೃಷಿಕರಿಗೆ ಮಾರುಕಟ್ಟೆಗಳಲ್ಲಿ ತರಬೇತಿ ನೀಡುವುದು ಅಗತ್ಯವಿದೆ. ಗೂಡುಗಳ ವಿಲೇವಾರಿಯ ನೀತಿಗಳು ಹಣ ಪಡೆಯುವ ಕ್ರಮಗಳು ಹಾಗೂ ಗುಣಮಟ್ಟದ ಬಗ್ಗೆ ಅರಿವು ಇವುಗಳ ಬಗ್ಗೆ ಅರಿವಿನ ತರಬೇತಿ ಅಗತ್ಯ. ಇದಕ್ಕಾಗಿ ಪ್ರತ್ಯೇಕ ಬ್ಯಾಂಕಗಳನ್ನು ಮಹಿಳೆಯರಿಗೆ ತೆರೆದಿಡಬೇಕು ಹಾಗೂ ಈ ಬ್ಯಾಂಕುಗಳು ಮಾರುಕಟ್ಟೆಯ ಪಕ್ಕದಲ್ಲಿರುವಂತಿರಬೇಕು. ಮಹಿಳೆಯರು ಮಾರುಕಟ್ಟೆಗಳಿಗೆ ಆತ್ಮವಿಶ್ವಾಸದಿಂದ ಬರಲು ಅವರುಗಳಿಗೆ ಪ್ರತ್ಯೇಕ ಗೂಡು ಸಂಗ್ರಹದ ವ್ಯವಸ್ಥೆ ಹಾಗೂ ಶೀಘ್ರ ವಿಲೇವಾರಿಯ ವ್ಯವಸ್ಥೆ ಕಲ್ಪಿಸಬೇಕು.

8. ಈ ಎಲ್ಲಾ ಜ್ಞಾನಾರ್ಜನೆ ತಿಳಿದು ಮಹಿಳೆ ರೇಷ್ಮೆ ಕೃಷಿಯಲ್ಲಿ ಸಬಲೀಕರಣಗೊಳ್ಳಲು ಆಕೆಗೆ ತರಬೇತಿಯ ಅಗತ್ಯವಿದೆ. ಮೌಖಿಕ ತಿಳುವಳಿಕೆಯ ಜೊತೆಗೆ ಪ್ರತ್ಯೇಕ ಅವಶ್ಯಕ ಹಾಗೂ ಪ್ರಗತಿಪರ ರೈತರ ಮನೆಗಳಿಗೆ ಭೇಟಿ ಅವಶ್ಯಕ ಆದರೆ ಆಕೆಗೆ ಹೆಚ್ಚು ಸಮಯ ಹೊರಗಿದ್ದು ತರಬೇತಿ ಪಡೆಯಲು ಸಾಧ್ಯವಿಲ್ಲ. ಆದ್ದರಿಂದ 35 ದಿನಗಳಲ್ಲಿ ಆಕೆ ಎಲ್ಲವನ್ನು ಸಂಕ್ಷಿಪ್ತವಾಗಿ ಕಲ್ಪಿಸಿ ತರಬೇತಿ ಗ್ರಹಿಸಿಕೊಳ್ಳಲು ಉತ್ತಮ ವಾತಾವರಣ ಸಮೀಪವಿದ್ದರೆ ಉತ್ತಮ.

ಹೀಗೆ ರೇಷ್ಮೆ ಕೃಷಿಯಲ್ಲಿ ಮಹಿಳೆ ಮಹತ್ವದ ಪಾತ್ರ ವಹಿಸಿದ್ದು ಎಲೆಯಿಂದ ಎಳೆಯವರೆಗೂ ಪ್ರತಿಯೊಂದು ಹಂತದಲ್ಲೂ ಆಕೆ ಪಾಲ್ಗೊಂಡು ತನ್ನ ಕೊಡುಗೆಯನ್ನು ನೀಡುತ್ತಾ ಬಂದಿದ್ದಾಳೆ. ಇಷ್ಟಾದರೂ ಸಹ ರೇಷ್ಮೆ ಕೃಷಿಯಲ್ಲಿ ಮಹಿಳೆಯನ್ನ ಕೂಲಿ ಆಳಿನಂತೆ ಕೆಲಸ ಪಡೆದು ಕೊಳ್ಳಲಷ್ಟೇ ಬಳಸಿಕೊಳ್ಳಲಾಗಿದೆ ಹೊರತು ಆಕೆಗೆ ಸ್ಥಾನಮಾನ ಕೊಟ್ಟಿಲ್ಲ. ಹಣ ಸ್ವೀಕರಿಸುವ ಕ್ಷೇತ್ರಕ್ಕೆ ಅವಳನ್ನು ಪರಿಚಯವೇ ಮಾಡಿಸಿಲ್ಲ. ಪುರುಷ ಪ್ರಧಾನ ಸಮಾಜವು ರೇಷ್ಮೆ ಕೃಷಿಯ ಸಾಕಾಣಿಕೆ ಕೈಗೊಳ್ಳುವಾಗ ತೆಗೆದು ಕೊಳ್ಳಬೇಕಾದ ನಿರ್ಧಾರಗಳ ಬಗ್ಗೆ ಮಹಿಳೆಗೆ ಅರಿವು ಮೂಡಿಸಿಲ್ಲ. ಆದ್ದರಿಂದ ಆಕೆಗೆ ವೈಜ್ಞಾನಿಕ ಮಾಹಿತಿಗಳೊಂದಿಗೆ ಪ್ರಾತ್ಯಕ್ಷಿಕೆಗಳನ್ನು ನೀಡಿ ತರಬೇತಿ ಕೊಟ್ಟಾಗ ಜ್ಞಾನದ ಸಂಪೂರ್ಣ ಅರಿವಾಗಿ ಆಕೆಯ ರೇಷ್ಮೆ ಕೃಷಿ ಕ್ಷೇತ್ರದಲ್ಲಿ ಸಬಲೀಕರಣಗೊಳ್ಳಲು ಸಾಧ್ಯವಾಗ ಬಹುದಾಗಿದೆ.

ಉಲ್ಲೇಖಿಸಿದ ಗ್ರಂಥ ಸಂಗ್ರಹ

1. ಗುಪ್ತ.ಬಿ.ಕೆ, ಗುಪ್ತ.ವೈ.ಕೆ 1997 ಸಿಲ್ಕ್ ಇಂಡಸ್ಟ್ರಿ – ಎ ಟೂಲ್ ಫಾರ್ ವುಮೆನ್ ಎಂಪ್ಲಾಯ್‌ಮೆಂಟ್ **ಇಂಡಿಯನ್ ಫಾರ್ಮಿಂಗ್ 47 (4) : 19**

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4. ಸತೀಶ್ ಪರ್ವ ಹಾಗೂ ಎಸ್.ಪಿ.ದಂಡಿನ್ 2006 **ಮೆಕ್ಯಾನೈಸೇಷನ್ ಇನ್ ಸೆರಿಕಲ್ಚರ್** – ಕೇಂದ್ರ ರೇಷ್ಮೆ ಮಂಡಳಿ ಪ್ರಕಟಣೆ.

5. ಶ್ರೀಲತಾ 2006 ರೇಷ್ಮೆ ಕೃಷಿಯಲ್ಲಿ ಮಹಿಳೆಯ ಪಾತ್ರ **ರೇಷ್ಮೆ ವಾಹಿನಿ 3 (2) : 5**

STUDIES ON SOIL PATHOGENS OF COFFEE NURSERY AND ITS MANAGEMENT

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ABSTRACT

Coffee is one of the commercial crop grown in Madikeri and contributes about 30% of the total production of the India. There are many diseases causing pathogens which infect coffee plants. Among them, soil fungal pathogens were known to cause lots of problems in coffee plantations. In present investigation, soil samples from different nurseries were collected and subjected for pathogen screening. Isolated pathogens were identified as *Penicillium spp* , *Aspergillus spp.* and *Fusarium spp.* These pathogens were subjected for biocontrol assay with leaf extract of *Solanum surattense* and crude metobolites of *Tricoccusss spp* and *Deinococcus spp.* Among these three biocontrol agents, *Solanum surattense* showed encourage result. However, *Penicillium spp* could not controlled by this extract. Dose dependency study of leaf extract was also showed promised results against Aspergillus *spp.* and *Fusarium spp.*

Coffee is universal in it appeal. it is stimulating blend of human energy and efficiency. Coffee cultivation in India is mainly confined to Karnataka, Kerala, Tamil nadu and Andhra Pradesh and on a limited scale to Arunachal Pradesh, Assam, Madhya Pradesh, Manipur,

Kodagu district of Karnataka produces 30% of India coffee in about 6000 hectares contributing about 5000 crores annually to the national exchequer. There are many soil borne pathogens know to cause the diseases in nursery stage. Among the pathogens *Penicillium spp, Aspergillus spp. Fusarium spp, Rosellinia bunodes and Poria hypolateritia.* In the present study, soil samples from different nurseries of

coffee plantation of Kodagu were screened for soil-borne pathogens and isolated pathogens were tested their controlled growth efficacy against bacterial culture *Deinococcus* and *Trichococus*, which are known as biocontrol agents and leaf extract of *Solanum surattense* which is considered as medicinal plants.

MATERIALS AND METHODS

Soil samples collected from different nurseries of Kodagu. Totally four samples were collected from coffee nursaries of Chettalli, Moodnad, Siddapura and Polibetta and stored them in polythene covers for further use.

Screening of soil samples:

The soil samples collected from different coffee nursery beds were subjected to serial dilution techniques for screening soil-borne pathogens.

Serial dilution technique:

For these methods, one gram of soil samples was taken and assorted with 10 ml sterile distilled water and this was further diluted up to 10^{-7}. Finally, the serially diluted soil samples was plated onto the potato dextrose agar media contained petri plates and incubated at 25 ° C for 5-7 days. Later the pathogens were mounted on a slide, and observed for mycelia structure and spore types under microscope.

Biocontrol Assay for Soil Pathogens Using Bacterial Cultures

Tricococcus spp and Deinococcus spp *bacterial* culture was used for the Biocontrol assay against soil pathogens isolated from coffee nursery bed. ***Tricococcus spp and Deinococcus spp were*** cultured in nutrient broth media for 48 hours at 37 ° C and broth was centrifuged at 10000 rpm for 20 min. and supernatant was used as biocontrol agent source in well diffusion method.

Preparation of Leaf extract of Solanum surattense for bioassay:

Leaves were collected from Solanum surattense and washed thoroughly with distilled water and were homogenized with buffer (0.1M, pH 7.4) and alcohol (95%) in cold mortar and pestle. The homogenate was further centrifuged at low rpm and supernatant was used as antifungal agent.

WELL DIFFUSION METHOD:

Potato dextrose agar media was prepared and media was poured on to the sterile Petri plates, which contained fungal spore suspension of *Penicilliun* or *Aspergillus* or *Fusarium spp*. Further, wells were made on solidified PDA plates using sterile cork borer in equidistance and wells were loaded with varied concentration of bacterial Biocontrol agent source and leaf extract of Solanum surattense (20 µl, 40 µl, 60 µl, 80 µl) along with appropriate control in the central well and Petri plates were incubated at 27 ° C ± 2 ° C for seven days and plates were observed for inhibition zones and were measured.

RESULTS:

Isolation of pathogens from soil sample

The sample collected from Siddapura and Polibetta showed *Fusarium spp* infection along with *Penicillium spp* and *Aspergillus spp*. In Murnad sample only *Aspergillus* spp was recorded. Chettalli sample had *Penicillium spp* and *Aspergillus spp*(table1). Result suggested different regions of Kodagu had various types of fungal species. This could be due to weather variation in Kodagu.

Table (1) : Results of isolation of pathogens from soil sample by serial dilution method

Region	Organism isolated
Chettalli	Penicillium, Aspergillus
Murnad	Aspergillus
Siddapura	Penicillium , Fusarium, Aspergillus
Polibetta	Fusarium,Penicillium, Aspergillus

Identification of Pathogens:

The pathogens isolated identified as *Fusarium spp, Aspergillus spp* and *Penicillium spp.*

Fusarium spp

Bright white colony on PDA plate, produces dark pink colour on the reverse side of the plate. Mycelium is branched and septet .macroconidia found at the tip of conidiophores are long.5-7 celled globular or ovoid in dry basipetal chains

Penicillium spp :

Conidiophores arising from the mycelium singly or less often in synnmata, branched near the apex, pencillate ending in phialides, conidia(phialospore) hyaline or brightly colored in mass 1- celled, mostly globose or ovoid in dry dabipetal chains

Aspergillus spp :

Conidiophores upright, simple,globose or elevate swelling bearing phalidas at the open or radiating from the often enteric surface, conidia(phialospore) 1- celled, globose often variously coloured in mass in dry basipetal chains

Biocontrol efficacy of Solanum surattense leaf extract

The aqueous extract of leaves tested by agar gel and agar disc diffusion method did not show any inhibition against soil pathogens.

In screening of the plant extract against soil pathogen showed encouraging result only for alcohol and buffer extract against *Aspergillus spp* and *Fusarium spp*. The maximum inhibition 10mm and 9mm were recorded at 80ul concentration in gel diffusion method for *Aspergillus spp* and *Fusarium spp* respectively for alcohol extract and 13 and 16mm in buffer extract. No inhibition zone was showed for water extract for any of the pathogen. The result also indicated that gel diffusion was better for screening plant extract over disc diffusion method where as no inhibition was recorded for alcohol and buffer extract in agar disc diffusion method table (Table 2 and 3).

Table 2: Screening of alcohol extract of plant extract of the plant against soil pathogens.

Different Concentrations	Inhibition Zone(mm)					
	Agar disc diffusion			Agar well diffusion		
	Aspergillus Spp	Fusarium Spp	Penicillium Spp	Aspergillus Spp	Fusarium Spp	Penicillium Spp
20	-	-	-	-	-	-
40	-	-	-	-	-	-
60	-	-	-	-	7	
80	-	-	-	10	9	
Control	2	2	2	2	2	2

Table (3) Screening of buffer extract of the plant extract against soil pathogens

Different Concentrations	Inhibition Zone(mm)					
	Agar disc diffusion			Agar well diffusion		
	Aspergillus spp	Fusarium spp	Penicillium spp	Aspergillus spp	Fusarium spp	Penicillium spp
20	-	-	-	-	-	-
40	-	-	-	-	-	-
60	-	-	-	10	14	-
80	-	-	-	13	16	-
Control	-	-	-	-	-	-

Screening of *Trichococcus spp* and *Deinococcus spp* antifungal metabolite against fungal pathogen:

The crude metabolite from *Trichococcus spp* and *Deinococcus spp* did not show any antifungal activity against any of the soil pathogen isolated from coffee nursery bed.

THE SILVICULTURE IN THE SANSKRIT LITERATURE

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संस्कृत साहित्य में वृक्षविज्ञान

- तरुलता वी पटेल

वैदिक काल में लोगों का जीवन वनस्पतिमय था। वन्यप्रदेशों और ग्रामीण क्षेत्रो में वनस्पतियों का ही बाहुल्य था। लोगों ने दन्तधावन से लेकर आहार तक, शय्या से लेकर रथ तक, वस्त्र एवं आच्छादान और गृहनिर्माण में वनस्पतियों का प्रभूत उपयोग किया जाता था। लेखन कार्य में भी पेड़ों की महीन छाल का कागज के रूप में तथा अनेक रंजक वनस्पतियों के रस का स्याही के रूप में प्रयोग किया जाता था।

यज्ञो में वनस्पतियों का विशेष उपयोग था। यज्ञशाला के निर्माण से लेकर यज्ञ की परिधि, यूप, विविध पात्रो, सोम और उसके अभाव में प्रतिनिधिभूत अन्य द्रव्यों आदि के लिए विभिन्न वनस्पतियों का उपयोग किया जाता था। इस तरह वनस्पतियों का विशेष उपयोग किया जाता था। प्रस्तुत शोधलेख में वृक्षविज्ञान के बारे में सविस्तर चर्चा की गई है।

वृक्षों का वर्गीकरण

वैदिक वाङ्मय में वनस्पतियों का वर्गीकरण उनके स्वरूप एवं गुणकर्म पर प्रकाश डालता है।[१] प्राचीन महर्षियों ने पत्र, पुष्प, फल, काण्ड आदि अवयवो अन्य रचनात्मक विशेषताओं, उद्भवस्थानों तथा गुणधर्मों का सूक्ष्म निरीक्षण करके उनके आधार पर वनस्पतियों को विभिन्न वर्गों में स्थापित किया है। सामान्यतः औद्भिद द्रव्य वनस्पति, वानस्पत्य, वीरुध् तथा औषधि – इन चार वर्गों में विभाजित किये गये हैं। अथर्ववेद में उपर्युक्त चारों विभाग स्पष्ट रूप में प्राप्त होते हैं। चरक[२] ने अपने ग्रन्थ चरकसंहिता में वनस्पतियों का वर्गीकरण विस्तृत रूप से दिया है।

सामान्य रूप से छोटे पौधों के लिए 'औषधि' तथा बड़े वृक्षों के लिए 'वनस्पति' शब्द का प्रयोग प्रारंभ काल से होता आया है तथा इनका युग्म रूप औषधि वनस्पति समस्त वानस्पतिक जगत् का बोधक रहा है।[३] औषधि का ही गुल्म, लता आदि विशिष्ट संस्थान का बोध कराने के लिए 'वीरुध' एक वर्ग हो गया। उसी प्रकार वनस्पति का एक विभाग 'वानस्पत्य' हो गया, जो अपेक्षाकृत छोटे वृक्षों का बोधक है। ऋग्वेद तथा अथर्ववेद में 'औषधि' शब्द अनेक वार प्रयुक्त हुआ है। औषधि के फलपाकान्त लता,[४] तृण,[५] अन्न,[६] ग्रावा,[७] देव[८] आदि अर्थ किये गये हैं।

अमरकोश[९] एवं पुराणो[१०] में भी वृक्षयोनि के कई भेद माने गये हैं। तदनुसार इनके वनस्पति, औषधि, लता, त्वक्सार आदि भेद मुख्य हैं।

वनस्पति के अवयव

वनस्पति के विभिन्न अवयव यथा काण्ड, शृंग, पर्व, पत्र, पुष्प, फल और मूल का उल्लेख वैदिक वाङ्मय में उपलब्ध होता है। प्राचीन महर्षियों ने अपुष्पा तथा सपुष्पा और अफला तथा फलीनी औषधियों का विभाजन अत्यन्त सूक्ष्मता से किया था। अथर्ववेद[११] में सुन्दर शैली में सभी अवयवो का उल्लेख मिलता है। 'पयस्वतीरोषधयः' से औषधियों के क्षीर का संकेत होता है। केवल बाह्य रचना का ही नहीं अपितु आभ्यन्तर रचना

का भी वर्णन उपलब्ध होता है। बृहदारण्यक-उपनिषद[१९] में पुरुष के अवयवों एवं धातुओं के समानान्तर वनस्पतियों तथा वृक्षों की रचना का वर्णन निम्नांकित मिलता है।

पुरुष	वनस्पति
१ लोम	१ पर्ण Leaves &Hairs]
२ त्वक्	२ बहिरुत्पाटिका [Epiderm]
३ रक्त	३ निर्यास [Latex]
४ मास	४ शकर [Mesoderm]
५ स्नायु	५ किनाड [Endoderm]
६ अस्थि	६ आभ्यन्तरकाष्ट [Heart Wood]
७ मज्जा	७ मज्जा [Pith]

वनस्पतियों का उद्भव एवं विकास

अथर्ववेद के अनुसार वनस्पतियों का पिता अन्तरिक्ष तथा माता पृथिवी है और इसके मूल समुद्र में रहते है। इससे अन्तरिक्ष में फैलनेवाली या दिव्य औषधिया, पृथ्वी पर होनेवाली तथा समुद्री वनस्पतियों का संकेत होता है।[१३] पृथ्वी पर होनेवाली वनस्पतियों के भी दो वर्ग हो गये है, एक पर्वतीय प्रदेश में होनेवाली, दूसरी समतल भूमि में होनेवाली।[१४] अथर्ववेद में एक स्थल पर इन्हें क्रमशः पर्वतीय और वाह्य कहा गया है।[१५] वातबहुल (जांगल) प्रदेश में होनेवाली वनस्पतियों का भी उल्लेख है।[१६] जल में होनेवाली वनस्पतियों का भी निर्देश है जो शेवाल से आवृत रहती है।[१७] ऋग्वेद के औषधि सूक्त में कहा है कि औषधियों के सैंकडों उद्भव स्थान है।[१८] इनमें भूमि सर्वोत्तम मानी गई है।[१९]

वृक्षों के लिए भूमि

प्राचीन समय में कम पानी वाली जमीन को जागंल, ज्यादा पानीवाली जमीन को अनूप, और सामान्य पानी वाली जमीन को सामान्या कहते थे। जिस जमीन में सभी प्रकार के वृक्ष पाये जाते है उसे आर्दश कहते हैं। काली भूमि में मधुर, कम पीली भूमि में खटाश, श्याम भूमि में नमकीन, लाल भूमि में तीखा, श्वेत भूमि में कडवापन, और पीली भूमि में तूराश (फीका) का गुण होता है। श्वेत और पीली भूमि वृक्ष के लिए सर्वश्रेष्ठ मानी गई हैं। नमकीन वाली भूमि विष – पाषाण - सर्प और चूहें के बिलवाली भूमि वृक्ष को बोने के लिए वर्जित मानी गई है।[२०]

कौटिलीय अर्थशास्त्र[२१] में सूखी जमीनों में तथा जलमय प्रदेशों में जो चीजें जैसी भूमि में अच्छी पैदा हो सकती हो, उनको वैसे ही स्थानों में बोने का उल्लेख प्राप्त होता हैं। वराहमिहिर[२२] ने भूमि को मृदु बनाने के लिए खेत में तिल उगाने के बाद उसमें फूल आते हीं उसे कूचल कर संस्कार करने से भूमि वृक्ष को बोने के लिए योग्य बनती है ऐसा कहा हैं।

भविष्यपुराण[२३] में भूमि का शोधन कर बैलों से हल जुतवाकर पाँच प्रकार के श्रेष्ठ अन्न यत्र-तत्र बुवाकर बिल्ववृक्ष का यूप गाडने का उल्लेख मिलता हैं। अग्निपुराण[२४] में वृक्षों के आरोपण के पहिले शस्त्र से जमीन पर गड्ढा बनाकर उसकी शुद्धि करने का उल्लेख हैं।

जल के किनारे वाली भूमि कद्दू, ककडी, तरबूज आदि बोने के लिए उपयुक्त होती हैं। जहाँ पर नदी का जल एक बार घूम गया हो, वह भूमि पीपल, अंगूर तथा ईख आदि बोने के लिए अच्छी होती है। शाक, मूल आदि बोने के लिए कूएँ के पास की भूमि, जई आदि हरे गौत (Grass) बोने के लिए झील, तालाब आदि के किनारे गीले प्रदेश वाली भूमि और जिस भूमि के बीच में तालाब बने हो उस भूमि में काटे जाने वाले गन्ध, भैषज्य (औषधि, धनिया, सौंफ आदि), उशीर (खस), पिण्डालुक (कचालू या शकरकन्दी आदि) इत्यादि चीजों का बोना उपयुक्त होता हैं।[२५]

वृक्षारोपण विधि

वृक्षारोपण के पूर्व नक्षत्र विधान में हस्त, उत्तरा, फाल्गुनी, उत्तराषाढा, उत्तरभाद्रपदा, स्वाति, रोहिणी, श्रवण और मूल नक्षत्र आदि एवं ब्राह्मण और चन्द्रमा की पूजा करके वृक्ष का आरोपण करने का उल्लेख मिलता है।[२६] बृहत्संहिता में पवित्र होकर स्नान, चन्दनादि से वृक्ष की पूजा करके वृक्ष लगाने का उल्लेख मिलता हैं।[२७] दिव्य दृष्टि वाले मुनियोंने वृक्षारोपण के लिए तीनों उत्तरा, रोहिणी, मृगाशिरा, रेवती, चित्रा, अनुराधा, मूल, विशाखा, पुष्य, श्रवण, अश्विनी तथा हस्त आदि शुभ नक्षत्रों को उत्तम कहा हैं।[२८]

वृक्ष लगाने के लिए अर्ध धनुष्य जितनी मिट्टी को खोदकर नई चिकनी मिट्टी डालने के बाद वृक्ष लगायें और अन्त में पानी सीचें। फल - फूल वाले वृक्षों को गौं के गोबर का लेप लगाकर रोपना चाहिए। पलाल के सूखे तन्तुओ को पक्के केलों का लेप लगाकर कुछ दिनो बाद थोडा थोडा पानी सींचने से पौधों का नीलरक्त अंकुर आने के बाद उसे बोया जाता है।

वाटिका रोपण के समय हल की आकृति वाले श्रवण, अभिजितादि नक्षत्र तथा मूल नक्षत्र श्रेष्ठ माने गये है। पुनः वनपाल देवता और अग्नि, सोम तथा शेषनाग की पूजाकर विष्णुमन्त्र से उसमें बीजों का रोपण करने का उल्लेख हैं।[२९] हर एक बीज को बोने के समय में बीज की पहिली मुठ्ठी भरकर उसको सुवर्ण के जल से भिगोकर बोने का, और उसके साथ निम्नाकिंत मन्त्र को पढने का उल्लेख है।[३०]

"प्रजापतये काश्यपाय देवाय च नमः सदा।
सीता में ऋध्यतां देवी बीजेषु च धनेषु च॥"

जल की न्यूनाधिकता को देखकर तथा ऋतु के अनुसार खेतों में बीज डालने का उल्लेख प्राप्त होता हैं। वर्षा के प्रारम्भ में सायंकाल और प्रातः काल में तथा शीतकाल में दिन के अन्त में वृक्षारोपण उत्तम माना हैं।[३१]

आम, कटहल आदि वृक्ष के बीजों को एक गढढें में डालकर कुछ गर्मी देकर, फिर ठीक समय पर उनको गाय की हड्डी और गोबर के साथ मिलाकर रखा जाये। इस प्रकार से इन सब बीजों का संस्कार करके फिर इनको खेंत में बोना चाहिए। तुलसी का अषाढ, सावन, वैशाख, भाद्रपद मास में तथा वैष्णव नक्षत्रों में रोपण करना शुभदायक हैं।[३२]

खाद डालने का विधान

वैदिक वाङ्मय में खाद के लिए 'करीष', 'शकृत', 'शाकन्', 'शाक', 'शक' शब्दो का उल्लेख हैं। अथर्ववेद में घृत, मधु और दुग्ध का खाद वृक्षों में डालने का उल्लेख हैं।[३३] एवं 'शारिशाक' शब्द द्वारा गाय के गोबर को चावल के पाक के लिए खाद के रूप में उपयोग करने का निर्देश हैं।

वृक्ष में बकरी, भेड और गौ की विष्ठा की खाद तथा जल और मांस की खाद देकर उनका पोषण करवाने का उल्लेख हैं।[३४] सब बीजों के बोये जाने के बाद, जब इनमें अंकुर निकलें, तब इनमें गीली छोटी मछलियों का खाद लगाकर, सैंढ के दुग्ध से इन्हें सिंचना चाहिए। ऐसा करने से पौधों का, कीडा आदि से रक्षण होता हैं।[३५]

फल एवं फूल हेतु घृत और शीतल जल से सींचे और छाग (बकरी) की शकृत् (भींगडी) का चूर्ण, जौ का चूर्ण, तथा तिल, किसी पशु का मांस और जल मिलाकर सात दिन तक रखें। फिर उसकी खाद डाले। इससे सब प्रकार के वृक्षों में फल-फूल की वृद्धि होती हैं।[३६]

सिंचन

वैदिक वाङ्मय में नदी और कुएँ के पानी से सिंचन का वर्णन है। इसके अतिरिक्त जलाशय, तालाब, सरोवर, समुद्र आदि का भी निर्देश हुआ हैं।

सिंचन हेतु उद्यान के मध्य में तडागादि का निर्माण करने का उल्लेख हैं। पुराणानुसार ग्रीष्म ऋतु में सायं-प्रातः तथा शीतऋतु में मध्याह्न में या एक दिन बाद जल से सिंचन करने का उल्लेख हैं। वर्षाऋतु में रात्रि में जमीन का जल सूखने पर नये वृक्ष का रोपण करना तथा वृक्षों में जल सिंचन करने का उल्लेख मिलता हैं।[३७] घृत व दुग्ध आदि से भी सिंचन करने का वर्णन है। विंडग, घृत, और कीचड़ लेप कर वृक्षों को शीतल जल से सिंचन का विधान हैं।

महाभारत[३८] के शान्तिपर्व में मूलों के द्वारा जल- अवचूषण- प्रक्रिया का विवरण मिलता है।

"वकत्रेणोत्पलनालेन यथोर्ध्वं जलमाददेत्।
तथा पवन संयुक्तः पादैः पिबति पादपः।"

जैसे कमल नाल को मुख में रखकर अवचूषण करने से पानी का उद्धरण किया जा सकता है ठीक वैसे ही पौधें वायु की सहायता से मूलों के द्वारा पानी का अवचूषण करते है।

वृक्ष को लगाने में दूरी निर्धारण

बृहत्संहिता[३९] एवं अग्निपुराण[४०] में वृक्ष को लगाने की दूरी में एक वृक्ष से दूसरा वृक्ष बीस हाथ पर लगाना उत्तम, सोलह हाथ पर मध्यम और बारह हाथ पर लगाना अधम माना है। तृण को दो हाथ पर, गुल्म तीन हाथ पर और गुल्म वृक्ष चार हाथ के अन्तर पर रोपना चाहिए।

शुक्रनीति में वृक्षों को परस्पर उत्तम को बीस हाथ की दूरी पर, मध्यम को पन्द्रह हाथ, साधारण को दस हाथ की दूरी पर, और सबसे निकृष्ट को पाँच हाथ की दूरी पर रोपने का उल्लेख है।[४१]

भविष्यपुराण[४२] के अनुसार बीस- बीस हाथ की दूरी पर पौधों को रोपकर आम्रवन या वाटिका का निर्माण करने का उल्लेख है। बकुल, वञ्जुल और धात्री के वृक्ष को अधिक दूरी पर तथा श्रीपर्णी, पुंनाग और बिल्ववृक्ष को सात हाथ दूरी पर रोपना चाहिए।

वृक्षों की संवृद्धि

१ फल और फूलों की वृद्धि के लिए कुलथी, उडद, मुद्ग, तिल तथा यव आदि को दुग्धमिश्रित कर उबालें। उष्णोपरान्त शीतल कर उससे वृक्ष का सिंचन करना चाहिए।

२ भेड़ें एवं बकरी की लेंडी (गोबर) का चूर्ण, जौ का चूर्ण और तिल का चूर्ण घृत से सान कर शीतल जल में मिला दे और उसे वृक्ष को सींचने से फल में वृद्धि होती है।

३ सात रात्रि तक जल में गोमांस रख दे और उससे वृक्ष को सींचने से सभी वृक्ष फल-पुष्प से लदे रहते हैं।

४ मत्स्योदक द्वारा मात्र जल से सींचना आमों के लिए इष्ट हैं। तथा खर्जूर और नारियल आदि में नमक के पानी से वृद्धि होती हैं।

५ मछली के जल से सींचने से वृक्षों की शाखा प्रशाखायें प्रस्फुटित होकर वृद्धि होती है।[४३]

६ मछली के धोने के बाद उसी जल से सींचने से वृक्षों की वृद्धि होती है।

७ भेड़ तथा बकरी की विष्ठा का चूर्ण, तिल तथा गोमांस और जल इन सबो को सात रात्रि तक वृक्ष के मूल के भीतर देना चाहिए। वृक्षों में इस प्रयोग से फल और पुष्प की वृद्धि अत्यन्त होती है।[४४]

८ भेड़ और बकरी की भेंगन (भेडारी) का चूर्ण दो आढक,[४५] तिल एक आढक, सत्तू एक प्रस्थ,[४६] जल एक द्रोण[४७] तथा गौमांस एक तुला[४८] आदि का मिश्रण एक पात्र में सप्त रात्रि तक रखें। तत्पश्चात् फल-फूलों की वृद्धि के लिए उससे वृक्ष, गुल्म और लताओं को सींचना चाहिए।

९ सभी बीजो को दस दिन तक दूध में भींगोना, हरोज उन बीजों को घृत वाले हाथो से बाहर नीकालना, दस दिन पश्चात् उन्हें बाहर निकाल के गोबर में अनेक बार मसलने के बाद उसे सूखने दे, उसके बाद बीजों को सूकर और हिरन के मांस से धूप दी जाती है। फिर मांस और सूकर की चरबी के साथ मिलाकर शुद्ध जमीन में बोये जाते है। तत्पश्चात् पानी मे दूध को मिश्रित करके उनका सींचन करने से उनकी वृद्धि और पुष्पों में बढावा होगा।[४९]

१० श्वेत सरसव और खाद के सींचन से खर्जूर, बिल्व और लकुच की वृद्धि होती है।

११ नीम के पर्ण, कूणप जल, और चावल से सींचन करने से नारंगी का विकास होता है।

१२ मूर्गे की विष्टा, पलाल और भूसी (धान आदि के छिलके) के जल से पीली अंगूर का फल-फूल में वृद्धि होती हैं।

१३ उड्द के खाद से आँवला के पुराने वृक्ष की वृद्धि होती हैं।

१४ कुलथी का चूर्ण या मछली का पानी सींचने से अनार मे वृद्धि होती है। त्रिफला, मछली और घृत का लेप लगाकर त्रिफला के धूप से अनार में बड़े फल आते है।

१५ घृत का धूप, मिट्टी के साथ जौ का पानी, दुग्ध मिश्रित जल या कूणप जल के सींचन एवं वावडींग और तिल के खाद के लेप से छोटे वृक्षों में वृद्धि होती हैं।

१६ यष्टिमधु और महुवा के फूल को साकर, कृष्ठ और मध मे मिलाकर बनायी गुटिका को मूल में डालने से वृक्ष में वृद्धि होती हैं।[५०]

वृक्ष के रोगनाशक उपाय

शीत वायु और गर्मी की अधिकता से वृक्ष रोगी बनते हैं। उसके पर्ण पीले हो जाते हैं। शाखाएँ सूख जाती हैं। अंकुर की वृद्धि नहीं होती और उसमे से मधु, क्षीर बहता रहता हैं। ऐसे वृक्षों की चिकित्सा करने का उल्लेख वराहमिहिर ने किया है।[५१]

रोगी वृक्षों की चिकित्सा में पहले वृक्ष का जो अंग विकार युक्त हो उसको शस्त्र से काट डालें पुनः विडंग, घृत और पङ्क को मिलाकर वृक्षों में लेप करें। तत्पश्चात् दुग्ध मिश्रित जल से सींचन करना चाहिए।[५३] वायविडंग के चावल तथा मछली का मांस वांच्छित फल देता है और विशेष रूप से सभी वृक्ष के रोगों को नष्ट करनेवाला है।[५३]

यदि वृक्ष के फल नष्ट हो जाते हों तो उसके लिए कुलथी, उडद, मूंग, जौ, तिल इनमेंसे किसी एक को डालकर औटाकर शीतल किये हुए जल से सींचन करना चाहिए। इससे वृक्ष सदा फूल-फल देने लगते हैं।[५४]

वृक्ष को कभी कभी बाह्य भय होते है। हिम, तूफ़ान, धूवाँ, आग और मकड़ी वृक्ष को हानी पहुँचाते हैं। वृक्ष के नीचे धूवाँ न करना चाहिए। वृक्ष के उपर से मकड़ी को दूर करना चाहिए। वृक्ष को उपयोग में लेने से पहिले परीक्षा कर लेनी चाहिए। वृक्ष के छेदन में रुधिर निकले, अथवा वृक्ष में कम्पन और शब्द प्रतीत हो, मधु, क्षीर आदि बहने लगे तो ऐसा वृक्ष नहीं काँटना चाहिए।[५५]

श्री विश्ववल्लभ में चक्रपाणिमिश्र ने आठवे अध्याय में वृक्ष के रोगों के लिए वात, पित्त और कफ को उत्तरदायि माना हैं।[५६]

वात्त प्रकृति वाला वृक्ष छोटा, हलका, सूखा हुआ, और कम चेतना वाला होता हैं। उसे फल-फूल नहीं आते। वायु के दोष से वृक्ष सूख जाते हैं। वायु के दोष दूर करने लिए गाय का गोबर, लोध्र, चरबी और कूणप जल से सींचना चाहिए। तथा स्निग्ध मांस रसो का सींचन करना एवं कटु, तीक्त और कषाय रस से वात दोष का निवारण होता हैं।

पित्तप्रकृति वाला वृक्ष सूर्य के तेज को नहीं सह पाता। वो कृश, पीला, बिन शाखा का और अकाल में फल देता हैं। पित्त को दूर करने लिए "पित्तं जामातरमिव" अनुसार स्निग्ध मधुर और शीतल जल देने से पित्तजनित दोष दूर होते हैं।

कफ प्रकृति वाला वृक्ष स्निग्ध वातवाला और उसके आसपास लताएँ लगी होती हैं। वृक्ष के मूल में कड़वे, खट्टे, तूरे और रुक्ष द्रव्य डाला हुए उष्ण जल का सींचन करने से कफ दोष का निवारण होता हैं।

वृक्ष की शाखाओं में पानी झरतां हो तो उसे काँटकर कङ्कु वटकर्कोटी, नेतर, अर्जुन और वल्कल को दूध में उबालकर उसका लेप लगाना चाहिए।

वृक्ष के मूल जन्तुयुक्त हो तो उसे दूर करके घृत, मूत्र, विडंग, सरसव और तिल का लेप लगाना, धूप करना और उनके मिश्रित जल से सींचन करना चाहिए। बीजली से जले हुए वृक्ष को धनियाँ, उशीर, मूंग, महुडा, जौ और तिल के चूर्ण को दुग्ध मिश्रित जल में डालकर सींचना चाहिए।

घर/ उद्यान/ देवालय/ नदी/ तालाब

गूलर, पीपल, बर्गद, गोरखइमली, चन्दन, जम्बीरीनीबू, कदम्ब, बकुल, आमडा, कैथ, आम, पुंनाग, चम्पा, नीप (जल कदम्ब), कोकम, अनार, सरल (चीड), अखरोड, शीशम, शिग्रु, भिस्सट, नीम, जम्बीर, खिरनी, खर्जूर, करञ्ज, अञ्जीर, तमाल, आंवला, पूगफल, लकुच, नारियल, कदली, अशोक आदि तथा अन्य भी अच्छे फलवालें वृक्ष को ग्राम के समीप में लगाने का उल्लेख हैं। जो वृक्ष काँटेदार तथा अन्य खैर, अश्मन्तक, सागौन, अरणी, सोनापाठा, बर्बूर, शाल, कुटज, अर्जुन, पलाश, धव, देवदारु, भोजपत्र, सलई, करौंदा, हरड, भिलावा, बहेडा और

अन्य जो महुआ आदि एवं प्रतान वाली (लम्बी पतली शाखाओं) वाली, गुच्छोंवाली आदि वृक्षों का जंगलो में रोपण करने का उल्लेख हैं।[५७]

बगीचे या घर के समीप शुभ करने वाले निम्ब, अशोक, पुन्नाग, शिरीष, प्रियंगु वृक्षों का रोपण करने का उल्लेख हैं। घर तथा उद्यान के पास दक्षिण दिशा में उत्पन्न काँटेवाले वृक्ष अथवा पुष्पित तिल के पौधें शुभ होते हैं। घर से उत्तर की ओर प्लक्ष (पिलखन) का वृक्ष, पूर्व में वट का वृक्ष, दक्षिण में आम का वृक्ष और पश्चिम में अश्वत्थ (पीपल) का वृक्ष शुभ होता हैं।[५९]

घर से पूर्व की ओर काँटेदार वृक्ष कुश, कलम आदि लगाने से हानि होती हैं। नीम तथा मदार भी अशुभ हैं, पर शाल्मली तेज की वृद्धि करनेवाला होता हैं।

श्मशान घाट और अपने घर की दक्षिण दिशा में तुलसी लगाने से अशुभ होता हैं।[६०] देवमन्दिर या मार्गों पर छायादार फूल-फलोंवाला वृक्ष लगाने से यश मिलता है और पितृगण तर जाते हैं। नदी के किनारे पीपल का आरोपण बड़ा ही पुण्यकारक हैं।[६१]

जलाशय के तट पर नीम, अशोक, सोपारी, शिरीष, प्रियंगु, कदली, जामुन, दकुल और अनार के वृक्ष लगाने का उल्लेख हैं। जलाशय के तट पर दूर्वा-घास, विविध वनौषधियों (मुंज), कुरुन्द एवं कुश आदि का भी रोपण करने का विधान हैं।[६२]

नगराभिमुखी परिखाओं के कूलों पर पुष्पों के सौरभ से मत्त भ्रमरों वाले फूलों के वृक्ष लगाने का विधान है। परिखाओं के चतुर्दिक बाह्य भागों पर कँटीली जिन में लताएँ एवं गुल्म भी यत्र – तत्र सटे हों ऐसी झाडियों का आरोपण करने का उल्लेख किया हैं।

प्रस्तुत निर्देशों के आधार पर हम कह सकते हैं कि हमारे महर्षियों को वृक्ष एवं वनस्पतियों के बारे में पूर्ण ज्ञान था। आधुनिक वनस्पति विज्ञान की इस शाखा के मूल हमारे प्राचीन ग्रन्थ में हैं।

पादटीप

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२ च. सं. अन्नपानविध्यध्याय पृ. २६६

३ तमोषधीश्च वनिनश्च। ऋ. ७/४/५

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९ अमर. २/४/६

१० मत्स्य. पु. ७०/१४२-४५

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१२ बृ. उप. ३/९/१-६

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२५ कौ. अर्थ. पृ. २६४

२६ अग्नि. पु. अ. २८२ पृ. १३७३

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३५ कौ. अर्थ. पृ. २६५

३६ अग्नि. पु. अ. २८२. ११-१२ पृ. १३७४

३७ बृ. सं. अ. ५५. ९ पृ. ४२०

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४३ अग्नि. पु. अ. २८२. ३१/२९/१३/१२, पृ. १३७४

४४ शुक्र. नी. अ. ४/५५/५६ ,पृ. २४५

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५१ बृ. सं. अ. ५५/१५

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५६ एजन. पृ. २०९, २१०

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INTERLACING OF PHILOSOPHICAL AND MEDICAL SCIENCES IN HUMAN LIFE WITH ENERGY TRANSFER

(BIRTH/DEATH &RE-BIRTH)

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Introduction

Present actions are directed by past thoughts or inspirations. Future actions ensue from a resultant of past thoughts / inspirations and present actions. If we view it implicitly; " when present exists; past dies and when future exists past and present die".

Let us illustrate this thought by giving following examples.
1) If we analyze water cycle ; then the states such as water , vapor, precipitation, formation of rain drops, each new state makes its immediate predecessor extinct. However the ' Water' state after various transformations again become ' water'. This is resurrection.
2) In a similar manner; the weather changes from summer to rainy to autumn to winter to spring to summer. Due to the dynamicity of the universe; physical and chemical changes can be viewed as rebirth.

We can refer to the following theory of Energy transformation:

"The Energy neither be created nor destroyed. However, it can be converted from one form to another".

We will now illustrate the life cycle starting from zygote formation (in the form of foetus) to birth, infancy, youth, maturity, old age and death as a phenomenon of new state after the death of earlier one.

Since this is a life cycle, after the death, the next tangible state would be zygote formation again ; which is nothing but 'rebirth'.

Vedanta says, Living being performs actions based on thoughts. So if we actually consider the causal scenario: when 'thought' is the cause, 'action' is its effect. There exist a perfect relationship between this cause and effect. This can also be seen from Newton's third law which states, **"For every action there is equal and opposite reaction"**

The human body has basically two parts apart from the soul (The living vital element). The two parts are the visible body and subtle (causal / *karana sharira)* body. This subtle body consists of mind and *prarabdha* (actions of earlier lives). When the man dies the body decays, whereas the mind and the soul depart. The decayed body subsequently forms coal, mineral etc as per the law of conservation of energy. The mind is a very strong form of energy as it can control the various actions of the body parts.

In addition to the controlling power of the body, mind can also control other energies like water, electricity, atomic energy etc.

The mind is the mirror image of brain and it works under control of the subtle body. After the death of the body, the mind with *karma* (actions) and soul in bio-magnetic form get converted into electro-magnetic wave, and come out of the dead body through the *navarandras.*

The magnitude of the converted frequency (electro-magnetic frequency / wave coded with a defined frequency) is directly proportional to the goodness and *karma* of every facet. As a result of death, the Aura of the living being also vanishes.

Aura of a living body

Vedanta talks of three bodies ? Visible, Causal and the Soul.

Visible (Gross) Body: This consists of all touchable of the body such as skin, flesh, blood, bones, spasm etc.

Causal / Subtle body (*karana sharira*) is covered by the visible body and is the experiences made by the human being during its past live/s. It has the subtle elements such as mind, intelligence, ego and conscience etc.
Lets us say a person was born as an animal in his just previous birth and now he is a human being. So he will have much affinity towards that kind of animal and also has some nature inherited from that animal. (Scientists can easily understand this if they understand that the homosapiens have evolved from the monkeys / chimpanzees).

Soul (*atman*) is a living vital element of the gross body. It is all pervasive like the super soul (*Paramatman*), but presently resides in the living body till his death. The soul is an extraction from the super soul. The super soul exists in the soul, however the reverse is not always true. This is precisely the reason, saints and spiritual practitioners advocate to meditate in order to be tuned with the super soul.

Now as a summary, **the soul is the inner element covered by causal body having the visible body as the outer covering.** As the magnitude of the Aurá increases, so the human being imbibes Divine potential. The reverse happens when the magnitude of the Aura diminishes. Now how does the magnitude increase: By past attainments and / or spiritual practice, positive flow of electro-magnetic currents will ensue which augments as we keep doing such good deeds.

There are, bio-chemical and bio-magnetic currents flow in the body which are known as the soul currents. These currents flow by taking the help of the four *tatwas* (water / air / heat waves and materials). When these currents flow through the brain, mind is generated. The flow of currents is controlled by the past and present *karmas* / actions. These are the result of blessings / curse from human beings, animals / birds /

plants and planets. As per the **principles of electro-magnetism, when current flows through a conductor it creates magnetic field around the conductor.** In the same way, the flow of the bio-magnetic & bio-chemical currents (proportional to its magnitude) produce Aura (magnetic field).

Hence we can conclude that : **the sum total (effective) of magnetic radiation of all the three bodies is known as Aura.**

The luminous Aura of the body has the stored records of all *prarabdha* (good and bad actions) in a form better than nano technology. The magnitude of Aura depends on health, wealth, luck, spirituality etc. It will also acts in reverse way.

Human Body is compared with a Battery

Human body is materialistic in nature and is made up of mainly water (65%),carbon (18%),Nitrogen (3%), calcium (1.5%), iron (blood), and other combination of elements of earth and its surroundings.

The Earth is electrically ground and hence it is taken as a reference point for measuring voltage. The body has come from the Earth, hence its voltage potential also is at the ground level. The *Prana / Atman* / soul, the living vital element comes from *Aakaash* as it is in the form of Electro magnetic wave. It has positive potential and its frequency is infinity, hence its wave length is zero (pl. refer Frequency spectrum). As a result of this, its physical dimension / size is zero. **This is the ideal condition.** God exists in ideal conditions only as he is pure, sincere , honest, divine love. *Atman* / Soul is a part of *Paramatman* / Super Soul. People also call him as the Supreme / God .

The living body works like a battery (The battery consists of Positive and Negative electrodes). The soul / *Prana* is positive and the body is Negative in nature. A toy car works on a battery. When a battery discharges the activity of the toy car stops.

In the same way when soul / *Prana* comes out permanently from the body, because of old age or accident, then it is called as death. Now the body (having negative potential) goes back to Earth from where it has come.

Birth Scene: Entry of the Soul in Human body

The soul enters into the mothers womb in the second month to third month after proper growth of Heart, Brain, Sex organs (male / female), finger prints etc. The first two to three months, the soul is superimposed on mother's Aura. During this period the foetus is one of the part of the mother's organ.

Before that the soul searches and selects for the suitable father as per his genes , past relationships & *Karmas* (actions) and stays in his Aura for three months before entering the mother's Aura.

This concludes that for three months before fertilization the *Atman* rests with the Aura of Father and in the next 9 months it stays with the mother. (Total is 12 months)

This phenomenon can be compared with the Sun as father and the Earth as mother. The Soul comes from the Sun (Father helps from outside), enters into materialistic body (proportionate *tatwas* of water, air, heat and elements of the Earth).

The science behind the *Ataman*, entering into a new life through father and there-after the mother's womb :

We have mentioned earlier the *Atman* along with the mind and *karma* leaves the dead body, and gets converted in to a coded electro-magnetic wave. The bands of higher frequency spectrum is discussed here for better analyzation.

The *Parmataman* has infinite vibration (frequency). The known Electro-magnetic frequency spectrum staring from audible to Gamma vibrations, form a band of frequencies. From this known spectrum, Gamma /Cosmic frequencies are the largest. (pl. refer Fig.One)

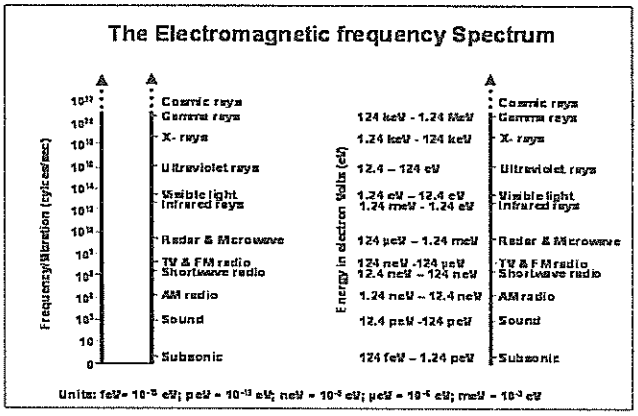


Fig: One.

From Gamma (vibration) frequencies to *Paramatman* (vibration) frequency there is a wide frequency band coverage which can be thought of in a logarithmic scale (whereas the audio to Gamma frequency band do not form logarithmic relationship).

The living beings such as plants, insects, birds, animals, and human beings also have mind vibration / frequency which can be suitably mapped in an appropriate position from the band starting from the Gamma ray to infinite. Various frequency (vibration) bands exist in the descending order from the *Paramatman.* As the frequency in the Electro-magnetic spectrum increases the energies (power) levels also increases. (Fig: Two)

Mind vibrations (frequencies) – Plants to Universal Supreme

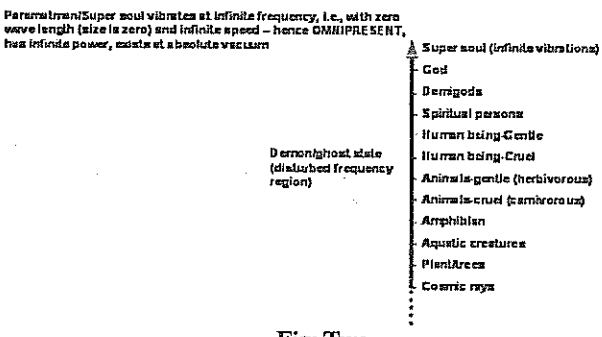


Fig: Two

If a person attains qualities near to the God, then his mind vibrates in a form of electro-magnetic wave with a frequency band near to the *Paramatman.*

The mind frequency modulated with the *Atman* (which is infinite and also acts as a carrier) reduces the effective frequency of *Atman.* However the *Atman* frequency will guide effective frequency of the *Atman* to the right foetus for re-birth.

These frequencies are in a coded form and they get synchronized with the frequency of the person who it claims to be it's father. There after this coded signal also get tuned to its mother frequency to reside as a foetus. This the phenomenon of rebirth (we can compare this with mobile instrument and its telephone number- where as the mobile instrument is foetus and the telephone number is *Atman* in the coded form.)

No mistakes / partiality happen in this process because it is under the control of *Atman*, which is part of the *Parmatman.* The *Atman* of a bad person never goes into a good foetus and vice-versa. The *Atman* takes care of the *Karmic* results.

Hell and Heaven:

There are two concepts after the death of a person – one is *Swarga* (Heaven) and the other is *Naraka* (Hell). In case of *Swarga*, the *Atman* gets amalgamated with the *Paramatman.* (In reality, self-realization experience five stages of God realization. This is termed as *Moksha.* The experiences are 1. *Salokya* - house of God, 2. *Samipya* – near to God, 3. *Saroopya* – identical to God, 4.*Sayujya* – merging with God, 5.*Sarsti* – oneness with God.). In this case, *karma* (actions) and mind become extinct. If the *Atman* does not get salvation, then it re-enters another body. The waiting time for *Atman* from death to re-birth is known as *Naraka* (Hell). During the *Naraka*, the *Atman* suffers while getting the new body. It concludes that the *Naraka* is the period where the Atman do not get foetus in time and had to wait from death to re-birth for the new body. It may take few days to any number of years.

There is a another phenomenon in astrology known as *Kalsarpayoga.* A person having so much of his world that his attachment never dies even after his physical death. In such case the atman comes back to the same surroundings after a time period known as *Naraka.*

Death Scene: Departure of the Soul from living body

Death is a scene, when in the extreme case the soul goes out of the body and the vital force no longer exists. When the four *tatwas* water wave, heat wave, air wave and the elements of the Earth in the appropriate proportion are maintained, then the soul, the living vital element exists in the body. When any or more of these four *tatwas* become abnormal (because of accident / Old age), the *Prana* / Soul comes out from one or more of the *Navarandras / Sahasrarachakra.*

The Soul is dynamically present from *Sahasrara* to *mooladhara charka.* During such dynamism, it experiences the functioning of *charkas* (energy centers in the body) and inspires , nourishes them. In an occasion when a discrepancy, miscommunication or malfunction exists, then the Soul renounces the body, thereby making it incidentally dead.

The renunciation of Soul from the body is not abrupt when any of the above conditions arise. As a matter of fact the soul tries to make amendments to the various elements of the body depending on the *prarabdha* (past actions that are not reacted upon). In case the amendments (internal, external and spiritual) help normalize the various proportions between the two extreme *chakras,* then the soul continues to remain in the body. The opposite results in case the amendments fail.

The soul / *Prana* in the body is in the form of bio-magnetic current. It is just like the flow of water in a tree. As stated above, it is pertinent that all the five basic *tatwas* are in a balanced state. If this does not happen, the four elements other than the soul lose balance and the soul which is in the form of bio-magnetic current reduces to zero. Then the soul comes out of body along with Subtle mind energy and converts itself in the form of electro-magnetic wave in a defined coded form for the next feotus which concludes the fact that **"The Energy can neither be created nor destroyed, but it can be converted from one form to another".**

ROLE OF ANTIOXIDANT (ALPHA-TOCOPHEROL) ON CARDIOPULMONARY FITNESS IN ENDURANCE ATHLETES (CYCLISTS)

A Randomized Double Blind Placebo Control Design

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INTRODUCTION

As a result of greater oxygen consumption during exercise there is an increased flux of oxygen through mitochondria, 2%-5% of which is not completely reduced to water, thus forming reactive oxygen species. During exercise of higher intensity Reactive Oxygen Species (ROS) are generated by activation of cytokines secondary to muscle damage. Exercise stimulates redistribution of blood flow, provoking hypoxia which can increase the production of superoxide by xanthine oxidase in muscle. Bouts of strenuous exercise increases lipid peroxidation, generating malanodialdehyde and F (2alpha)- isoprostanes, release of muscle enzymes like lactate dehydrogenase & creatine kinase. Dietary and enzymatic antioxidant defenses appear to play protective role in muscle

cells by reducing associated oxidative damage to lipids, nucleic acids & proteins.[1] Antioxidant supplementation is likely to provide beneficial effects against exercise induced oxidative tissue damage[2].

Vitamin E deficiency can increase free-radical induced tissue injury to levels comparable to those found, so an adequate status of vitamin E is important for maintaining membrane integrity during exercise [3,4] Consequent with various findings on exercise free radical relationship, scientific literatures were filled with a relatively consistent findings of an increase in antioxidant enzyme activity in various tissues of trained athletes. The added protection would come in the form of exogenous supplementation. The most well researched nutritional antioxidants in exercising subjects have been the vitamin E and C. Vitamin E is considered to be extremely important because of its association with cell membranes.[5] Aerobic exercise increases production of heat shock protein 70 (HSP70) due to increased oxygen influx through oxidative energetic systems and as a result of mitochondrial uncoupling associated with elevated temperature during exercise. The deprivation of vitamin E during chronic and acute exercise initiates HSP synthesis in trained rats.[6]

Hence an approach has been made in the present study to assess the effect of supplementation of Vitamin E (alpha-tocopherol) on the cardiopulmonary fitness of endurance athletes (cyclists) by a double-blind placebo control study.

MATERIAL AND METHODS -

The study was placebo control double blind random allocation technique. It was conducted on trainee athletes (cyclists) from District Youth Service and Sports Office, Bijapur. Permission to conduct the study was obtained from the Authority of Districts Youth Services and Sports Officer.

40 cyclists volunteered for the study in the age group of 18-19years. Three could not complete the study due to personal reasons. Two study groups were made, one taking vitamin E as experimental group, other one taking placebo as placebo group; the subjects were randomly allocated by lot to either experimental or placebo group equally. Experimental group received vitamin E tablet 200mg per day for 21 days and they were 19 in number. Placebo group received a tablet of placebo (Pudin Hara) which looked exactly similar to that of vitamin E and they were 18 in number.

Control group were selected among the students of first MBBS of BLDEA's Shri B.M.Patil Medical College Hospital and Research Center Bijapur. They were total 33 in number between the age group of 18-19 years. The ethical clearance for the study was obtained from Ethical Committee of our college as per requirements of Rajiv Gandhi University of Health Sciences of Bangalore.

METHOD OF COLLECTION OF DATA

All the exercise data were collected during morning hours between 7am to 9am to avoid any possible diurnal variations. Subjects were told to report an hour before experiments. The details of the procedure of the exercise tests were explained to the subjects and demonstrated before hand to allay apprehension. They were asked to refrain from eating and drinking for an hour and allowed to take rest for half an hour before the experiment. All the parameters were recorded in the Performa of each subject. After the supplementation regime of 21 days once again all the parameters recording was repeated on subjects of study group.

RECORDING OF PHYSIOLOGICAL PARAMETERS

The following parameters were recorded in pre and post exercise conditions (1 minute after exercise) in all the subjects.

1. Respiratory rate (cycles per minute)
2. Heart rate (beats per minute)
3. Systolic and diastolic blood pressure (mmHg) by using mercury sphygmomanometer.

Recording of Cardiopulmonary Fitness Parameter –

1) Recording of physical fitness index by using Harvard step test:

Physical fitness index of each subject was recorded by using Harvard Step Test [7]. Each subject completed up & down task (24 steps per minute) on an 18 inch bench for 3 minutes or until exhaustion whichever is early.

Exhaustion is defined as when the subject could not maintain the stepping rate for 15 per second. The physical fitness index (PFI) 105score was calculated as follows:

$$PFI = \frac{\text{Duration of exercise in seconds} \times 100}{5.5 \times \text{pulse rate (1-1.30 minute after exercise)}}$$

2) Determination VO_2 max:

VO_2 max was measured in subjects applying the step test of Margaria et al [8]. The details of this study involve to determination of exercise heart rates on two separate step test studies and measurement of VO_2 was not necessary as energy cost of step test is same for all fit persons and would be obtained from nomogram with any step height and frequency. Das and Bhattacharya described that steady state exercise heart rate is same when it is measured with time taken for five heartbeats with an electronic stop watch [9], consequently, Das suggested simplification of Margaria's equation for determination of VO_2 max.

Accordingly study has been carried out on a 33cm. step height and the two step frequencies are 15 and 20 per minute respectively. Five minute rest pause was given in between two step test works. With the following equation VO_2 max was determined according to Margarita et al. [10] (1965).

$$VO_2 \max (ml.Kg\text{-}1.Min\text{-}1) = \frac{f.\max (V''O_2 - V'O_2) + f'V'O_2 - f''V'O_2 - f'V''O_2}{f'-f''}$$

where f max = maximum exercise heart rate, f' and f'' are two exercise heart rates at two workloads $V'O_2$ and $V''O_2$ respectively.

The indirect maximum heart rate was obtained with time taken for five beats using electronic stopwatch immediately at the end of each step test work.

STASTICALANALYSIS:

Mean and standard deviation of all the sets of observations were calculated. Significance of the differences was calculated by applying 'Z' test and 't' test. 'p' value < 0.05 is taken as significant.[11]

RESULTS

Various physiological parameters recorded in subjects of both experimental (19) and placebo (18) group before exercise, before and after supplementation of either vitamin E or placebo drug is presented in table i. From the values in the table it can be observed that none of the parameters vary significantly before and after supplementation. This is true for both vitamin E and placebo group.

Table i: *Various Physiological Para meters of subjects in Experimental and Placebo Group, before and after supplementation.*

(Values are Mean ± SD)

	Experimental (n=19)		Placebo (n=18)	
Parameter	Before supplementation	After supplementation	Before supplementation	After supplementation
Resp rate/ min	17.15± 1.98	18.68± 1.21^{NS}	17.05± 1.84	17.33± 1.59^{NS}
Heart rate Bpm	74.36± 7.20	76.26± 5.60^{NS}	72.11± 6.47	70.22± 4.74^{NS}
SBP mmHg	121.05± 7.17	122.94± 6.87^{NS}	117.0± 6.47	117.33± 6.99^{NS}
DBP mmHg	76.84± 7.14	76.73± 7.17^{NS}	76.77± 4.52	76.44± 4.59^{NS}

NS: Not significant

Table ii represents comparative values of physical fitness index in experimental and placebo subjects before and after supplementation. Neither of the group has shown significant difference in physical fitness index before and after their respective supplementation of vitamin E and placebo.

Table ii: Comparison of Physical Fitness Index before and after Supplementation in Experimental and Placebo Group

(Values are Mean ± SD)

Variable	Experimental Group (n=19)	Placebo Group (n=18)
Before supplementation	83.12±8.90	85.34±9.91
After supplementation	84.08±9.12	85.22±9.37
Level of significance	NS	NS

NS: Not significant (p >0.05)

Values of VO_2 max recorded in placebo and experimental groups before and after supplementation are given in table iii. In none of the group the mean value of VO_2 max recorded before and after supplementation varies significantly.

Table iii: Comparison of VO_2 max. (ml/min/kg) in Placebo and Experimental groups before and after supplementation of drug

(Values are Mean + SD)

Group	Experimental (n=19)	Placebo (n=18)
Before supplementation	37.06±2.18	35.44±1.71
After supplementation	38.38±2.43	35.97±1.54
Level of significance	NS	NS

NS: Not significant (p >0.05)

DISCUSSION:

Relationship between diet and athletic performances were studied long before nutrition became a science. Coaches, athletes all over the world, have long contemplated the possibility that some nutrient can supercharge the body and their by increase the athletic performance. Many studies dealing with vitamin E have been conducted to know its effect on physical performance. The current study has been planned with an objective of to elucidating the effect of vitamin E (200mg/day) supplementation for 21 days on cardiopulmonary fitness in endurance athletes (cyclists), and comparing this effect with that of placebo in a double blind model.

We recorded physiological parameters like BP, RR and Heart rate of non-athletes (control) and athletes (subjects) before and after supplementation of vitamin E. Analysis of data shows that supplementation of vitamin E has not improved either of physiological parameters in the study subjects. The change in these parameters before and after supplementation of vitamin E is within the limit of normal physiological range. Few authors have reported no significant effect on physical performance from vitamin E supplementation [12,13]. In our study also we found the same effect.

Highly physically active persons who can perform well in various sports and possessing higher values of VO_2 max have capacity to yield larger amount of energy and can perform better in athletic field activities[14]. Determination of VO_2 max is thus one of the important criteria to assess the cardiopulmonary efficiency and physical fitness of a subject [15]. In view of this we have assessed the effect of supplementation of antioxidant on performance of athletes by recording both PFI score and VO_2 max as cardiopulmonary fitness tests.

Previous studies have reported that vitamin E is playing a significant role during the training of runners and lower level of vitamin E in the blood can hamper the performance of runners[16]. Chatterjee and Maitra[17] in their study found that vitamin E intake significantly increased endurance capacity of untrained girls during their three phases of menstrual cycle, Simon and Pabst[18] from their study concluded that vitamin E has beneficial effect on physical performance and on cell protection , at high altitude.

In our present study , when we compared the cardiopulmonary fitness of two groups of endurance athletes before and after supplementation of vitamin E and a placebo, both recordings PFI and VO_2 max does not show any significant

difference from pre supplementation to post supplementation values. ($p>0.05$), Our observations are in agreement with Peterson, et al [19],where vitamin E and C supplementation did not influence the cytokine, muscle enzyme or lymphocyte response to exercise. Stampfer, et al [20] also found no effect of vitamin E on prostacycline production, arachidonic acid metabolites on platelet reactivity.

A number of other studies done [21,22,23,24] on the effect of supplementation of antioxidant as double blind crossover study found no beneficial effect of these antioxidants (vitamin E and C) in trained athletes.

Thus majority of the studies that investigated the effect of vitamin E on exercise performance have found no beneficial effect on measures of endurance or aerobic capacity. Our results also do not show any beneficial effect on cardiopulmonary efficiency by antioxidant supplementation in endurance athletes (cyclists).

In conclusion, our study supports the generally accepted view regarding vitamin E supplementation in exercise helps in reducing the markers of oxidative damage after exercise [25,26] but such supplementation does not help in increasing the endurance capacity in Athletes, whose diet is not otherwise deficient in vitamin E .

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DEVELOPMENT AND EVALUATION OF CONTROLLED RELEASE BEADS OF LIPID LOWERING DRUG USING NATURAL POLYMERS

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INTRODUCTION

As a regulator of homeostasis, cholesterol is essential to life. However, high levels of this lipophilic substance lead to atherosclerosis, a pre-disposing factor to the development of coronary artery disease (CAD). Atherosclerosis involves an accumulation of cholesterol and other blood lipids and lipoproteins in macrophage cells found in the intima of arteries. Lipid-engorged macrophage cells become foam cells, and foam cell infiltration progresses to fatty streaks in the arterial wall. Plaque formation, thrombosis, and vessel occlusion can follow, leading to CAD. The CAD involves one or more specific cardiovascular pathologies, including myocardial infarction (MI), ischemia, and angina pectoris. About 13-14 million of population in the United States is believed to be suffering from this complex and life-threatening condition and over 25 million people worldwide are expected to die from cardiovascular-related diseases by the year 2020. In addition to free cholesterol and its esters, triglycerides (long-chain fatty acid esters of the polyalcohol glycerol) and lipoproteins (macromolecular substances that solubilize blood lipids) are found in the bloodstream. High levels of triglycerides and the lipid-rich lipoproteins that promote the formation of atherosclerotic plaques (low density lipoproteins [LDL] and very low density lipoproteints [VLDL]) are also a significant health risk in developed nations where lifestyles are sedentary, stress is "sky high," and fat-laden meals are too often the norm. Patients with elevated levels of triglycerides and "bad cholesterol" are at risk for myocardial infarction and/or cerebral vascular accident (stroke). Serum cholesterol comes from both exogenous (dietary) and endogenous (biosynthetic) sources, so following a low-fat diet and exercising regularly can keep serum lipid levels in check for many. However, an individual's specific biochemical and metabolic profile can often work against even the healthiest lifestyle. For these "biochemically challenged" patients, lipid-lowering drugs such as simvastatin have literally provided a new lease on life (1).

Simvastatin is a lipid lowering agent derived synthetically from a fermentation product of *Aspergillus terreus*. After oral administration, it readily absorbs from the gastrointestinal tract (GIT) and is hydrolysed to corresponding β-hydroxy acid form. This is a principal metabolite and an inhibitor of 3-hydroxy-3-methylglutaryl-coenzyme-A (HMG-CoA) reductase, the enzyme that catalyses the rate limiting step in biosynthesis of cholesterol. The drug is having an oral daily dose of 10-20 mg, with bioavailability of less than 5%, and plasma half life of about 1.9 hours (2). Simvastatin reduces levels of circulating atherogenic lipoproteins by competitive inhibition of the microsomal enzyme HMG-CoA reductase; so, it is used in the treatment of hypercholesterolemia (3, 4).

Simvastatin is a powerful lipid-lowering drug that can decrease low density lipoprotein (LDL) levels by up to 50%. It is used in doses of 5 mg up to 80 mg. Higher doses (160 mg) have been found to be too toxic, while giving only minimal benefit in terms of lipid lowering. There is no real effect on HDL and triglyceride levels.

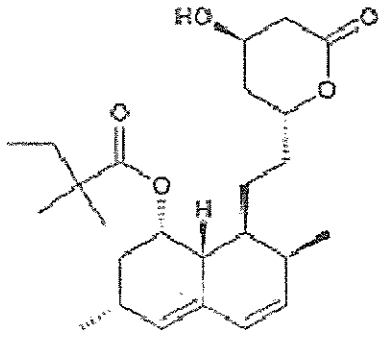


Figure 1. Chemical structure of simvastatin

Controlled drug delivery is defined as sustaining drug action by maintaining a relatively constant and effective drug level in the body with concomitant minimization of undesirable effects that may be associated with kinetic pattern of controlled release. The main objective of controlled drug delivery is to reduce frequency to an extent that once daily dose is sufficient for therapeutic management through a uniform plasma concentration at steady state. An ideal controlled drug delivery system is one which releases the drug at a predetermined rate, locally or systemically for a specific period of time. Controlled drug release occurs when a polymer, whether natural or synthetic is judiciously combined with drug or other active agent is released from the material in a pre-designed manner

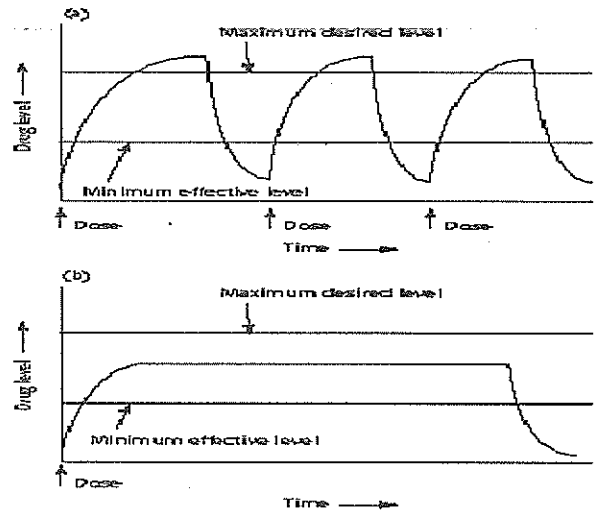


Figure 2. Drug levels in the blood with (a) conventional dosage form and (b) controlled-release dosage form.

Controlled release multiple unit dosage forms have advantages over single unit ones as they can spread out in a more uniform manner over a large surface area in the gastrointestinal tract (5). This can reduce the local irritation of the gastrointestinal tract by some drugs and can provide a larger area for drug absorption. Also with multiple unit dosage forms the intestinal retention of polymeric materials can be avoided (6). Using innovative microencapsulation technologies and by modifying the polymeric matrix, multi unit dosage forms can be developed in to an optimal drug delivery systems which will provide desired release profile (7). Several synthetic polymers have been used to prepare multi-unit dosage forms. Recently, research efforts have been concentrated to develop particulate delivery systems using natural polymers because of simple and eco-friendly preparative conditions.

The objective of the present research work was to prepare and evaluate the spherical beads using natural polymers like carboxymethylcellulose and tamarind seed polysaccharide for controlled release of simvastatin. After oral administration through conventional dosage forms like tablets, simvastatin undergoes extensive first pass metabolism in the liver leading to bioavailability of less than 5%, and plasma half life of about 1.9 hours, hence, repeated administration of drug is required to maintain the blood concentration, but the repeated administration can cause the toxic effects due to drug accumulation in the body. Therefore, if simvastatin is prepared in the form of controlled release beads, these problems associated with conventional tablets can be avoided.

Experimental

Simvastatin (SMT) was obtained from Ranbaxy Ltd. Carboxy methylcellulose sodium salt (NaCMC), aluminum chloride hexahydrate, sodium hydroxide, and Conc. HCl was purchased from S.D fine Chemicals, Mumbai. Tamarind seeds were obtained locally and the seed polysaccharide (TSP) was isolated in our laboratory. Double distilled water was used through out the study.

Preparation of beads

An accurately weighed quantity of simvastatin (20% & 40% w/w of dry mass of the polymer) was dispersed in an aqueous solution of NaCMC and TSP (in the ratios of CMC:TSP; 3.5:0.5, 3:1, 2.5:1.5, 2:2. Total polymer concentration was 4% w/v) and mixed homogenously using a magnetic stirrer. The dispersion was extruded in the form of droplets into aqueous solution of different concentrations of aluminum chloride (5, 10 and15% w/v) using hypodermic syringe. After incubating for additional 15 minutes in $AlCl_3$ solution, the beads were removed and placed in ethanol for 1 minute; then dried at 40 °C for 10 hours.

Then the beads were evaluated for size analysis, drug entrapment efficiency and *in vitro* drug release.

***In-vitro* drug release study**

In- vitro drug release study was carried out using a USP-23 rotating basket dissolution tester (Electrolab TDT-06P, Mumbai, India). The dissolution rates were measured at 37.0± 0.5° C at 50 rpm basket speed. Drug release from the beads was studied in 900 ml dissolution medium (pH 1.2 buffer or pH 7.4 phosphate buffer). At predetermined time intervals, 5 ml aliquots were withdrawn and analyzed using UV-Visible spectrophotometer at a λ_{max} of 238 nm.

RESULTS AND DISCUSSION

When the dispersion of simvastatin, NaCMC and TSP was added to the aqueous solution of $AlCl_3$, beads were formed instantaneously. The beads were spherical in shape and having a size range 1146 to 1299 μ depending upon the formulation variables. As the concentration of TSP was increased in the formulation, the size of the beads increased and as the concentration of $AlCl_3$ was increased, the size of the beads was decreased. The drug entrapment efficiency indicated that the beads were capable of encapsulating 67% to 83% of simvastatin. Increase in concentration of TSP polymer resulted in decreased encapsulation, while increase in $AlCl_3$ resulted in increased drug entrapment efficiency (see Table 1).

The CR beads C1, C2, C3, C4, C5, C6 and C7 have shown a drug release of 86%, 91%, 96%, 98%, 86%, 77% and 81% respectively at the end of 7th h as shown in Fig. 3 and 4. As the concentration of TSP was increased, the drug release was increased, whereas increase in $AlCl_3$ resulted in decreased drug release. The drug release from all the beads followed the diffusion mechanism. In conclusion, the formulation C6 containing 2.5% NaCMC, 1.5% TSP and 15% $AlCl_3$ has shown least drug release hence, it can control the release rate of simvastatin for prolonged period, and it is a good formulation. This study suggests that the simvastatin can be released in a controlled manner in order to avoid the frequent administration and for better patient comfort and compliance.

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Table 1. Data obtained from evaluation of simvastatin controlled release beads

Formulations	Size (μ)	Drug Entrapment efficiency (%)	% drug released	*r* values (Higuchi model)
C1	1214	83.75	86.12	0.9825
C2	1239	77.18	91.06	0.9987
C3	1243	72.26	96.01	0.9993
C4	1299	67.33	98.83	0.9995
C5	1188	76.64	86.83	0.9994
C6	1146	79.37	77.36	0.9946
C7	1163	75.54	81.54	0.9951

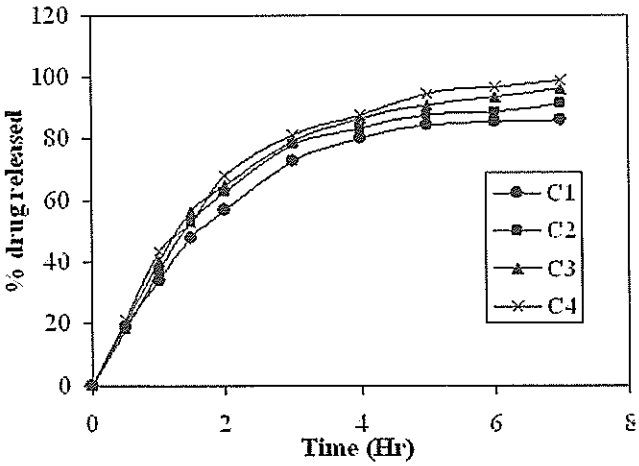


Figure 3. Release of simvastatin from beads

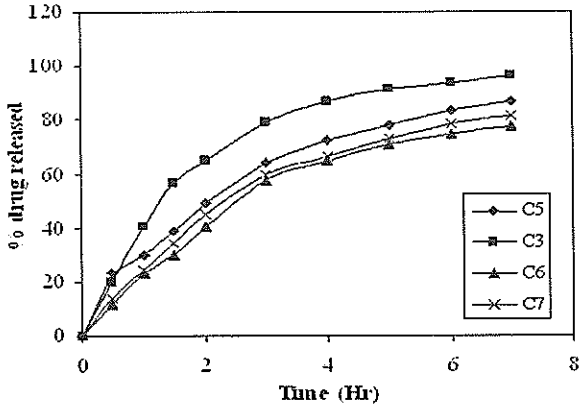


Figure 4. Influence of cross-linking agent on the release of simvastatin from beads

PHYSICAL FITNESS AFFECTING THE LIFE STYLE OF ADOLESCENCES

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Introduction: This is the law that only the strong shall thrive that surely the weak will pursuits and only the fit will survive- (Robert. W. Service).

Definition: Physical fitness is the ability to last to bear up or to with stand stress and to pressure under difficult circumstance where an unfit person would be ineffective or would quit.

This indicates the importance of physical fitness in few but apt words. Physical fitness is not only essential for an individual as well as to whole nation. Due to modern amenities at a very fast rate neglecting their disadvantages .Hence the sedentary comfortable life style is prevalent at the cost of physical fitness.

It is the time to consider about the physical fitness and exercise in the adolescent age group. The positive health is the terminal goal of the health planners while the physical fitness is the means to achieve the targets.

The limitations of fitness are determined largely by inheritance .But the potential for fitness is largely developed by daily living practice and exercise, habit adequate nutrition, sufficient rest and relaxation suitable work and appropriate medical care. They are also important in maintaining the fitness.

To achieve good fitness in children sports programmers should be arranged accordingly. At first stage, priority of fun, recreations sports programmers' skill development and opportunity for competition should be provided. At second stage the exercise should be both competitive as well as more exhaustive than first stage. Whereas in third stage and fourth stage the exercise should be severe enough to attain maximum fitness .Because at this stage, the muscle strength, cardiopulmonary strength and endurance of the children are developed maximally.

Physical fitness increase the level of intelligence children with low fitness is emotionally unstable and less defensive.

Physically fit children show better adaptability to stress, less neuromuscular tension and less fatigability.

Regular aerobic exercise profoundly improves an individual's ability to oxidize fatty acids within active muscles during steady rate of exercise.

Regular exercise positively brings about an emotionally stable

mind .In a physically fit person symptoms alleviation of depression is greater. Moderate exercise is within enhanced cognitive function.

Appropriate kind and amount of exercise constantly emphasized will develop muscular strength and endurance, body flexibility, circulatory and respiratory endurance. Hence properly directed exercise is the only means of acquiring the ability to engage in tasks demanding strong and sustained physical efforts.

In view of the above fact a comparative study was carried out among Residential and nonresidential boys of age group 14-17 years.

The anthropometric, physiological respiratory cardiopulmonary fitness and hematological parameters were taken into consideration.

Results: We observed that mean ht, wt, BMI, SBP, PR_1, P_M ,IRV,(ml),ERV(ml),and VC(ml) all these mentioned parameters were increased significantly in

Residential (group I) than in nonresidential (Group II).

Mean PFI% and VO_2 max ml/kg/min were also increased significantly in group I and in group II .Hb% also increased significantly in group I .

RESULTS AND DISCISSIONS

Table 1

Comparison of Anthropometric Parameters between Group I and Group II

Parameters	Group I			Group II			
	Mean	± SD	SE	Mean	± SD	SE	P values
Age (year)	14.94	0.747	0.11	14.878	0.754	0.11	>0.05
Height (cms)	160.29	9.64	1.4	155.39	8.93	1.3	<0.01
Weight (kg)	46.76	7.83	1.1	45.16	7.89	1.1	>0.05
MAC (cms)	21.43	2.27	0.32	21.49	2.75	0.39	>0.05
CC (cms)	73.29	5.22	0.75	71.41	6.9	1.0	>0.05
Abd C (cms)	67.41	7.10	1.0	65.47	7.89	1.1	>0.05
BSA (sq mt)	1.462	0.157	0.022	1.410	0.137	0.02	>0.05
BMI (kg/mt^2)	14.44	1.87	0.27	18.21	3.23	0.46	<0.001

Table 2

Comparison of Physiological Parameters between Group I and Group II

Parameters	Group I			Group II			
	Mean	± SD	SE	Mean	± SD	SE	P values
RR (cycle/mi)	21.6	12.8	1.8	20.39	2.28	0.33	>0.05
SBP (mmHg)	111.92	6.22	0.89	89.35	8.98	1.3	<0.001
DBP (mmHg)	70.82	7.86	1.1	74.08	7.02	1	< 0.05
MAP (mmHg)	84.82	6.43	0.92	86.47	6.8	0.97	>0.05
PR (bpm)	80.98	9.29	1.3	89.35	8.98	1.3	<0.001
PR_1 (bpm)	122	21.2	3.0	148.7	23.1	3.3	<0.001
PR_2 (bpm)	136.5	17.6	2.5	100.5	12.2	1.7	<0.001
P_{max} (bpm)	157.3	13.2	1.9	182.1	19.3	2.8	<0.001

Table 3

Comparison of Respiratory Parameters between Group I and Group II

Parameters	Group I			Group II			
	Mean	± SD	SE	Mean	± SD	SE	P values
BHT (sec)	36.4	10.8	1.5	31.94	9.88	1.4	<0.05
ENDT (sec)	36.3	11.9	1.7	33.3	10.1	1.4	>0.05
TV (ml)	423.5	69.3	9.9	401.5	58.3	8.3	>0.05
IRV (ml)	1178	293	42	1104	299	43	>0.05
ERV (ml)	1003	351	50	877	225	32	<0.05
VC (ml)	2351	452	65	2202	390	56	>0.05
FEV_1 (%)	85.63	9.71	1.4	85.3	5.85	0.84	>0.05
PEFR (lit/min)	471	101	14	411.2	56.1	8.0	<0.001

Table 4

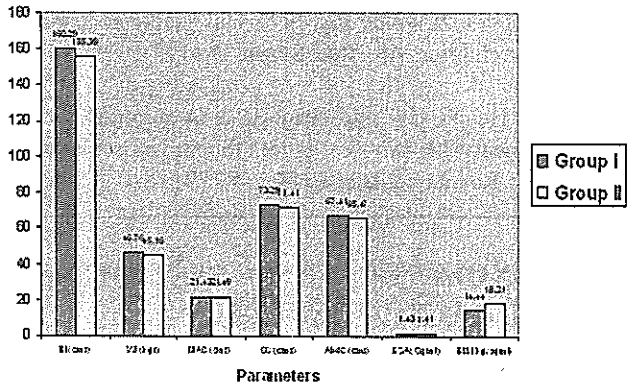
Comparison of Hematological Parameters between Group I and Group II

Parameters	Group I			Group II			
	Mean	± SD	SE	Mean	± SD	SE	P values
Hb (gm/dl)	14.63	1.04	0.15	13.27	1.10	0.16	<0.001

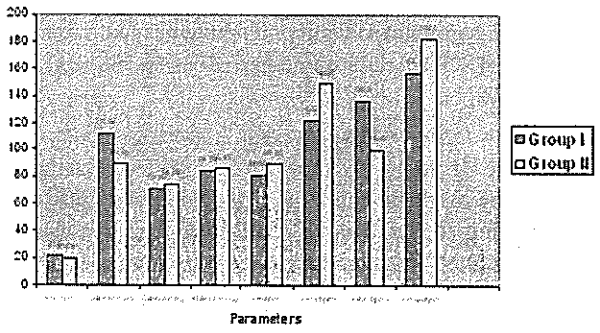
Table 5
Comparison of Cardiopulmonary fitness Parameters between Group I and Group II

Parameters	Group I			Group II			
	Mean	± SD	SE	Mean	± SD	SE	P values
PFI (%)	64.34	6.86	0.98	62.03	4.43	0.63	<0.05
VO_2 max (ml/kg/min)	54.4	65	9.3	29.38	8.74	1.2	<0.001

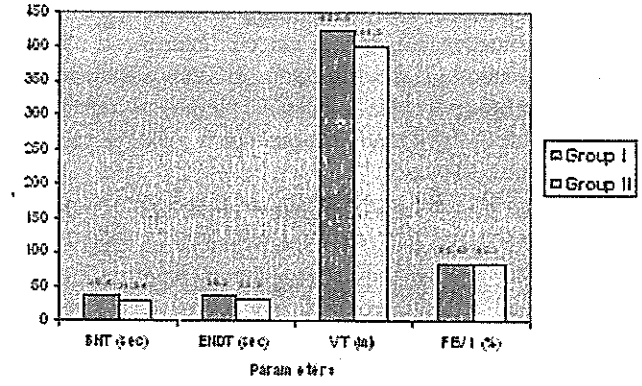
Graph 1 : Comparison of Anthropometric Parameters between Groups I & II



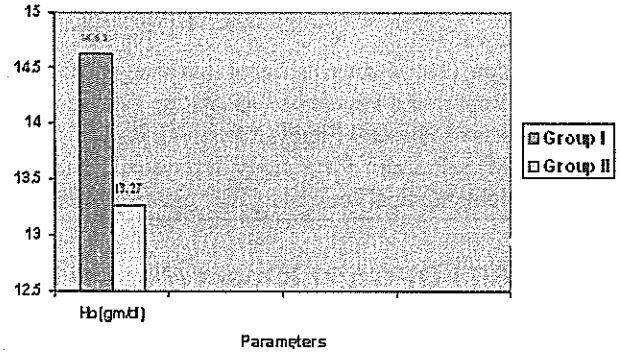
Graph 2 : Comparison of Physiological Parameters between Groups I & II



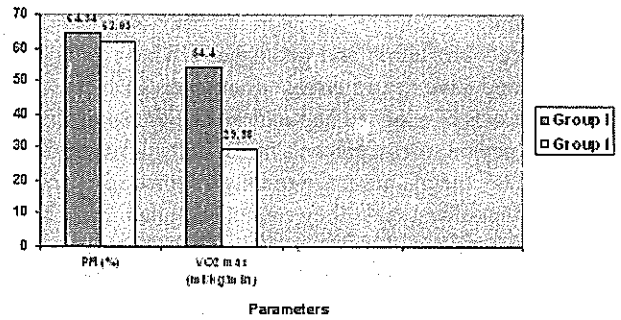
Graph 3 : Comparasion of Respiratory Parameters between Group I & II



Graph 5: Comparision of Hematolgical Parameters between Group I & II



Graph 6: Comparision of Cardiopulmonary Parameters between Group I & II :



Our data analysis showed that residential boys had better cardiopulmonary fitness, anthropometric physiological parameters than nonresidential school boys .This reflects a higher and better growth pattern of children of group I .This growth pattern in group I may be related to regular physical activity of training given in the residential schools. Regular physical activity and training may be one of the contributing factors in attainment of such growth .WE observed that group I residential children had good to excellent VO_{2max} (45.2-50.9 and 51-55.9ml/kg/min respectively. But group II belonged to very poor to poor category of VO2 max (35-40 ml/kg/min .The obtained values for group I was 54.4+-6.5SE9.3 and for group II 29.38+-8.74 with SE 1.2 .

In our study obtained PFI ratio did not correlate with that of STD HST protocol of Broucha et al (1943).

We observed that the recovery HR in group I was lower as compared to that of group II .This could show the body capacity to adapt to greater training loads.

Conclusion: The Vo2max score is influenced by various factors such as mode of exercise, persons' heredity status, training, age, sex, and body composition.

We have considered the mode of exercise, age, sex and body composition. We conducted the study on residential and nonresidential school boys of age 14-17 years. We came to conclusion from our study that cardiopulmonary fitness parameters are higher in the residential than those of nonresidential school boys. The higher values of cardiopulmonary fitness among the residential children may be due to their regular diet, regular pattern of life and regular exercise.

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EFFECT OF GARLIC *(ALLIUM SATIVUM)* ON ANTIOXIDANT DEFENSE SYSTEM IN ERYTHROCYTE OF ALBINO RATS EXPOSED TO HEAVY METALS (NICKEL II & CHROMIUM VI)

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Introduction:

Heavy metals are stable and persistent environmental contaminants and have the potential to cause various alterations in target tissues of exposed humans. Hence the environment, in which a person works, can be a major factor in determining health. Heavy metals are trace metals with a density atleast five times that of water. As they cannot be metabolized by the body, these metals are bioaccumulative. Among these, nickel and chromium are used extensively in stainless steel industry, the single largest industry, along with welding and electroplating industry. As a result, occupational exposures to these are very high via inhalation or ingestion of metal containing diet. After entering into the body, both nickel and chromium penetrates all organs but mainly accumulates into liver, kidney, lungs, bone etc [1,2]. Nickel can induce severe liver and kidney damage by altering several marker enzymes and ascorbate-cholesterol metabolism along with histopathological alt rations [3,4]. On the other hand, hexavelent chromium has been reported to cause hepatotoxicity in both human and laboratory animals [5]. There is also evidence of progressive lung cancer with exposure to Cr (VI) in chrome pigment industry workers [6]. Evaluations of toxicity of the metals are facilitated by results of basic hematological assays [7]. Nickel and Cr induced alteration of hematological parameters were reported earlier [I, 2]. Nickel can affect erythrocyte membrane lipid bilayer and membrane protein [8]. It is well documented that heavy metals usually bind with the RBC membranes and plasma albumin and stimulates metallothioneins and ROS. This results in oxidative damage in RBC and in various tissues [9, 10]. RBCs are equipped with defense system representing their antioxidant capacity. This system includes glutathione and other enzymes like superoxide dismutase (SOD), glutathione peroxidase (GSH-Px) and catalase (CAT) [11].

Garlic *(Allium sativum)* has played an important dietary and medicinal role throughout the history of mankind. The therapeutic efficacy of garlic encompasses a wide variety of ailments including cardiovascular, cancer, hepatic and microbial infection [12]. Previous studies in our lab showed that garlic has some beneficial effect in preventing nickel and Cr induced alteration of serum lipid profile [13]. All these are attributed to the presence of various organosulfur compounds in garlic which are having tremendous antioxidant property [14]. As our previous studies and various other studies have revealed the beneficial effect of aqueous homogenate of raw garlic, the present study was designed to investigate the possible protective role of fresh aqueous homogenate of garlic on some hematological parameters, RBC antioxidant defense system and lipid peroxidation in male albino rats treated with nickel sulfate (NiSO4) and potassium dichromate (K2Cr207).

Materials and Methods

Adult (aged 60-70 days) laboratory bred male Wister rats weighing 160 :t 5 g each were fed with laboratory stock diet and water *ad libitum* for 7 days. The acclimatized animals were divided into six groups of six animals each. Group I served as an untreated control. Group II were administered aqueous homogenate of fresh raw garlic at a dose of250 mg/ Kg b.wt; orally [15] Group III was treated with nickel sulfate

(New India Chemical Enterprises, Kochi, India) in double-distilled water at a dose of2.0 mg/lOOg b.wt, intraperitoneally (Lp.) [16]. Group IV rats received both nickel sulfate (2.0 mg/ lOOg b.wt, Lp) and garlic (250 mg/ Kg b.wt; orally) simultaneously. Group V rats were given potassium dichromate (Qualigens Fine Chemicals, Mumbai, India) in double distilled water at a dose of 0.5 mg/lOOg b.wt, intraperitoneally (Lp.) [17]. Group VI rats were treated simultaneously with potassium dichromate (0.5 mg/lOOg b.wt, i.p.) and garlic (250 mg/ Kg b.wt; orally). Nickel sulfate and potassium dichromate were given on alternate days until tenth dose whereas garlic was administered orally everyday until twentieth dose. The entire experimental protocol was approved by institutional ethical committee and utmost care was taken during the experimental procedure, as well as at the time of sacrifice, according to the Helsinki Declaration of 1964 [18]. After the treatment, the animals were sacrificed by decapitation always between 9:00 h and 11 :00 h and fresh blood was immediately collected into heparinized test tubes. All the hematological parameters Le. total red blood corpuscles (RBC) count, packed cell volume (PCV), total white blood corpuscles (WBC) count, total platelets count and clotting time were measured by using fully automated hematology analyzer (Sysmax K-4500) [19]. The hemoglobin (Hb) concentration in the red celllysates was determined by the cyanmethemoglobin method [20]. To determine antioxidant status of erythrocytes, blood samples were centrifuged at 3000 rpm for 15 min to remove the plasma and buffy coat (consisting leucocytes and platelets). The erythrocytes were washed three times in buffered saline (0.9% saline in 0.01 M phosphate buffer, pH 7.4), and the packed cells were suspended in equal volume of the buffered saline. Erythrocyte lipid peroxide (LPO) was measured as the production of malondialdehyde (MDA) which in combination with thiobarbituric acid (TBA) forms pink chromogen compound whose absorbance at 530 nm was recorded. The concentration of MDA was calculated using a standard curve obtained from the reaction between varying MDA concentration (0.1, 0.5, 2.0 and 3.0 runol MDAig hemoglobin) [21]. The activity of erythrocyte superoxide dismutase (SOD) was determined spectrophotometrically at 480 run by the epinephrine method [22] and it was expressed in units of enzyme activity per gram of hemoglobin (Unitlg Hb). Total erythrocyte glutathione (GSH) was estimated by the method of Beutler *et ol* [23]. Measurement of erythrocyte glutathione peroxidase (GSH-Px) was based on the following principle: GSH-Px catalyzes the oxidation of glutathione by cumene hydroperoxide. In the presence of glutathione reductase and nicotinamide adenine dinucleotide phosphate (NADPH) the oxidized glutathione is immediately converted to the reduced form with concomitant oxidation ofNADPH to NADP+. The decrease in absorbance at 340 run was measured [24]. The erythrocyte GSH-Px activity was expressed as Unitlg Hb. The enzyme unit of GSH-Px was defined as the number of reduced NADP oxidized per minute at 37°C and according to the Randox application procedure. Catalase (CAT) activity in hemolysate was assayed by the method of Aebi. From the hemolysate an aliquot of 10 11 was diluted with phosphate buffer (50 mmol/ l, pH 7.4) to a final volume of5.0 ml. CAT activity was measured by adding 1.0 milliO2 (30 mmoVI, Merck) to 2.0 ml diluted hemolysate and reading the decrease in absorbance at 240 run between 20 and 30 s with a spectrophotometer against a blank consisting of 2.0 ml diluted hemolysate and 1.0 ml deionized water at 37°C. Each sample was assayed twice, and the mean of the first order rate constant (k) was calculated. The final results corrected for the dilution and related to the Hb concentration, the enzyme activity was expressed as k/g Hb as described in the literature [25].

Mean + SD values were calculated for each group. To determine the significance of inter-group differences, we analyzed each parameter separately. A one way analysis of variance (ANOV A) followed by post hoc't' test was done to determine which of the groups differed among themselves. Duncan's multiple range test was applied with the level of significance fixed at $P < 0.05$ [26].

Results:

Intraperitonial nickel sulfate administration resulted in significant decrease in red blood cell (RBC) count, white blood cell (WBC) count, hematocrit value (PCV%) and haemoglobin (Hb) concentration when compared to that of control group. Simultaneous garlic administration also ;howed a significant decrease in the above parameters from control value, but when compared to that of nickel treated group, a significant increase have been found. A significant increase of clotting time (CT) followed by a decrease in platelet count in nickel treated group was observed when compared to untreated control. But simultaneous garlic administration was unable to improve the above parameters significantly. Similarly, after treatment with potassium dichromate, RBC count, WBC count, Hb concentration and hematocrit values were decreased significantly from untreated control value. Garlic administered simultaneously to chromium treated rats was significantly able to bring the changed value of RBC, WBC and Hb concentration only towards that of control value. Although we have found a significant decrease in platelet count in chromium treated rats, but garlic administration was unable to improve the situation. In rats, treated with only garlic homogenate, there was no significant change in the above parameters except a significant fall in platelet count.

In the red blood cells of the nickel sulfate and potassium dichromate treated rats malondialdehyde (MDA), glutathione (GSH) levels and the activities of superoxide dismutase (SOD), glutathione peroxidase (GSH-Px) and catalase (CAT) were significantly increased when compared to untreated control (Group I) rats. Simultaneous treatment with garlic and nickel sulfate partially reversed this change to near untreated control values except SOD activity. There was no significant improvement in the above parameters in rats treated simultaneously with potassium dichromate and garlic (except MDA

level).

Discussion:

From our observation, it can be seen that, treatment with either nickel sulfate or potassium dichromate indices anemia type condition (decreased RBC count, PCV and Hb concentration) in rats although both nickel and chromium are essential trace element for normal physiological functioning of our body. Previous studies have shown that nickel may adversely affect hematopoiesis [27]. In our study, decrease in RBC count, PCV% and Hb concentration may be due to non-regenerative anemia arise of nickel induced direct injury of hematopoietic stem cells resulting in decreased RBC count, WBC count, Platelet count [28]. In this study, decrease in platelet count occurred may be due to decrease production or increased consumption of them. Alteration of WBC count and decreased hematocrit value in rats have already been reported following administration of nickel [29]. Nickel sulfate may depress bone marrow activity and significantly decreased all the types of blood cells, as per our observation in our previous study [28]. Study by Hyeon *ef ai,* revealed that Cr (VI) exposure to rats resulted in reduction of RBC count and hematocrit value along with a decrease in haemoglobin concentration [30]. The decrease in hemoglobin appears to be due to inhibition of its biosynthesis by decreasing the succinyl pool as well as glycine pool. Both are required in the initial stage of the heme biosynthesis [31].

Simultaneous treatment with garlic decreased the toxic effect of both nickel and chromium on hematological values and showed a protective role in anemia, leucopenia and thrombocytopenia in our study. This may bay be due to the stimulation of bone marrow activity. It is also known that, sulfur compound in garlic significantly prolong bleeding time and thrombine time [32]

Reactive oxygen species (ROS) include free radicals and non-radical species like superoxide and hydroxyl radical and hydrogen peroxide, singlet oxygen etc. ROS are implicated as important pathologic mediators in many disorders. Increased generation of ROS and enhanced lipid peroxidation are considered responsible for toxicity of wide range of compounds [33]. Our present study reveals that, treatment with either nickel sulfate or potassium dichromate increase lipid peroxidation by increasing MDA concentration in red blood cells of rats. This increase in MDA concentration was definitely accompanied by increased ROS formation [34]. As a result, enhanced lipid peroxidation, DNA damage, altered calcium and sulfydryl homeostasis as well as marked disturbances in antioxidant defense system occurred [35]. Simultaneous treatment with garlic was found to be effective in prevention of oxidative damage in erythrocyte, induced by both nickel sulfate and potassium dichromate resulting in a significant decrease in erythrocyte MDA concentration. The present study reported an increase in the level of GSH and the activities of GSH-Px, SOD and CAT enzymes in RBC of rats treated with nickel or chromium. This change may be attributed to adaptive change. There is report that reduction of hexavelent chromium to trivalent chromium in RBC occurs by the action of glutathione [36]. It is also previously reported that oxidative stress increase the GSH-Px activity [37] in thjs study increased SOD activity indicates an increased production of superoxide radical in heavy metal (nickel II and chromium VI) toxicity. The increase in GSH-Px and CAT activity after nickel or chromium exposure may be explained by their influence on hydrogen peroxide as substrate, which is formed in the dismutation reaction of superoxide radical [38, 28). This action is followed by increased formation of aSH by glutathione reductase [39].

Simultaneous garlic administration with nickel sulfate brought erythrocyte GSH level and activity of GSH-Px and CAT near to that of control value confirming a protective role of garlic extract on nickel induced impairment of erythrocyte antioxidant defense system. But such improvement was not found in rats treated with potassium dichromate and garlic simultaneously. The cause may be due to a different pathway of action of chromium (VI), which should be evaluated in further studies.

It can be concluded from present findings that both nickel sulfate and potassium dichromate induced oxidative stress in RBC leads to anemia, leucopenia and thrombocytopenia along with elevated erythrocyte MDA level and altered antioxidant defense system. Simultaneous treatment with aqueous homogenate of fresh garlic may protect against nickel and chromium induced toxicity but garlic may be more protective in nickel induced toxicity.

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INFLUENCE OF MENSTRUAL CYCLE ON HEMATOLOGICAL PARAMETERS

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Introduction

Menstruation is defined as *"periodic and cyclical shedding of progestational endometrium accompanied by loss of blood"* during the reproductive age between menarche (onset of menstruation) and menopause (cessation of menstruation) [1].

The menstrual cycle influences a number of tissues and alters a variety of functions, periodically in tune with the phase of the menstrual cycle. In addition to the well known cyclic changes occurring in ovary, uterus, cervix, vagina, breast etc., the neuro-hormonal changes of menstrual cycle are known to induce certain hematological variations.

The naturally occurring fluctuations in the levels of sex steroid hormones during the menstrual cycle provide a convenient basis for analyzing the interactions between sex steroid hormones and immune mechanisms.

Growing evidence identifies both cyclic and rhythmic variation in the concentrations and functions of immune cells. Clinical and experimental evidence support the hypothesis that gonadal steroids regulate immune function. Receptors for steroid hormones, as demonstrated by cytosolic and nuclear assays, have been found in circulating lymphocytes. Steroid hormones are known to induce immunological events such as altering immunoglobulin secretion, and depression of suppressor T cell activity. The platelet count has been reported to be higher in females than in males. Studies also indicate that platelet function is periodically altered during the menstrual cycle due to the influence of progesterone and estrogen on Von Willebrand factor concentrations[3].

The optimal availability of immune cells in the peripheral blood stream of women plays a critical role in their response to disease and therapeutic interventions. Recent clinical studies show that survival rates for women with operable breast cancer varied based on the time of the menstrual cycle at operation [2].

Menstrual Cycle

The term "menstruation" is derived from the Latin word "menstruus" meaning monthly4. Menstruation is the visible manifestation of cyclic uterine bleeding due to shedding of the endometrium due to invisible interplay of hormones. As soon as regular periodic flow has become established in a completely mature, adult pattern, the regulation of the normal cycle is under the control of neurohormonal mechanisms with its feedback systems present in the hypothalamic - pituitary - ovarian axis. The hypothalamus secretes regularly peptides i.e. Gonadotropin releasing hormone (GnRH). The release of GnRH by hypothalamus is pulsatile, with pulses occurring every 90 minutes. This leads to pulsatile

release of FSH and LH. Frequency of GnRH bursts is increased by estrogen and decreased by progesterone. . The FSH level rises during the proliferative phase and reaches its peak level on 12th day of cycle. The LH levels remains almost static through out the cycle except for the pre-ovulatory surge occurring 24-36 hours prior to ovulation. This LH surge is due to increased frequency of GnRH bursts, increased sensitivity of anterior pituitary to GnRH bursts during this period and probably due to increased estrogen / estriol ratio.

The naturally occurring estrogens are 17 beta estradiol, estrone and estriol, which are steroid in nature. The physiological functions of estrogens are varied and numerous, but with respect to maintenance of the menstrual cycle, it exerts a negative feedback effect on the release of FSH and LH during the entire cycle except during the pre-ovulatory period when it exerts positive feedback effect on LH and causes LH surge5. Progesterone is a steroid principally secreted by the corpus luteum and in small amounts by the follicle. The negative feedback action of progesterone is probably responsible for short duration of mid-cycle gonadotropin surge6.

Menstrual cycle and its patho- physiological impact- an overview

The menstrual cycle is an integral part of life, in woman and is associated with pronounced physiological changes. Existing data suggest that variations occur in renal, cardiovascular, haematological and immune systems during the different phases of menstrual cycle. Studies indicate that sympathetic nervous activity in the luteal phase is significantly greater than in the follicular phase whereas parasympathetic nervous activity is predominant in the follicular phase7.

It is known to alter the severity of certain diseases like Rheumatoid arthritis and Systemic lupus erethematosis during the different phases of menstrual cycles. Patients with Bowel diseases like Irritable bowel syndrome, ulcerative colitis and Crohn's disease experience worsening of symptoms during

premenstrual and menstrual phases9. In a study conducted on ten premenopausal women, 33 to 51 years of age, with variant angina, ischemia of the heart muscle was most frequent around the time of menses, when estrogen levels were highest and the blood vessels were least likely t9 dilate in response to increased blood flow. Ischemia was least frequent in the middle of the menstrual cycle (around the time of ovulation), when estrogen levels were lowest and the blood vessels were most likely to dilate10.

The incidence of cardiovascular disease among women during their reproductive years is considerably less than in men and this difference decreases after menopause. Their cardio protective effect may be mediated by Nitric Oxide. Fifteen women aged 20-40 years were studied to evaluate effect of LH, FSH, E2, Progesterone and cGMP on the 5th follicular and 22od luteal day of the cycle and during the ovulatory period. In conclusion, there was an increase in platelet cGMP during the ovulatory period and a correlation between E2 and cGMP suggesting that E2 modulates NO production. The cardio protective effect may be, at least in part mediated by the increase in NO production 11

Role of Menstrual cycle on hematology:

Studies show that menstrual cycle causes alteration in blood cell counts, immune status, hemostatic mechanisms, blood viscosity, fibrinogen concentration, etc during the different phases of menstrual cycle. The analysis of circulating blood cell counts over the course of the normal menstrual cycle showed a certain pattern.

A study on thirteen healthy women with regular menstrual cycles found that the total leucocyte count was increased in the luteal phase of the ovarian cycle as compared with the follicular phase (Wilcoxon, $p < 0.05$) 8. WBC counts were found to be significantly increased in the luteal phase as compared with the follicular phase of the ovarian cycle in another study 12.

The increase in total WBC count in the secretory phase is due to increases in all subpopulations (lymphocytes, monocytes and granulocytes). Increases in granulocyte and monocyte numbers in the secretory phase are suggested to be due to increased 17 P - E2 concentrations, promoting the release of granulocyte and monocytes from the bone marrow. The increase in lymphocyte population may be due to increased number of helper and cytotoxic T cells as well as natural killer cells8.

A study on 21 women, aged 18 - 35 years and not taking hormonal contraception found a highest neutrophil count at the onset of menses 13. A statistically significant rise of granulocytes was found in luteal phase when compared to ollicular phase ($p < 0.05$) in another study 14.

Changes in neutrophil count seem to follow changes in oestrogen level with a delay of one to two days. Normally in other tissues neutrophils are granulocytes that have a central role in the inflammatory process, containing enzymes with strong bactericidal actions. During menstruation increased neutrophils presence aids anti-bacterial protection when the epithelial barrier is disrupted. Neutrophils are a source of several anti microbials including: alpha-defensins, lactoferrin, lysozyme and W AP motif protein, elafin 15.

The level of estrogen or progesterone may be an important factor in regulating the neutrophil count. A rise of neutrophil count is also associated with increasing hormone levels in pregnancy. Estrogen seems to enhance granulocyte proliferation in vitro 16.

The influence of menstrual cycle on lymphocytes was found to be contradictary. A study on thirteen healthy women with regular menstrual cycles found that the lymphocyte count in follicular phase was 183+18 X 107 / L and raised in luteal phase to 233 + 23 X 107 / L which was statistically significant. The increase in lymphocyte count in their study was attributed to increased numbers of helper and cytotoxic T cells as well as NK cells. During the luteal phase of the normal ovarian cycle the immune response shifts towards a type - 2 response. The pregnancy associated changes in the immune response are already observed in the luteal phase. The physiologic meaning of this phenomenon may be preparation of the maternal immune system for potential implantation of the semiallogenic blastocyst 8.

In a recent study no significant changes were noticed in the various blood leukocytes during the different phases of the menstrual cycle, though the percent change varied from 1.56% to 24.19% 17. In a study the midluteal peak of monocyte count coincided with the progesterone peak. It is thus possible that Monocytes may have receptors for progesterone 14.

The different phases of menstrual cycle probably do not have any significant influence on the RBC count 18. Data from 1712 women aged 18 - 44 years from the Second National Health and Nutrition Examination Survey (NHANES II) found that the mean haemoglobin content was lowest for women whose blood was drawn during menses and highest for women examined in luteal phase or late luteal phase of the menstrual cycle but this rise was not statistically significant. However the different phases of menstrual cycle probably have no significant influence on haemoglobinl9.

The platelet counts are lower during menses and peak during proliferative phase or during ovulation2°, 21. An increased platelet count during mid cycle was associated with an increase in platelet survival time returning towards normal. This may be either due to reduced platelet clearance, an increased proportion of younger cells or both. The proposed hypothesis is that hormonal changes during the menstrual cycle may alter the Fcy receptor - mediated clearance of antibody - coated platelets by macrophages and modulate platelet survival.

In a study on "Menstrual cyclic thrombocytopenia" three patients with cyclic thrombocytopenia occurring in phase with the menstrual cycle were studied and found high platelet (up to 900 X 109 / L) counts at midcycle and nadir (5 - 20 X

109 / L) at the onset of menses. Tso, time to half activity, was shortened to 0.7 day during the period of thrombocytopenia and was prolonged to 3.2 days when the platelet count increased (normal platelet *Tso* is about 4.8 days) 22.

A study on 24 healthy women with normal menstrual cycles, showed a non significant variation in platelet count during the different phases of menstrual cycle though a higher mean value was found during the proliferative phase. Also a negative correlation was found between the platelet count and Mean platelet volume during all the phases of menstrual cycle23.

In an investigation of primary haemostasis parameters using platelet function analyser, no significant difference could be found for mean closure time value during the'follicular phase as compared with luteal phase. Fibrinogen and fibrinogen degradation products were significantly increased in the luteal phase as compared with follicular phase. This study indicated that the platelet function is periodically altered during the ovarian cycle due to the influence of progesterone and estrogen on Von Willebrand factor concentration3

Conclusion

In conclusion the different phases of menstrual cycle have a definite influence on the blood cell counts, the immune status and haemostatic mechanisms but its relevance during the various patho physiologic states needs further research and evaluation. Its effect on RBC count, Haematocrit, hemoglobin and Blood indices appear to be very limited.

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COMPARATIVE STUDY OF PERCENTAGE RECOVERY HEART RATE BETWEEN SEDENTARY AND PHYSICALLY ACTIVE YOUNG HEALTHY AGE MATCHED ADULTS OF BIJAPUR (KARNATAKA)

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Introduction:

Physical activity plays a significant role in the prevention of coronary heart disease and other atherosclerotic diseases, hypertension, type 2 diabetes, osteoporosis and osteoporotic fractures, as well as some types of cancer (colon cancer and possibly also breast cancer). Exercise reduces the risk of all-cause mortality by approximately 10% and of cardiovascular diseases by 20% [1]. The increase in heart rate that accompanies exercis is due in part to a reduction in vagal tone. Recovery of the heart rate immediately after exercise is a function of vagal reactivation. Because a generalized decrease in vagal activity is known to be a risk factor for death, it is hypothesized that a delayed fall in the heart rate after xercise might be an important prognostic marker. A value of :;12 beats per minut for the recovery of heart rate was considered abnormal. Increasing levels of physical fitness were strongly correlated with decreasing rates of abnormal values for the recovery of heart rate among men and women. A low value for heart-rate recovery after exercis testing is a powerful and independent predictor of the risk of death. [2]. Hence the objective of our study is to compare recovery heart rate (which has been previously shown to be a marker of decreased vagal activity) between physically active and age matched sedentary group of Biapur. Karnataka.

Materials and methods:

Fifteen young, healthy adults belonging to mean age group of 34.30 + 3.86 years, with sedentury life style and fifteen age matched young healthy adults belonging to mean age group of 33.33 + 3.68, with regular physically activity as per guidelines of American College of Sports Medicine (ACSM), 1998 [1] were selected in this study after ruling out the cardio respiratory disorders and diabetes mellitus. The selected subjects were asked to come in the morning hours in the labaratory with a breakfast. The height was measured in centimeter (cm) on a wooden stadiometer, weight was recorded in kilogram (kg) on weighing machine, the body surface area (m2) was calculated with the help of Dubois nomogram, the body mass index (BMI) was derived by Quetelet's index from body weight! (height) 2. The resting metabolic rate (RMR) was calculated by Harris - Benedict equations.

Men: RMR = 66.473 + 13.751 X BW + 5.0033 X HT - 6.755 X Age.

Where BW = body weight in kilograms, HT = height in cm.

The percent recovery heart rate was assessed in sedentary and physically active subjects by Harvard Step Test. Each subject was asked to complete up and down task (24 steps per mi!1ute) on an 18" bench for three minutes duration. Pre-exercise pulse rate was recorded after thre m tes r st i supine position and expressed in beats per minute (bpm). The peak exercise pulse rate was obtained with time taken for five beats using electronic stop watch (accuracy was 0.01 sec) j: lmediately at the end of step test work, whichwas later converted to beats/min. post excrcise pulse rate was obtained one minute after the step test. the pulse rate was recorded for 30 sec and multiplied by two to convert to beats/min. The recovery heart rate was obtained by subtracting Peak exercise pulse rate from post exercise pulse rate and expressed in beat / min. The value for the recovery of heart rate was defined as the reduction in the heart rate from the rate at peak exercise to the rate one minute after the cessation of exercise [2]. Percent recovery heart rate was calcualted as peak-exercise HR-post-exercise HR/peack-exercise-post exercise HRX100

The pre exercise blood pressure, both systolic and diastolic, was recorded using sphygmornanormeter by auscultatory method in supine position after three min. rest (along with pre exercise pulse rate). The post exercise systolic and diastolic blood pressure was recorded in supine position after two minutes of exercise without changing the position of arm cuff and sane sphygmomanometer was used for all the subjects.

The expeimental protocol was approved by Institutional Ethical Committee as per the guidelines of declaration of Helsinki 1975.

All the values (mean + SD) of sedentary group and physically active group subjed were compared by student unpaired 't' test. $p < 0.05$ has been considered as level of significance in all the cases.

Result:

Table 1 shows age, heright, weight. BSA, BMI and resting metabolic rate of sedentary and physically active group subjects. Table 2 shows pre- exercise pulse rate is significantly less in physically active subjects when compared to sedentary subjects. Peak-exercise puise rate, recovery heart rate and percent recovery heart rate is found to be significantly more in physically active subjects when compared with sedentary subjects. Table 3 depicts pre and post exercise systolic and diastolic blood pressure of sedentary and physically active subjects. There is no significant difference in pre-exercise systolic blood pressur between sedentary and physically active subjects; where as post-exercise SBP is significantly more in sedentary subjects compared to physically active subjects. There is significant increase in post- exercise SBP as compared to pre- exercise SBP in both the groups. No

significant change is found in pre and post-exercise DBP between sedentary and physically active group.

Discussion:

Sedentary group and physically active group dò not have any significant difference in age, height, weight, BSA, BMI and resting metabolic rate. Significant decrease in resting pulse rate in physically active group may be due to a combination of an increased stroke volume and an increased vagal tone [3]. The physically active group showed a significantly faster decrease in heart rate to pre exercise value than the age matched sedentary controls. Heart rate recovery after exercise depends on several factors: the intensity of exercise, the cardiorespiratory fitness, cardiac ANS modulation, hormones changes and baroreflex sensitivity [4]. Our finings corroborates with Ohuchi et al. (2000) who have demonstrated that the greater cardiac parasympathetic activity at rest should be in part responsible for the faster heart rate recovery after exercise [5]. Dixon et al. (1992) found that athletes, who had higher vagal activity and lower sympathetic activity, also had faster heart rate recovery after exercise than non athletes [6]. In our study postexercise SBP is significantly more in sedentary subjects compared to physically active subjects: a study from Johns Hopkins shows that people who develop very high blood pressure during exercise are the ones most likely to develop high blood pressure in later years [7]

In the present study it may be concluded physical fitness is related to vagal modulation of heart rate during exercise and has beneficial effects on cardiovascular autonomic function.

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CIVIL, MECHANICAL, AEROSPACE, TRANSPORTATION AND POWER ENGINEERING

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AERO-ENGINE OF A FIGHTER AIRCRAFT AND ITS ACCOMPANIMENTS

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ABSTRACT

Fighter aircraft needs a power plant that can provide thrust as required at various altitudes with varying speeds. It shall provide maximum thrust at high altitudes at supersonic speeds of 1.7-2.0. The same power plant shall also operate efficiently at low altitudes at low speeds. The proposed power plant is aero gas turbine engine. A successful aero-engine is possible only then, when it is designed on the basis of scientific and technological base. This shall be developed and shall continue developing based on latest technologies. This scientific and technological strength supports the design phase of the aero-engine. The weak foundation of technology knowledge will cost the aero-engine project dearly in program time as well as result wise. The advanced technologies are very expensive but it helps significantly in the technology perfection and time. This paper highlights the related subjects required to be perfected to design, develop, manufacture and test to supply the aero-engine to the customer in time.

1. Introduction

Since the invention of jet engine in early 20th century piston engines have given way to aero-engines to be replaced as power plant in helicopters, civil and fighter aircrafts. The power plant can be straight jet engines, low or high bypass turbo fan engines, propeller engines or thrust vectoring engines. The technical specifications of every power plant are specific to its end user i.e., flying object. The design and development of aero-engine for fighter aircraft is based on the need of a pilot who is in the air field where the engine shall operate satisfactorily. Aim is to obtain the thrust when ever demanded by the pilot to be air borne. This paper deals with the various aspects of the engineering considered to achieve the required technical requirements laid down by the mutual understanding between the aero-engine designer and the fighter aircraft designers.

2. Technical specifications

Air force is the customer of the aero-engine to power its fighter air craft. The interaction between the user and aero-engine designer brings out the operating conditions of air craft in terms of altitude and speeds. It also brings out the volume/space made available in the aircraft, number of engines to be installed, thrust required at various altitudes based on mission requirement thereby confirming the envelope of engine operation. This is shown in red line in the Figure 1 which shows the engine operability zone in altitudes and speeds of the aircraft. All operating conditions are to meet the goal of air defense, air superiority and interdiction of the country's aerial space.

3. Design steps of aero-engine

3.1. Performance

Based on the data obtained from the user, an aero-engine cycle is evolved. This is generally a gas turbine thermodynamic cycle, which studies the compressor, combustor, turbine, after burner and nozzle. It is used for a design point. The design point revolves around the point on which operation of the aircraft is critical. The aircraft travels from ground to an altitude of 15 Km and hence all operating points falling in this category shall be considered as off-design. Control laws are designed such that it provides the thrust demanded by the aircraft at various operating conditions without jeopardizing the component life and performance of the engine. The limitations of the cycle parameters are based on the materials available in the global market and the technology to manufacture the components. Figure 2 shows the gas turbine cycle obtained for a fighter aircraft aero-engine. Point A is the Turbine Entry temperature which is the limiting parameters of the aero-gas turbine cycle in the order of 1750 to 1850 K. This temperature shall be faced by the turbine stator and rotor blades. Point B is higher than Point A in the afterburner chamber. It exceeds the Point B magnitude by 200 to 250 degrees as there are no static or rotating parts found down the jet pipe and effect the engine cycle.

3.2. Aerodynamic design

Detailed aero-dynamic design of individual components is carried out keeping the inlet and exit conditions obtained from performance with adequate margins. The preliminary design predicts the component size and is corrected till it satisfies the volume provided by the user. Decisions of number of stages of compressor and turbine, number of blades in each stator and rotor rows of every stage, volume required for complete combustion in combustor and after burner system, fuel flow rate and its distribution are followed by rotor support system, gear-box, lubrication and secondary air system. It decides the bearing systems and provision of cooling system to the aero-engine components. Similarly, the ignition system, control system monitors the supply of fuel to the combustion and after burner chambers, opening and closing the variable guide vanes of compressor and exhaust nozzle, supply and scavenge the oil to and fro from the bearings is also studied to integrate with the aero-engine layout as shown in Figure 3. The subsystems

of the control systems of an aero-gas turbine engine are shown in Figure 4.

The dedicated design and analysis of the engine components are carried out using 3-Dimensional aero-dynamic Computational Fluid Dynamics computer codes like CFX, PHOENICS, STAR-CD, Fluent and FINE Turbo which solves steady/unsteady, compressible Navier Stokes equation for individual components. Figure 5 shows the results obtained from a 3-Dimensional grid of a 6 stage designed compressor and the total pressure distribution in the blade passages.

Hot end components require conjugate heat transfer analysis where the material of the components is also meshed and thermal conductivity equations are solved. Figure 6 shows the temperature levels obtained from a conjugate heat transfer analysis for a cooled turbine blades.

3.3. Structural Design Analysis

Geometry obtained from the aero-dynamic design of individual component is used for stress analysis, vibration and thermal analysis. Preliminary analyses are carried out to know the maximum stress appearing on the components which operate under complex loading conditions in extremely hostile environments. Designers are faced with challenging tasks to design components for structural integrity in the hostile environments of aircraft flying at supersonic range, generating thrust of 82 KN, high gas temperatures at the entry of hollow and film cooled turbine (>1700K), centrifugal accelerations due to high engine rotational speeds of ~16000 RPM and higher thermal gradients in turbine disk in the range of 450°C. The finite element analyses are carried out using the computer programs like ANSYS, NASTRAN and ABACUS. First two software are used a linear models where as third software is based on non-linear or for complex integrated geometries. It predicts the displacements, stress and strain levels of the components. The displacements will define the growth of the components and based on these analysis, clearances are maintained in the compressor and turbine. Stress and strain data are used to determine the life estimation of the components by carrying out low cycle fatigue, high cycle fatigue or creep analysis.

Aerodynamic or speed related excitations at natural frequency can lead to High Cycle Fatigue damage, alternating mechanical and thermal stresses during take-off and landing cycles can cause Low-Cycle Fatigue or thermal or Thermo-Mechanical Fatigue damages, and creep damages, accompanied by superimposed hot gas corrosion during steady state conditions. Hence the accurate understanding of the gas turbine's operating environment in terms of loading during a flight mission is developed based on detailed aero-thermo dynamics analysis. These aero thermal and mechanical operating environment and loads along with aircraft maneuver are used in designing all the critical components of aero-engine such as Fan, Compressor, Turbine rotors and structures, Frames, engine mounts, Combustor and afterburner system casings and Liners, Convergent Divergent Nozzle Flaps by detailed finite element analysis. These components are designed for identified failure modes such as overload, fatigue, creep, buckling, resonance, flutter and impact. Components of the Turbine module are subjected to high thermal gradient. The disk at bore and rim will have a difference of 450 degree C where as turbine blade will be operating in the temperature levels of 1500 K.

4. Producibility

4.1. Materials

The operating conditions of varying modules decide the selection of materials. Fan inlet blades face Indian environment of -30°C to +40°C where as the blades of last stages of the fan face 120° C to 195° C temperatures with minimum temperature gradient in the disk. Titanium alloys are used for this range of temperature. Compressor blades work in the 200° C to 680° C ranges of temperatures. Titanium alloys are used for the disk and the blades. It is light weight but prone to catch fire due to rubbing with the casings. Here, the decision on clearance between static and rotating part plays a role to avoid fire and not to sacrifice the engine performance. Combustor obtains high pressure and temperature flow from compressor. During the combustion high temperature of more than 2000K gas is formed which is brought to 1700K using tempered air from the surroundings. The material chosen shall have good mechanical properties at elevated temperatures. The afterburner module has the same requirement. Casings are made of Inconel/Titanium and the liner is made of Haynes. Turbine blades are designed to operate at temperatures greater than 1900K. As there is no material available to operate under these conditions, the blades have to be extensively cooled which itself is an advanced technology proprietary to the engine manufacturers. Turbine disk is designed to high loads due to centrifugal forces, gyroscopic moments, aircraft maneuver, axial loads and bending, inertial loads due to acceleration and deceleration of aircraft and . Blades and disks are made of Nickel based super-alloys to with stand highly loaded conditions.

4.2. Conversion to Hardware

The component design is translated into manufacturing drawings. This will define the fits and tolerances, radial and axial clearances required by the components for its overall operation in the engine. Complex shapes and size of the components needs advanced processes and manufacturing technologies which helps to determine the procurement of precision machinery for manufacturing

the components.

The deviation in manufacturing affects the aerodynamics of the aero-gas turbine components. Rework on the components affects the life of the total system and delays the program time. Hence, the appropriate processes shall be used.

5. Component testing for aero-thermo dynamic and structural integrity

Rigs are the test beds to test the components individually. The test conditions are simulated to operating conditions. The tests are conducted on system level tests rigs. the selection of appropriate accessories to the rig are important to the successful testing of the components, For example compressor module requires compressor blade testing rigs to determine over speed and burst margins, blade natural frequency, Low cycle fatigue life evaluation of disks in a spinning rig, and aero-dynamic/aero-mechanical rig to prove the performance of the designed components. A large number of test rigs are required to carry out all these test to prove the module of the engine.

Similar kind of test facilities is required for the other modules too. Some of the rigs are shown in Figure 7.

6. Engine testing

6.1. Engine Assembly

Individual modules are assembled in the assembly hanger. The integration of various modules depends on the tolerances achieved during manufacturing. The pipeline manufacturing is another important aspect of the assembly. The pipelines pass over the casing which will carry the fuel to the combustion and oil to the bearings and hydraulic fluids to operate the jacks of nozzle actuating system. Pipelines which form the external dressing should be carefully designed for easy replacement of line replaceable units.

6.2. Engine Test Beds

The assembled engine shall be tested for its performance. There are three level of testing to predict the performance of the integrated engine: ground level test bed, altitude test bed and flying test bed.

6.2.1. Ground level test bed

It is used to predict the performance of aero-engine to establish the idle speed, engine operating line, performance of control system in integrated engine, lubrication system, fuel system, run down time, compressor characteristics, light up of the combustors and turbine characteristics. The test bed is designed such that high level of noise and pollution of high temperature exhaust gases do not emit directly into the atmosphere.

6.2.2. Altitude Test Bed

As the engine shall operate at various altitudes, a special chamber is designed and manufactured which simulates the atmosphere conditions on ground. Here engine can be tested up to 15 km altitude atmospheric conditions. It can also simulate the hot air injection, cold water injection tests with the starters.

6.2.3. Flying test bed

This is an important test carried out on the engine in an aircraft which is converted into a laboratory. Here one of the parent power plant is removed from the aircraft and is replaced by the newly designed, developed, manufactured and tested in altitude test beds. The performance of the engine is obtained on the real conditions of the prevailing atmosphere. Data available from these tests will boost the confidence of engine designers as it will represent the performance of engine in the flying very close to the actual flying conditions.

7. Instrumentation

Measuring the Performance is an important step in design to validate design performance of engine. The selection, design, manufacturing and installation of probes and sensors is a science which converts the physical quantities into digital and engineering units. Circle diagram and data acquisition system are standard of preparation of testing. Instruments like total pressure, static pressure, total temperature, static temperature, strain gauges of static parts and rotating parts, of cold and hot end components, speeds, and vibration and clearances probes are used for testing. The number of problems is reduced as the level of testing increases. Figure 8 show the strain gauged blade used for the rig level testing to determine the damper effectiveness.

Integrating with the aircraft is last step of delivering the product to the user, aircraft. It needs the knowledge of subsystem of aircraft to be connected to aero engine for its smooth performance of aircraft.

8. Project Management

Technology development is a critical factor for the progress of any nation. The technologies developed should be globally competitive and relevant to the present international scenario. Development of aero-engine is one of the critical and challenging technologies to achieve self-reliance and cost advantage. Advanced level technology management processes of concurrent engineering and technology transfer shall be adopted in keeping the pace of global technology maturity. During the development process, a strategic planning in amalgamation with corporate strategy and risk management will result in addressing following aspects of technology development:

- Technology portfolio matrix
- Technology transfer
- Assessing external forces
- Cost leadership

Technology development in Indian scenario needs not only the knowledge and implementation of technology,

but also requires timely and cost effective methodologies to adapt the technologies, keeping in view the strategies and final product.

9. Conclusions

The above paragraphs have shown that design and development of the aero engine is a complex phenomenon. Its accompaniments shall be acquired by testing the components. Equally important is the material availability and its data bank of characteristics available in the country. To develop this technology in the country, every related field mentioned here shall be progressed and thus create a school of aeronautics of engines.

10. Acknowledgement

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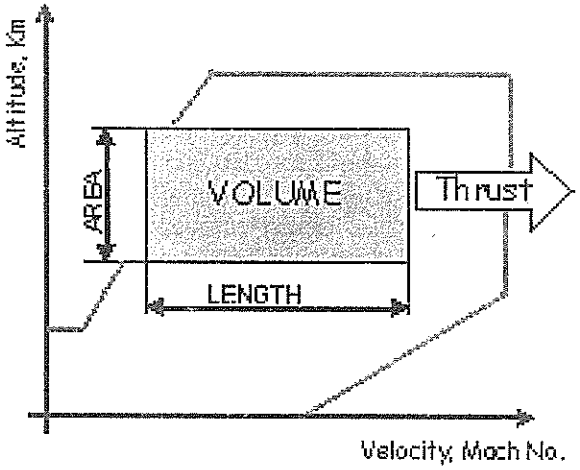


Figure 1: Gas turbine engine cycle

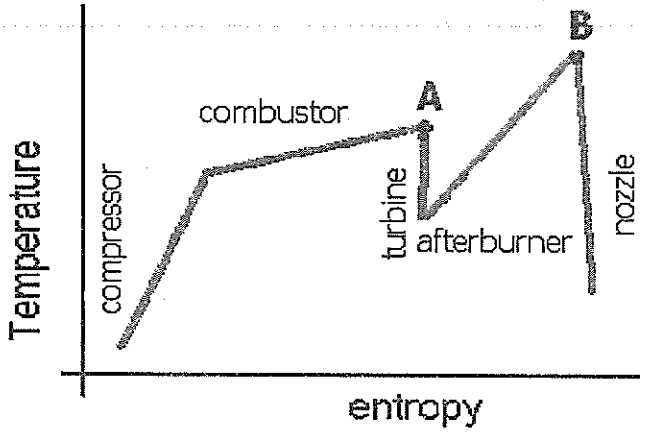


Figure 2: Gas turbine cycle

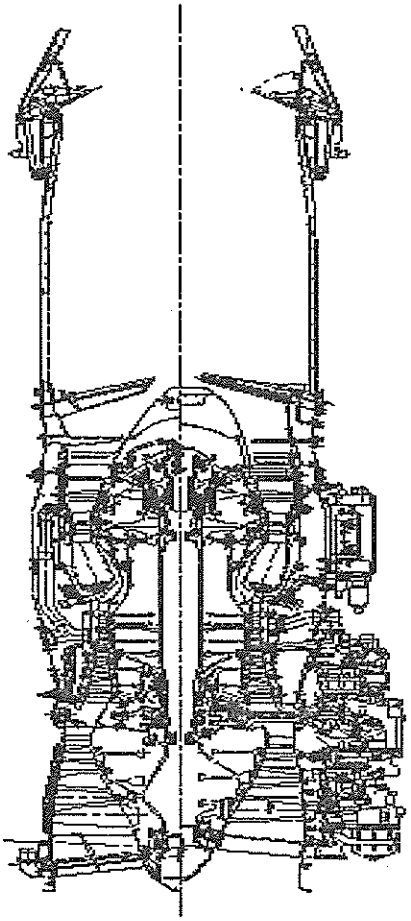


Figure 3: General layout of aero-gas turbine engine

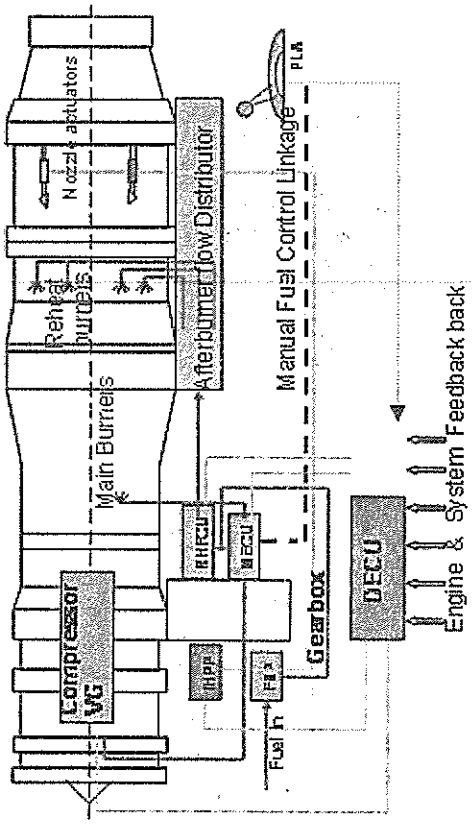
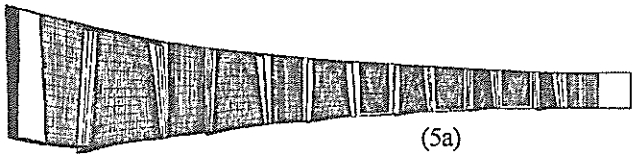
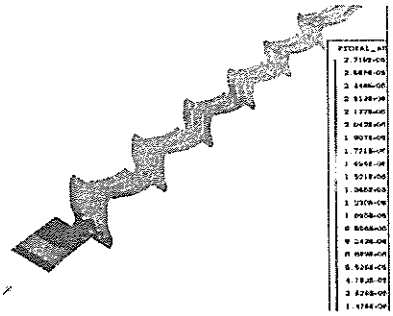


Figure 4: Control system of a typical aero-engine and its subsystems



(5a)



(5b)

5.a) 3D grid of the 6 stage compressor and
b) Total pressure distribution of the flow in the passages between the blades

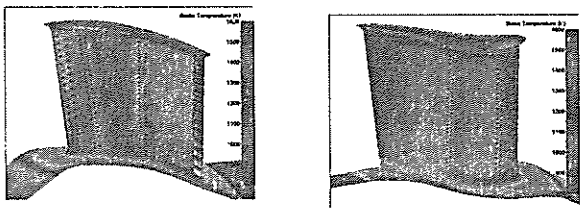


Figure 6: Turbine stator blade temperature distribution

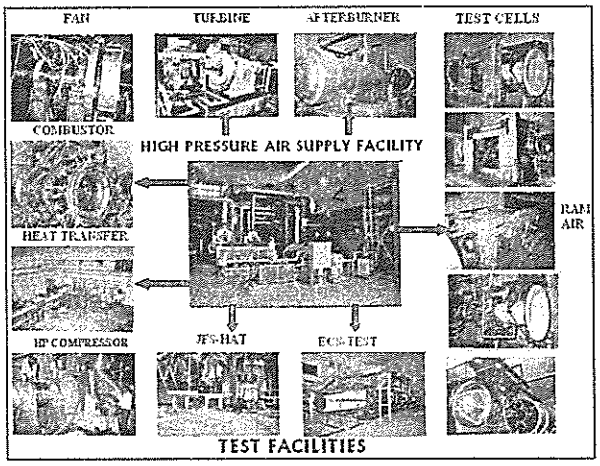


Figure 7: Test rigs for engine components

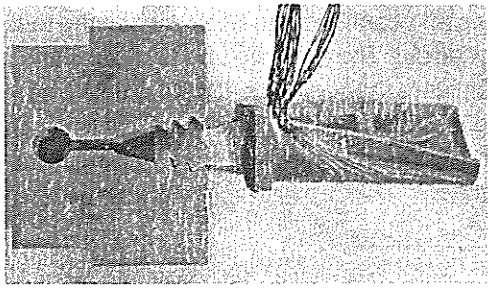


Figure 8: Strain gauged turbine rotor blade

PERFORMANCE MONITORING SYSTEM FOR DEVELOPMENTAL MARINE GAS TURBINE ENGINE

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Abstract:

Design and development of the state-of-the-art Gas Turbine Engine for marine application involves extensive testing and validation prior to integration with the naval ship. To achieve this, the instantaneous response as well as the transient response of the engine has to be studied under various operating conditions. This calls for elaborate ground testing of the engine by measuring the engine performance parameters from various physical locations on the engine. To meet this objective, a Performance Monitoring System was developed to test a Marine Gas Turbine Engine during its development phase. This system was developed using industry standard open architecture hardware and open platform software. The hardware included a highly flexible and completely programmable signal conditioning unit with an accurate and reliable acquisition unit. The system software was virtual instrumentation based user-friendly software. The salient features of the software includes acquisition, data formatting, data presentation, storage, replay, report generation, analysis etc.,

The developmental marine gas turbine engine was successfully tested using the new Performance Monitoring System for 36 hours. The data collected by this Performance Monitoring System has been extensively and successively used by the designers to fine tune the engine performance.

Introduction:

The indigenous development of a state-of-the-art gas turbine engine for marine application necessitates thorough study of the engine behavior and its performance to ensure its reliability before fitting it to the Naval Ship. For accomplishing this tedious task, elaborate testing of the engine should be carried out to cater for its endurance at various operating conditions. The engine should not only perform the functions as desired but it should operate under the safe conditions to prevent any catastrophy. To study the engine behavior during the test-

ing phase, measurements of various physical parameters like temperature, pressure, speed, flow, vibration, etc., from different locations on the engine are required. To fulfill this requirement a Performance Monitoring System (PMS) has been developed. This system acquires data from various sensors mounted at various locations on the engine. The system detects failure like overshoot of temp, vibration, etc., and gives appropriate warning to the operator to handle the engine in the safe conditions, while carrying out the engine test runs. The measurement hardware consists of appropriate sensors, signal conditioners and data acquisition, monitoring and display units. The GUI based Performance Monitoring System Software (PMSS) is developed using NI Labview that runs on a host PC for acquiring and storing the real world data during the test runs. The software enables online monitoring and control of the engine when the test run is being carried out. The software also provides various utilities to configure the hardware, perform online computations and analyze the data to generate warnings for the operator to protect the engine from damage during its testing phase.

System Description:

The Performance Monitoring System can acquire data from 600 physical channels that includes various parameters like temperature, pressure, speed, flow, vibration, etc., The parameters are conditioned using signal conditioning modules. The acquired data is stored in the computer for future analysis. The system in whole has three parts: Sensors, Signal Conditioners and Data Acquisition Unit. Figure 1 shows the acquisition unit along with the signal conditioning unit placed in the control room of the engine test house. The schematic representation of the Performance Monitoring System is shown in Figure 2 .

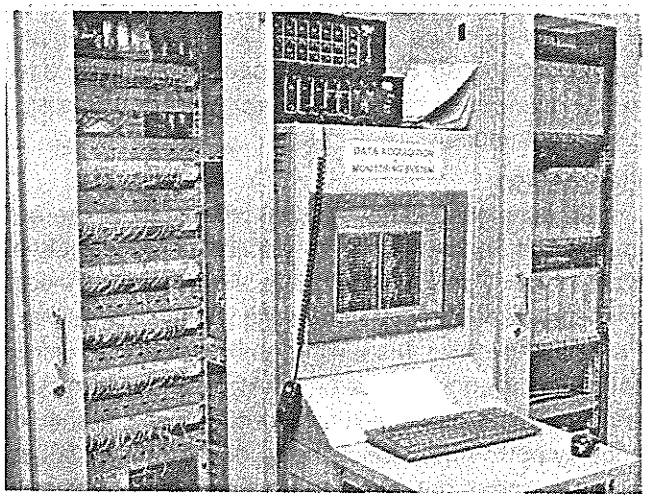


Figure 1 - Performance Monitoring System

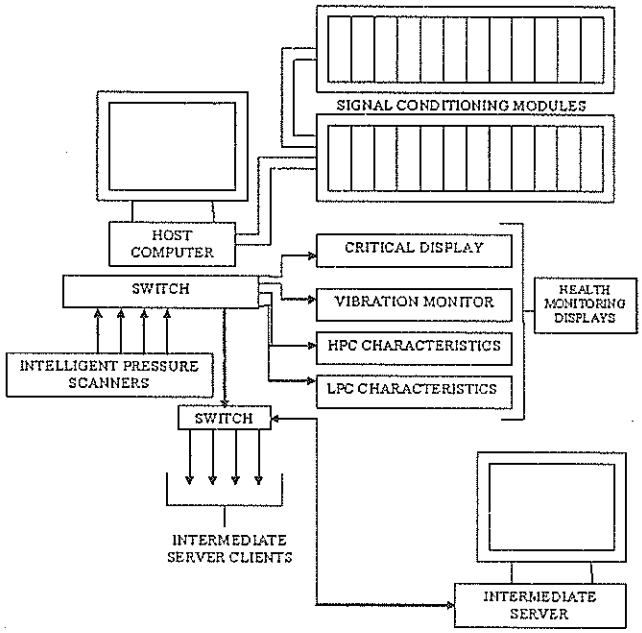


Figure 2 - Schematic Representation of the Performance Monitoring System

Hardware system design:

The system hardware consists of Intelligent pressure scanners, Signal conditioning unit and Host acquisition unit.

Intelligent pressure scanners:

The Intelligent pressure scanner has the capability to take 356 pressure inputs. It has an electronic pressure scanning unit and associated electronics to multiplex the inputs, convert it to digital data, correct the data for environmental effects, format the data and send it to host computer upon receipt of a command. The functions of this unit are fully programmable through host computer.

Signal conditioning unit:

The analog signals from various sensors are brought to the signal conditioner unit. This unit houses various types of signal conditioner boards to cater to the needs of different types of parameters. Depending upon the types of parameters and signal levels the software selects appropriate gain, filter settings, excitations voltages and current etc., The conditioning unit provides one multiplexed output for 512 analog inputs.

Host acquisition unit:

It is an industrial computer based unit running virtual instrumentation based software on a windows operating system. The host unit acquires analog multiplexed channels using a DAQ device and the pressure data from the intelligent pressure scanners via the Ethernet.

Software Design:

Figure 3 depicts the detailed control flow sequence of PMSS

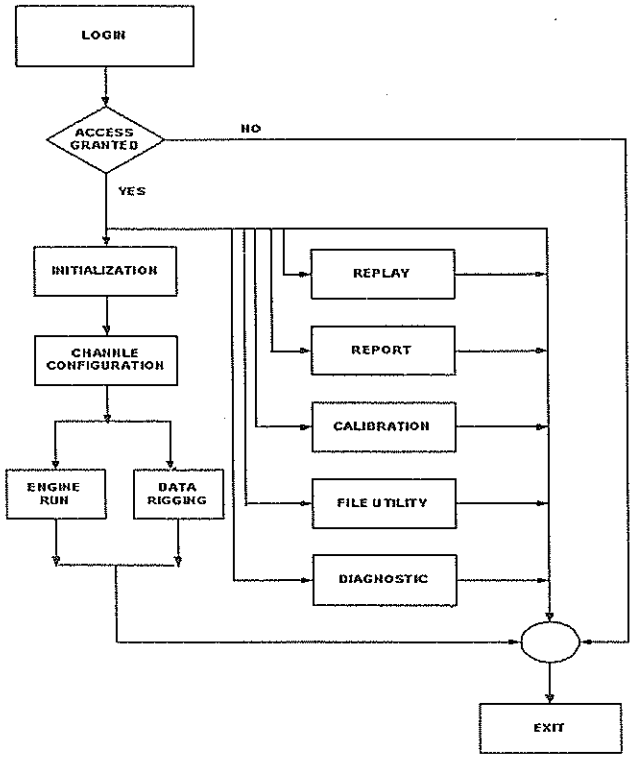


Figure 3 - Control Flow Sequence of PMSS

Software Architecture :

The Performance Monitoring System Software (PMSS) is based on client-server architecture consisting of performance and monitoring displays. It is developed in a graphical programming environment - LabVIEW. The software is menu-driven and consists of various components like login, initialization, channel configuration, acquisition, data rigging, engine run, report generation, utility, calibration and diagnostics.

The performance display is a computer which houses the DAQ card and gives the digital indications of values for studying the engine response. This display provides programmable multilevel audio visual alarms, in the event the safe limits exceed for the critical parameters.

The four engine health monitoring displays are operator configurable giving data as alpha numeric or graphical format including mimic diagrams. During a typical Engine run the four displays are normally configured to display vibration levels, bar graphs of critical parameters and low pressure and high pressure compressor performance graphs. The Low pressure and High pressure compressor performance graphs provides a real time representation of the compressor operating point and the available operating margins in various operating regions.

Software Features:

- Functional check displays complete self test of the system before the actual test run.
- Channel detection facility enables intelligent detection of simulated/ actual inputs for any channel.
- Leak test is used for automatically detecting leaks in pressure channels.
- Sensor failure detection is provided for temperature channels.
- Automatic Calibration of channels to determine scaling factors or linearization coefficients.
- Automatic error detection and rejection of erratic data.

Results and Discussions:

The system has been successfully used for testing the Marine Engine over 36 hours. During these tests, data from sensors mounted on the engine were acquired and the results were presented to various design groups in the form of instantaneous data at various engine operating points and continuous data during engine transient operations. Apart from this data, engine performance plots were generated. Sample test screens of the engine health monitoring displays are shown in figure 4. The main performance display screen during test run is shown in figure 5.This data was successfully used by design groups to fine tune the engine performance and achieve the test objectives.

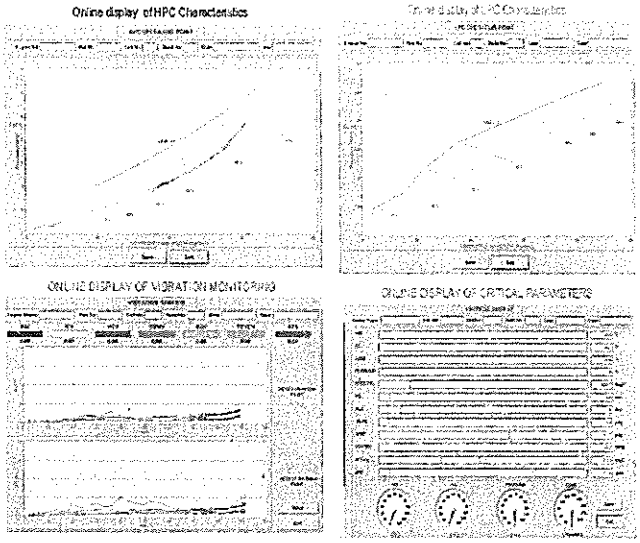


Figure 4 – Engine Health Monitoring Displays

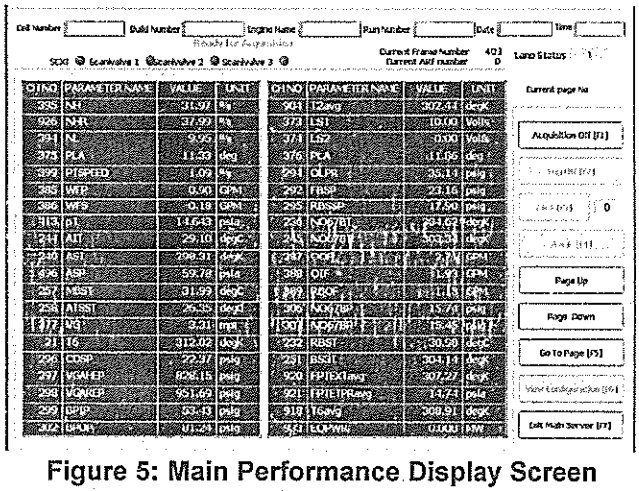


Figure 5: Main Performance Display Screen

Conclusion :

This has opened up a new chapter in the development of Performance Monitoring System of a whole new generation for Gas Turbine Engine testing applications. Not withstanding the success of the system, efforts are already underway to make it more reliable, rugged and easy to use. There is an opportunity to make use of this system for Gas Turbines used for power generation.

Acknowledgement :

I acknowledge the Director, Gas Turbine Research Establishment for all the encouragement and support provided throughout to make this system successful and also my colleagues for all the help rendered during the course of design and development.

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प्राचीन भवन-निर्माण कला

पण्डया भारवि एन.
शोध-छात्रा,
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भवननिर्माण एवं शिल्प-विज्ञान का नाम वास्तुकला है । वास्तुकला का विकास मानव - सभ्यता के विकास के साथ हुआ-ऐसी कल्पना स्वभावत: की जा सकती है । संसार के प्राणिमात्र में आत्मरक्षा और सुख-साधन का भाव नैसर्गिक रुप से पाया जाता है । हम देखते हैं कि पक्षी नीऽनिर्माण करते हैं और चूहें आदि बिल खोद लेते हैं । इस प्रकार बुद्धिजन्य कहे जाने वाले जीवजन्तुओं एवं पशुपक्षीयों में भी आत्मरक्षा के लिए सुन्दर से सुन्दर कलापूर्ण निवास निर्माण की भावना पाई जाती है, तो यह कल्पना स्वाभाविक है कि मानव में यह भावना-यह आकांक्षा और भी तीव्र रही होगी । उसने जन्म के साथ ही शीतोष्णता और वर्षा आदि से रक्षा की आवश्यकता का अनुभव किया होगा और उसी समय वास्तुकला का जन्म हुआ होगा ।

वास्तु-विद्या का जन्म वैदिक काल के ही समकालीन हुआ था परन्तु उसका रुप वेदांगो के समय में स्थिर हुआ तथा पुराणों और आगमों में उसका विकास हुआ । आगे चलकर वास्तु-विद्या के आचार्यों ने उसको एक स्वाधीन शास्त्र के रुप में खड़ा किया और यह शास्त्र शुक्राचार्य के अनुसार "विद्या-स्थान" के पद को भी प्राप्त हो गया ।

वैदिक वाङ्मय, पुराण, एवं महाकाव्य तथा बृहत्संहिता एवं मानसार आदि शिल्प-शास्त्रीय तथा अन्य विभिन्न प्राचीन ग्रंथों के परिशीलन में वास्तुविद्या के अनेक आचार्यों के नामोल्लेख एवं उनके सिद्धान्तों का उल्लेख मिलता है । अत: यह निर्विवाद है कि इस विद्या के मूल प्रवर्तकों का जन्म इस देश में अत्यंत प्राचीनकाल में हुआ था । भारतीय परंपरा के अनुसार प्रत्येक विद्या का अपना-अपना अलग जन्मदाता है। विभिन्न दर्शनों के संस्थापकों एवं प्रवर्तकों को हम जानते हैं । विभिन्न धार्मिक, नीतिसंबंधी एवं आर्थिक तथा राजनीतिक परंपराओं के प्रवर्तकों को भी हम जानते हैं । अत: वास्तु-विद्या के मूलप्रवर्तकों में हमें दो नाम विशेष उल्लेखनीय मिलते है । वे हैं विश्वकर्मा और मय । विश्वकर्मा की कल्पना देवताओं के स्थपति के रुप में सनातन काल से इस देश में चली आयी है । अत: देवभूमि भारत के इस उत्तरापथ भू-भाग पर विश्वकर्मा का अवतार हुआ । ऐसे बहुत संकेत प्राचीन ग्रंथो में मिलते है । इस भू-भाग से संबंध रखनेवाली वास्तु-कला तथा उस कला की विद्या के विभिन्न शास्त्रीय ग्रंथों में विश्वकर्मा को वास्तु-विद्या का प्रथम प्रवर्तक एवं आचार्य माना गया है ।

दैवी संस्कृति के साथ सनातन काल से इस देश में आसुरी संस्कृति का समानान्तर रुप में निर्देश किया गया है । यही नहीं, संस्कृति के भौतिक क्षेत्र में असुरों ने देवों की अपेक्षा विशेष उन्नति की थी

- यह हमारे पुरातन ग्रंथो से स्पष्ट है। वास्तव में जिसको हम आसुरी सभ्यता कहते है वह भी इसी देश की मूल निवासियों की सभ्यता है । इस सभ्यता की वास्तु-कला के आचार्य का अत्यंत प्राचीन नाम जो आर्यग्रंथो में मिलता है वह है मय। मय असुर था अतः आसुरी वास्तु-विद्या के मूल प्रवर्तक के रुप में इसे माना गया है और इस प्रकार भारतीय वास्तुविद्या की यह दूसरी परंपरा मय-स्कूल के नाम से प्रसिद्ध है ।

भूतल पर प्रथम भवन का जन्म :

समरांगण - सूत्रधार[९] में भूतल पर प्रथम भवन के जन्म अथवा मानव-आवास के प्रथम विन्यास का बड़ा ही रंजनात्मक शैली में वर्णन किया गया है । बहुत प्राचीन समय की वार्ता है, भारतवर्ष में लोग घने जंगलो में, सरिताओं कूलो पर, पर्वतों के शिखरों पर रहते थे । एक बार उन लोगों ने देवलोक में प्रवेश किया और वहाँ वे देवों के साथ विचरण करते हुए प्रख्यात विमानाकृति दिव्य कल्पवृक्षों के नीचे विहार करने लगे और उन्हीं की छाया में रहने लगे । मानवों और देवों का यह साहचर्य बहुत दिनों तक चलता रहा । कालान्तर में इन क्षुद्र मानवों को अपनी मर्यादा विस्मृत हो गयी और उन्होनें देवों की अवज्ञा करना प्रारम्भ कर दिया । अतः देवों ने भी मानवो के प्रति अपनी उदारता में संकोच किया और उन्हें "पुनर्मूषिको भव" की दशा में परिणत कर दिया । स्वर्ग से मानव पुनः भूमि पर उतर आये । उनको अपनी इस दशा पर बड़ा विषाद हुआ । जब देवों के साथ देवलोक में रहते थे, तब उनके आहार, विहार की कोई कमी न थी । वहाँ पर नगर, ग्राम, पुर आदि की न तो कोई आवश्यकता थी न किसी के अधिराज्य अथवा उसकी प्रभुता की ही कल्पना थी । सभी स्वतंत्र थे । अब मानवो द्वारा देवों के प्रति जो अवज्ञा हुई उसी का परिणाम मानवों और देवों का पार्थक्य था । मानवों की दिव्य शक्ति और दिव्यभाव लुप्त हो गये । सर्वप्रथम दैवी कृपा से उनकी प्राणरक्षा के लिए पर्पटक (एक वृक्ष) का प्रादुर्भाव हुआ, उसी से उन्होंने अपनी प्राण-रक्षा की । जहाँ तक निवास की आवश्यकता थी, वहाँ वे वृक्षो की छाया में वे वास करने लगे । दैव दुर्विपाक से यह पर्पटक भी विलीन हो गया और इस भूतल पर शालि-तंडुलों का प्रथम उदय हुआ । इस भय से कि ये शालि-तंदुल भी पर्पटक के समान विलीन न हों जाये, उन लोगों ने इनको जमा करने की विधि सोची । यह एक प्रकार का मन का विकार था । इसी विकार से अन्य विकारों को उत्पन्न होने में देर न लगी। कालान्तर में मनुष्यों की पुण्यश्लोकता समाप्त हुई । अमरता भी विलुप्त हुई । उनके शरीर रोग और शोक से आकुल हो गये, तुषधान्य से सेवन से उसमें मलप्रवृत्ति का प्रथम प्रादुर्भाव हुआ । तुषधान्य भी विनष्ट हो गये । कन्दमूल छोड़कर और कोई उदर-पूर्ति का अवलम्ब नहीं रहा । जाड़ा और गर्मी आदि आधिदैविक क्लेशो के साथ व्याघ्र-सर्प आदि के दुःखो की भी कमी न रही। इस प्रकार मानव अपनी रक्षा के लिए कृट्टिम गृहो की रचना की । शिलाखण्डों से उन्होंने कृट्टिम-भवनों की रचना प्रारम्भ कर दी और शिलाओं से ही वृक्षों को काट-काट कर उन गृहो की छावनी तैयार की। कल्पद्रमों का विमानाकार उन्हे याद था अतः उसी आकार में अपने शाल-भवन निर्मित किये। भूतल पर भवन-जन्म की यही कहानी है ।

इसी प्रकार भवनोत्पत्ति के आख्यान पुराणों में भी पाये जाते है । मार्कण्डेय[२] तथा वायुपुराण[३] समरांगण के इसी आख्यान के प्रतीक हैं । इस कथानक का साारांश यह है कि मानव-भवन का प्रथम मोडेल वृक्ष था । मत्स्यपुराण[४] में भी इसी तथ्य का उद्‌धाटन है । उसमें शाल-भवनों के साथ शाल शब्द की निष्पति प्रकृति पर शाखाओं का परिणाम प्रकीर्तित की गयी है ।

शाल-भवन अपने मौलिक रुप में घास-फूस का घर था जहाँ पर गौ आदि पशुओं को रखा जाता था । आगे चलकर वनस्पतियों के विन्यास में शालाओं का एक मण्डप अथवा छायानिकेतन-विन्यास विकसित हुआ और कालान्तर में इन भवनों ने स्थापत्य कला के संयोग से जन-भवन के परिष्कृत रुप में पदार्पण किया ।

भवन - निवेश एवं भवन - रचना :

भवन-निवेश का सर्वप्रथम अंग वास्तु-पदों का प्रकल्पन है । उस दृष्टि से भवन -विन्यास का प्रथम अंग वास्तु-विन्यास है । वैयक्तिकता, दृढ़ता तथा सौन्दर्य - ये ही भवन के प्रमुख गुण हैं। भवन न केवल भवन-वासी की आवश्यकताओं की पूर्ति करता है वरन् अपना स्वरुप भी तदनुरुप प्रदर्शित करता है । एक आवास-भवन देव-भवन से बिलकुल पृथक् रुप में दिखाई देना चाहिए । इसी प्रकार सभा-भवन, सैन्य-संस्थान अथवा अन्य साधारण भवन भी अपने-अपने स्वरुप को अवश्य प्रकट हुए दिखाई देने चाहिए ।

भवन - स्वरुप के अनन्तर उसकी दृढ़ता पर भी विचार आवश्यक है । भवन कई पीढ़ियों तक रहने के लिए बनता है, अतः उसके निर्माण में दृढ़ता सम्पादन का पूर्ण विचार आवश्यक है । भवन की तीसरी विशेषता उसका सौन्दर्य है । सौन्दर्य एकमात्र बाह्य दर्शन पर ही आश्रित नहीं; उसका संबंध अन्तरंग सुविधा से भी है । भवन निर्माण एक कला है । कला तभी निखरती है जब उसमें "सुन्दर" का सन्निवेश होता है । परन्तु वह कला जिसमें "सुन्दर" के साथ "शिव" का समन्वय नहीं वह भी सत्य नहीं बन सकती । अतः भवन न केवल अपने नेत्रो के लिए आकर्षक हो वरन् जीवन के लिए सुखदायक और मंगलमय हों । भवन के आकार, स्वरुप, वर्ण आदि के सम्यक् संयोजन एवं भवनांगो के सुन्दर निर्माण पर ही भवन-निवेश पूर्ण-रुप से अधिष्ठित होता है ।

यहाँ पर भवन नियमों के संबंध में यह बतलाना हैं कि भारतीय स्थापत्य-शास्त्र में ये नियम कहीं एक स्थान पर नहीं लिखे गये हैं, परन्तु हमारे ग्रंथो में बिखरे हुए कतिपय निर्देशो एवं आदेशों को एकत्रित कर यहा प्रस्तुत किया है । भवन के नियमों में भवनगत संस्थानों के न्यास के साथ-साथ भवन-निवेश में निर्माण प्रारंभ आदि के शुभ अवसरों को देखना आवश्यक है । संमरागण में कहा गया है कि वैशाख, श्रावण, मार्गशीर्ष, पौष तथा फाल्गुन मासों मे ही भवन-निर्माण आरम्भ करना चाहिए । इसी प्रकार पंक्ष की द्वितीया, पंचमी, सप्तमी, नवमी, एकादशी, त्रयोदशी तिथियाँ निर्माण प्रारम्भ के लिए विशेष प्रशस्त हैं।

ब्राह्मणों के लिए श्वेत,क्षत्रियों के लिए कृष्ण भूमि, वेंश्यों के लिए पीत और शुद्रो के लिए कृष्ण

भूमि श्रेयस्कर है ।[५] ब्राह्मणों के लिए साढ़े सात भूमिकाओं से अधिक निर्माण निषिद्ध हैं । क्षत्रियों के लिए साढ़े छे, वैश्यों के घरों में साढ़े पाँच, शुद्रो के लिए साढ़े तीन मंजिल का भवन ही विहित है । बृहदसंहिता में यही बात कही गई है ।[६]

गृह के ईशान कोने में देवगृह रखना चाहिए, अग्नि कोने में पाकशाला, नैऋत्य कोने में बरतन आदि के भंडार और वायव्य कोने में धान्य के भंडार होने चाहिए ।[७]

द्वार-निवेश भारतीय स्थापत्य का अति महत्त्वपूर्ण अंग है । इस विषय पर हमारे प्राचीन ग्रंथों में बडी सुन्दर समीक्षा है ।

किस दिशा का दरवाजा किस पद पर प्रतिष्ठित करना चाहिए, यह द्वार स्थिति का विचारणीय विषय है । समरांगण में चार विशिष्ट द्वारा - कोटियों का वर्णन है । उत्संग, हीनबाहु, पूर्णबाहु और प्रत्यक्षाय । इनमें उत्सङ्ग वास्तु एवं भवन के लिए एकदिक् द्वारों को कहेंगे जो मांगलिक माने गये है । हीनबाहु में वास्तु-प्रवेश से भवन वाम में पड़ता है अतः वह त्याज्य हैं । वास्तु-प्रवेश से भवन जहाँ दक्षिण है उसे पूर्णबाहु द्वार कहते है और वह पूर्ण सिद्धियों का प्रवर्तक है । और वास्तुद्वार का विनियोग जहाँ भवन-पृष्ठाश्रित है उसे प्रत्यक्षाय कहते है वह भी अप्रशस्त है ।[८]

बृहद्संहिता[९] और गरुडपुराण[१०] में कहा गया है कि दक्षिण में द्वार रखने से वीर्य का नाश होता है । पूर्व में द्वार होने से धन की वृद्धि, सन्मान, कोई बड़ा पद मिलता है । उत्तर में द्वार रखने से संतानो की मृत्यु, धन की हानि होती है ।

समरांगण[११] में कहाँ है कि गृह-मध्य के बीच द्वार-निवेश अनुचित है । आमने-सामने के दोनों दरवाजे एकाकार में नही बनाना चाहिए । उपर के तल के दरवाजों के नीचे नीचे के तल के दरवाजे होने चाहिए। बृहद्संहिता[१२] में इससे विपरीत बात कही गई है और आगे कहा गया है कि जो द्वार अपने आप खुल जाये या बंध हो जाये तो गृह में निवास करनेवालो में उन्माद होता है । कूल का विनाश होता है । अन्य द्वार मुख्यद्वार से अधिक श्रेष्ठ नही होने चाहिए । और मुख्य द्वार पे कलश, श्रीफल, शिव के गणों इत्यादि से अलंकृत करना चाहिए । समरांगण-सूत्रधार में भी मुख्य द्वार पे कुलदेवता, द्वारपाल, शंख, पद्मनिधि, अष्टमंगला, लक्ष्मी, सवत्सा धेनू इत्यादि के चित्र से अलंकृत करना चाहिए ।

बृहद्संहिता[१३] के अनुसार गृह के मुख्य द्वार के सामने रास्ता, वृक्ष, कोना, कुवाँ या स्तंभ हो तो वो अशुभ माना जाता है । किन्तु दुगुनी अंतर पे ये सभी चीजे हो तो दोषकर नही हैं ।

बृहद्संहिता[१४] में कहाँ गया है कि दक्षिण दिशा से प्रदक्षिणा करते हुए पलाश, वड, उदुम्बर और अश्वत्थ है तो वो अशुभ माना जाता है । किन्तु उत्तर दिशा से प्रदक्षिणा क्रम में ये शुभ माने जाते है। गरुडपुराण[१५] में गृह की पूर्व दिशा में पीपल, अश्वत्थ इत्यादि वृक्ष उगाने चाहिए । और गुलर का वृक्ष लगाने से शुभ होता है । इँशान कोने में सेमल (शाल्मलि) के वृक्ष को लगाना उत्तम माना है ।

राज - वेश्म (प्रासाद) :

हमने भारतीय भवन-स्थापत्य की तीन कोटियाँ निश्चित की है । साधरण भवन विशिष्ट भवन तथा असाधारण भवन । साधारण भवन का तात्पर्य साधारण-जनोचित वास-भवनों से हैं । विशिष्ट भवनों का तात्पर्य विशिष्ट कार्यों के लिए निर्मित भवनों से है, जैसे अश्वशालाएँ, गजशालाएँ, सभाएँ, यज्ञशालाएँ आदि । भवन की तीसरी कोटि देव-भवन है जिसकी पारिभाषिक संज्ञा हमने प्रासाद मानी है । वह न विशिष्ट भवन है और न साधारण भवन, वह असाधारण भवन है ।

राज-निवेश अर्थात् राज-भवन किसी महानगर अथवा राजधानी नगर की शोभा ही नहीं वरन् अनिवार्य अंग था । समरांगण[१६] में कहाँ गया है कि पुरनिवेश के प्रमुख अंगो, जैसे मार्ग विनिवेश तथा चतुर्दिक् प्राकारादि विन्यास एवं विभिन्न पदो पर भीतरी और बाहरी दोनों देव-वर्गो अर्थात् देवतायतनों की प्रतिष्ठा का निवेश संपन्न हो जाय तो फिर उस नगर के केन्द्र में पश्चिम की ओर हटकर तथा उत्तराभिमुखीन मैत्र पद वाले चतुरस्राकार प्रदेश पर राज-निवेश प्रारम्भ करना चाहिए ।

राजनिवेश के सामान्य सिद्धान्तों में एक विशेष ज्ञातव्य यह है कि यह नगर के मध्य में प्रतिष्ठित होने पर भी अपनी निजी रक्षा-व्यवस्था से संपन्न होना चाहिए, अर्थात् प्राकार और परिखाओं से इसे भी गुप्त करना चाहिए और प्राकारादि-विन्यास के नाना घटकों एवं विविध रचना विच्छित्तियों से इसे पूर्णरुप से अलंकृत भी करना चाहिए । समरांगण का यह स्पष्ट आदेश है कि राजभवन का निवेश बड़ा ही मनोरम एवं आकर्षक हो ।

हम द्वारो की बात करे तो पुर-द्वार के समान राज-भवन के भी तीन प्रकार के प्रमुख द्वार होते है जिनमे गोपुर-द्वारों का प्रथम स्थान है । गोपुर-द्वारों के द्वारा एक भवन-विशेष में आकर्षण तथा मनोरमता उत्पन्न करने के लिए प्राचीनों की परम आस्था प्रतीत होती है । राज-भवनों के गोपुर-द्वार भी उनकी गरिमा है । भारतीय स्थापत्य में द्वार-प्रतिष्ठा पद-प्रतिष्ठा पर आश्रित है । वास्तु-द्वार तथा भवन द्वार एक ही नहीं है । यदि राज-भवन में वास्तु-द्वार उत्तर की ओर है तो भवन-द्वार पूर्व की ओर । गोपुर-द्वारों के अतिरिक्त दो प्रकार के और द्वार है । महाद्वार तथा पक्षद्वार। इन महाद्वारों की प्रतिष्ठा राजगृह के विस्तृत पदों पर चारों प्रमुख दिशाओं में महेन्द्रादि नामों से महीधरादि पदों पर करनी चाहिए ।[१७]

विशिष्ट भवन :

विशिष्ट भवनों का तात्पर्य उत्तमोत्तम अथवा अद्‌भुत भवनों से नहीं है । इनका यहाँ पर तात्पर्य उन भवनों से है जिनका विभाजन अन्य भवनों तथा नहीं हो सकता । जिनका न तो जनभवनों के साथ वर्गीकरण हो सकता है और न राजभवनों तथा देवभवनों के साथ । अत: ऐसे-भवनों को हमने विशिष्ट भवनों की संज्ञा प्रदान कर इस शोधपत्र में अवतारणा की है । वैसे तो विशिष्ट भवनों की एक लम्बी सूची है परन्तु शिल्पग्रन्थों में चार ही भवन-विन्यास प्रमुख है जिनको विशिष्ट भवनों में हम स्थान दे रहे हैं। ये हैं - सभा, मण्डप, अश्वशाला तथा गजशाला ।

सभा :

सभा एक बड़ी ही प्राचीन रचना है । हमारे धार्मिक साहित्य में जैसे अथर्ववेद, तैत्तरीय संहिता, तैत्तरीय ब्राह्मण, छांदोग्य-उपनिषद् आदि में सभाओं के निर्देश आये है । इन अति प्राचीन वैदिकयुगीन सभा-भवनों के विन्यास में दो ही प्रधान उपकरण थे - स्तम्भ तथा वेदियाँ । यह एक प्रकार का द्वार, भिति आदि से विरहित स्तम्भ-प्रधान निवेश था । सभा राजनिवेश का भी एक प्रधान अंग थी जिसको आजकल की भाषा में हम दरबार के नाम से पुकारते हैं । सभा के राजनिवेश में एक दूसरा विकास मंत्रि-परिषद् या मंत्रशाला के रुप में हुआ, वह स्थान एक प्रकार से गुप्त एवं गोप्य स्थान था । अतः उसमें भित्तियों और द्वारों की रचना आवश्यक थी ।

महाभारत में सभाओं के बहुत सुन्दर वर्णन मिलते है । महाभारत का एक पर्व ही "सभा-पर्व" के नाम से विख्यात है जिसमें इन्द्र-सभा, वरुण-सभा, कुबेर-सभा तथा ब्रह्म-सभा के वर्णन है । और इन सभाभवनों मे प्रचीन वैदिक सभा की रचना-प्रसृति ही देखने को मिलती है । गणराज्यों में सभाभवनो की एक नवीन परम्परा विकसित हुई । तत्कालीन सभाभवनों नें न केवल राजनीतिक चर्चा अथवा व्यवहार निर्णय संपन्न होते थे वरन् सभाभवनों में मनोरंजन, द्यूत, प्रमोद, वादविवाद तथा विभिन्न प्रतियोगिताएँ पल्लवित हुई ।

समरांगणसूत्र[१८] में नन्दा, भद्रा, जया, पूर्णा, भाविता, दक्षा, प्रवरा तथा विदुरा-इन आठ सभाओं का वर्णन प्राप्त होता है । उपर की समीक्षा के अनुरुप सभा-विकास की सभी परम्पराएँ इस सभा-वर्गीकरण में प्राप्त होती हैं । जहाँ तक इनमें वास्तु-विन्यास का प्रश्न है । अर्थात् स्तम्भ-बहुलता, वह केवल प्रथम पाँच में विहित मानी गयी है । इन पाँचो सभा-भवनों में छत्तीस स्तम्भों का विन्यास बताया गया हैं । अतः वैदिक सभाओं की छाप इन सभा-भवनों में स्पष्ट है परन्तु अंतिम तीन सभाओं-दक्षा, प्रवरा, तथा विदुरा मे स्तम्भो का सर्वथा अभाव हैं ।[१९]

मण्डप :

मण्डपों की परम्परा विशेष कर पूजा-वास्तु से संबंध रखती है । परन्तु जन-वास्तु में भी इनका योग है । जिस प्रकार अरण्यों में कुटियों और कुटीरों तथा आश्रमों का विकास हुआ इसी प्रकार क्षेत्रों, उद्यानों, सरिताकूलों, तड़ागतीरों तथा सागरवेला पर मण्डपों का विकास हुआ । इन मण्डपों की रचना-कला सभा-भवनों से आयी । एक दो काष्ठमय. स्तम्भों के न्यास से एवं उपर की छावनी वन्य शाखाओं अथवा तालपत्रों से संपन्न कर छोटे-मोटे काम चलाऊ मण्डपों का आज भी विन्यास हम देखते हैं । मानसार[२०] में तीन मण्डप-कोटियों का वर्णन है । जनपदोचित भवन, समुद्र वेला अथवा सरिताकूल अथवा तडागतट या पुष्करिणी पर विनिर्मित अवकाशीय भवन (पहली कोटि) राजनिवेश के नाना भवन-विन्यास (दूसरी कोटि) तथा मन्दिरों के नाना-भवन (तीसरी कोटि) । राज-प्रासादों के नाना निवेशों को मण्डप के नाम से पुकारने की प्रसिद्ध परंपरा थी, जैसे अभिषेक-मण्डप आदि । मंदिरों में भी नाना मण्डप होते ही है, जैसे पुष्पमण्डप।

परन्तु विवाह-मण्डप, जल-मण्डप, धान्य-मण्डप आदि मण्डपों के साथ मार्गों पर विन्यस्त विश्राम-मण्डप के विन्यासों में मानव-वास्तु की परंपरा निश्चित है -यह निष्कर्ष असंगत न होगा।

गजशाला :

समरांगणसूत्र[२१] में ७ गजशाला के प्रभेद वर्णित है । सुभद्रा, सुभोगदा, चतुरस्रा, नन्दिनी, भद्रिका, वर्षणी, प्रमारिका ।

समरांगण में गजशाला के निर्माण के लिए बहुत बड़े पद की आवश्यकता पर प्रवचन है जो ठीक ही है, हाथियों को एक दो हाथ के थानों में थोड़े ही थामा जा सकता है । अतः "कल्प्या प्रासादवद् भागाः ।" अतएव इन सातों प्रकार की गजशालाओं की पारस्परिक विशेषताएँ एकमात्र वास्तुतत्त्वों-अलिन्द, प्राग्रीव, कर्णप्रासाद आदि के द्वारा है, इनके विन्यास-भेद से इनका भी विभेद समझना चाहिए ।

अश्वशाला :

समरांगण-सूत्रधार में अश्वशाला पर जैसा प्रौढ़, पारिभाषिक एवं वैज्ञानिक विवेचन मिलता है वैसा अन्यत्र अप्राप्य है । समरांगण की यह महती देन है । अश्वशाला का निर्माण राजनिवेश का प्रमुख अंग था। प्राचीनकाल में और मध्यकाल में भी घोड़े न केवल एकमात्र राजयान, सैन्य-अभियान साधन थे वरन् वे राजाओं और समृद्धों पर हावी थे । घोड़ा प्राचीन भारत का सर्वाधिक महिमामय तथा प्रशस्त पशु था। अतएव घोड़े का शास्त्र भी बना जिसको हम शालिहोत्र के नाम से पुकारते हैं ।

अश्वशाला के स्थापत्य को हम चार निम्नलिखित भागों में विभाजित कर सकते हैं ।

(१) अश्वशाला-निवेश
(२) अश्वशाला में उपकरण
(३) अश्वों की बांधने की व्यवस्था
(४) अश्वशाला के सहायक उपभवन

शाला निवेश :

अश्वशालाओं उत्तम-मध्यम-अधम प्रभेद से तीन सामान्य प्रकार है । उत्तम की रचना १०० अरत्नि अर्थात् १५० फुट के विस्तार में करनी चाहिए । मध्यम की १२० फुट तथा कनिष्क की ८० फुट। अश्वशाला विन्यास के संबंध में यह आदेश है कि इसका निवेश ऐसे स्थान पर हो कि अश्व - स्वामी जब अश्वशाला से निकले तो घोड़े उसकी बायीं तरफ रहें । अश्वशाला का प्रधान प्रवेश-द्वार पूर्व अथवा उत्तर में निविष्ट किया जाता था और उस मुखद्वार पर तोरण की रचना भी आवश्यक होती थी । अश्वशाला की ऊँचाई १५ फुट और चौड़ाई १२ फुट से कम नहीं होती थी । इसकी दीवारों पर नागदन्तों का होना आवश्यक था ।[२२]

अश्वशाला के संभार :

अश्वशाला के संभारों की बड़ी लम्बी सूची हैं । पहले तो अश्वशाला में अग्नि का रहना आवश्यक है । अग्नि का स्थान दक्षिण-पूर्व में विहित है । माहेन्द्री दिशा में जलकुम्भ की स्थापना प्रशस्त है । वायव्य कोण में औदूखल का निवेश आवश्यक है । इनके अतिरिक्त नि:श्रेणी, कुश, कुदाल, उदाल, गुडक, हस्तवासी, शीला, दीप, दर्वी, जूते, चित्रविचित्र पिटक आदि अश्वशाला के उपयोगी सम्भार एवं संग्रह माने गये हैं ।[२३]

अश्वस्थान :

अश्वशाला का स्थापत्य कैसा होता था इससे हमारे राजदरबारी कवि भी पूर्णरुप से परिचित थे । रघुवंश[२४] में "दीर्घेष्वमी नियमिता: पटमण्डपेषु" से भी स्थानों की इसी परम्परा पर प्रकाश पड़ता है । ये स्थान अलंकृत होते थे और इनके आयाम तथा विस्तार में एक किष्कु अथवा तीन किष्कु क्रमश: होते थे ।[२५] इनका विन्यास पूर्वाभिमुख अथवा उत्तराभिमुख होता था और इनको इसतरह से बनाया जाता था कि इनका मुखभोग ऊँचा तथा अधोभाग नीचा होता था । इनकी आकृति चौकोर होती थी ।

अश्वशाला में अश्वों को बाँधने के लिए चारों तरफ चारों कोनों में चार-चार हाथ का अवकाश छोड़ देना चाहिए । अश्वों को परस्पर इतना दूर अवश्य रखना चाहिए जिससे वे एकदूसरे का स्पर्श न करे सके और सुविधा से खड़े रह सके ।[२६]

अश्वशाला में भेषजागार :

अश्वशाला के लिए एक ऐसे अस्पताल की आवश्यकता है जिसमें कम से कम चार निवेश हों - भेषजागार औषधियों के रखने का स्थान, अरिष्टागार (जहाँ पर घोड़ियाँ बच्चे देंगी), व्याधि भवन (रुग्ण अश्वों के लिए चिकित्सा) तथा सर्व संभार-वैश्म अर्थात् जहाँ पर औषधियों के अतिरिक्त नाना प्रकार के नमक, तैल तथा वर्तियाँ सुरक्ष्य समझी जाती थी ।[२७]

तदोपरान्त कुछ अन्य निवेशो के भी उल्लेख प्राप्त होते है । जैसे कि जलाशय, कूपों, वापियों तथा कुण्ड़ों एवं तड़ागों के निवेश पर भी स्थापत्य प्रवचन हैं, किन्तु विस्तार भय से मात्र यहाँ पर नामोल्लेख किया गया है ।

संक्षेप में भारतीय जीवन सनातन से अध्यात्म भावना से प्रभावित रहा है, भारतीय कला इसका अपवाद नहीं । जहाँ तक भारतीय कला की उद्भावना का संबंध है, उसमें कलाकार के मानसिक योग एवं प्रारंभिक धार्मिक संस्कारों का होना अनिवार्य है । मानव सभ्यता की कहानी मानव की रहन-सहन, भोजन-भजन, परिधान एवं निधान के साथ-साथ आचार-विचार एवं देवार्चन तथा देव-प्रतिष्ठा की कहानी है । सभ्यता का

जैसे-जैसे विकास हुआ त्यों-त्यों उसके इन कार्यकलापों का भी विकास हुआ । संस्कृति एवं सभ्यता की रुप-रेखा में वैसे तो बाह्य परिवर्तन प्रचूर प्रमाण में हुए । यद्यपि आधुनिक देवहीन भौतिकवाद संस्कृति के इस रुप को नष्ट करने की ओर अग्रसरित हो रहा है, परन्तु वैज्ञानिक विकास के साथ-साथ आध्यात्मिक विकास के अभावात्मक परिणाम का अनुभव हम प्रतीक्षण कर रहे हैं ।

पादटीप

(१) स.सू. अ. ६

(२) मार्क. पु. अ. ४९

(३) वायु. पु. अ.८

(४) म.पु.७/८३ - १२०

(५) बृ.सं. ५३/९६ : अ.पु. २४७/१

(६) बृ.सं. ५३/१२,१३

(७) बृ.सं. ५३/११८ : ग.पु.अ. ४६

(८) स.सू. ४८/२५ से ३१

(९) बृ.सं. ५३/७२ से ७५

(१०) ग.पु. ४६/१ - ३६

(११) स.सू. ४८ /५८

(१२) बृ.सं. ५३/ ७९ - ८२

(१३) बृ.सं. ५३/७६

(१४) बृ.सं. ५३/८५

(१५) ग.पु. - ४६/ १ - ३६

(१६) स.सू. १५ / १-३

(१७) स.सू. १५ / ११

(१८) स.सू. २७ / १

(१९) स.सू. २७ / ६-८

(२०) मान. अ. २४

(२१) स.सू. - अ. - ३२

(२२) स.सू. - अ. - ३३/१७ - २१

(२३) स.सू. - अ. - ३३/३४ -४०

(२४) रघु. सर्ग - ५

(२५) स.सू. - ३३/२७

(२६) स.सू. - ३३/७९

(२७) स.सू. - ३३/७६

ELECTRICAL, ELECTRONICS AND COMMUNICATION

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ISSUES OF 3G MOBILE COMMUNICATION ; A REVIEW

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Abstract : Mobile telecommunication Networks are being upgraded since last few years. The generation of the mobile equipments rapidly increased with the revolutionary development in Electronics and software industries changing the scenario of Mobile communication. This paper will concise Wireless Communication basics and the generation of Mobile Technology. With the description of the evolution a small effort is made to list out the issues observed in the Mobile Technology, especially 3G mobiles.

Evolution to 3G

Cellular mobile telecommunications networks are being upgraded to use 3G technologies from 1999 to 2010. Japan was the first country to introduce 3G nationally, Korea then adopted 3G Networks soon after and the transition was made as early as 2004.

Mobile telephony allowed us to talk on the move. The internet turned raw data into helpful services that people found easy to use. Now, these two technologies are converging to create third generation mobile services.

In simple terms, third generation (3G) services combine high speed mobile access with Internet Protocol (IP) based services. But this doesn't just mean fast mobile connection to the world wide web.

Rather, whole new ways to communicate, access information, conduct business, learn & be entertained, cumbersome equipment and immovable points of access.

In users view

User may be anywhere service is provided, at anytime, from one terminal. The old boundaries between communication, information, media and entertainment will disappear. "Mobility" will be offered with many services that we currently regard as "fixed" – indeed, Mobile operators believes that mobility will become the norm for many communication services. We'll be able to make video calls to the office and surf the internet, or play interactive games with friends at home - wherever we may be.

The Speed

3G enables users to transmit voice, data and moving images. In order to these services, 3G improves the data transmission speed up to 144Kbps in a high-speed moving environment. 384Kbps in a low-speed moving environment & 2Mbps in a stationary environment. 3G provides services to Internet connection, transmission of large-scale data and moving contents photographed by digital cameras, videos & software downloading.

At present, maximum data transmission speed is 64Kbps offered by NTT DoCoMo's 3G services, and toward early 2001, 384Kbps will be possible. At the early stage of 3G services 144Kbps-transmission speed was expected. By 2005 when 3G is in general use, a maximum speed of 2Mbps is possible.

What is 3G?

A radio communications technology that will create a "bit pipe" for providing mobile access to internet-based services. It will enhance and extend mobility in many areas of our lives.

In the near future, mobility won't be an add-on: it will become a fundamental aspect of many services. We'll expect high-speed access to the internet, entertainment, information and electronic commerce (e-commerce) services wherever we are - not just at our desktop computers, home PCs or television sets.

3G services will add an invaluable mobile dimension to services that are already becoming an integral part of modern business life: Internet and Intranet access, video-conferencing, and interactive application sharing.

We are not just talking about "road warriors" who spend their entire lives travelling. It's more a question of supporting new, flexible working practices where employees need access to a wide range of information and services via their corporate intranets, whether they are at their own desk or anywhere else.

Employees who spend some of their working at home. Accountants that carry out audits at client premises. On-site maintenance engineers who need access to detailed instruction manuals, mobile emergency services who need a video link with a hospital or doctor for specialized advice. These are a few situations where 3G will play a valuable role.

We're likely to see 3G services enter our day -to-day lives in all sorts of new ways: for example, in shopping, especially Internet "mail order" (e-commerce), banking, or playing interactive computer games over the Net.

We'll think nothing of sitting on a train and using a mobile palmtop with Internet browser to log into our bank accounts. While on-line we'll be able to check our accounts, pay a few bills and click on a screen icon to immediately set up a video-conference to discuss our account with a bank clerk.

On vacation, we'll be able to use our mobile palmtops to obtain local tour guides, make a last-minute reservation

at a hotel, find and call the nearest taxi firm, and send video postcards.

Our refrigerators will have built-in sensors that detect which items need restocking and automatically send a reminder message to our Personal Digital Assistants (PDAs). We could even get the refrigerator to send an order direct to our local store. Likewise, vending machines will be able to tell the warehouse when they need restocking.

3G Applications

Basically, 3G opens the door to anything you can imagine. You will be able to do a multitude of things while going through your daily schedule, whether at work or at leisure. The scenarios below demonstrate just a few applications for 3G and only hint at what will be on offer in the future.

Scenario1: An executive at a client meeting realises that he has brought an outdated version of his presentation. It's no problem though because one of his colleagues back at the office emails the updated PowerPoint file directly to his 3G terminal. He transfers it to the laptop (wirelessly of course) and is in no time ready to start the presentation.

Scenario2: This scenario is about two women who are trying to find a gift for their friend. Two of them are out shopping, but they are out of ideas and use a web site that generates gift suggestions based on personality profiles. They decide to buy a handbag at a shop situated somewhere near the city centre (but at an unknown address to the women).

Not knowing exactly where the shop is, they use a map and positioning service to find it. The map is displayed on their 3G terminal and shows them the shop location and their current position.

In order to share their experiences with their friends and family, they have created a virtual photo album on their personal web site. This way, anyone with access to the Internet can follow them on their trip.

But what about those without Internet access? Well, that's been taken care of by the WalkMail network. The pictures are printed, together with the text, on high quality paper and delivered as regular postcards within 24 hours.

Scenario3: In this scenario, we see two men talking on their way from a meeting. They decide to go out to dinner, but one of the men would like to invite his wife along so he checks her calendar on his 3G terminal (their calendars are constantly in synch).

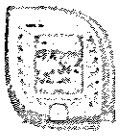
Scenario5: A young traveler has once again missed the train. Luckily, he has downloaded some of his favorite music from a web store. He's also got a pair of stereo headphones to use with the communication device. Seeing that one of his friends is on-line, he invites the friend to a peaceful game of chess.

3G Images

There will be a wide range, from simple single-application devices such as voice-only phones, to multi-purpose communicators capable of handling several voice, data and video services in parallel.

To date, the "terminal" for accessing mobile services has been the mobile phone. With the coming of 3G, we can expect to see a broadening of this concept to include a whole host of new terminals. These will be both general-purpose computing and communications devices, and devices with more specific purposes to serve particular marker segments. There will still be recognizable mobile phones. But many of these will have larger screens to display Internet pages or the face of the person being spoken to. There will be smaller "smart-phones" with limited web browsing and e-mail capabilities. The addition of mobile communications capabilities to laptop and palmtop computers will speed up the convergence of communications and computing, and bring to portable computing all the functions and features available on the most powerful desktop computers. There will be videophones, wrist communicators, palmtop computers, and radio modem cards for portable computers. Innovative new voice based interfaces will allow people to control their mobile communication services with voice commands.

We will also see the integration of 3G into a very wide range of devices and products other than user terminals. For example, the "telephone-on-a-card" will allow mobile services to be built into business equipment, vehicles and household appliances, for dedicated applications. Devices such as phones, computers and digital cameras will also be able to communicate with each other using short-range radio. Digital cameras will be able to use wide-area radio communications in real time and reduce the need for bulky memory and other components.



Nokia_7600_ front_shot



6650_front _shot



6650_hand

Issues

Although **3G** was successfully introduced to users in Europe, Australia, Asia, South America, North America and Africa, some issues are debated by **3G** providers and users:

- Expensive input fees for the **3G** service licenses
- Numerous differences in the licensing terms
- Large amount of debt currently sustained by many telecommunication companies, which makes it a challenge to build the necessary infrastructure for **3G**
- Lack of member state support for financially troubled operators

· Expense of **3G** phones

· Lack of buy-in by 2G mobile users for the new **3G wireless** services

· Lack of coverage, because it is still a new service

· High prices of **3G** mobile services in some countries, including Internet access.

· Current lack of user need for **3G** voice and data services in a hand-held device

· High power usage

Conclusion :

The issues observed in this generation of mobiles to be minimized in the next generation which is in progress. The WIFI,WiMAX and Bluetooth technologies are the perspectives for the next generation.

Acknowledgement

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WIRELESS SENSOR NETWORK AS DATABASE

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1.Introduction

A **Wireless sensor network**(WSN)is a wireless network consisting of spatially distributed autonomous devices using sensors to cooperatively monitor physical or environmental conditions, such as temperature, sound, vibration, pressure, motion or pollutants, at different locations. The development of wireless sensor networks was originally motivated buy military applications such as battlefield surveilance. However,wireless sensor network are now used in many civilian applications areas, including environment and habitat monitoring, healthcare applications,home automation,and traffic control.

In addition to one or more sensors, each node in a sensor network is typically equipped with a radio transceiver or other wireless communications device, a small microcontroller, and an energy source, usually a battery. The envisaged size of a single sensor node can vary from shoebox-sized nodes down to devices the size of grain of dust, although functioning 'motes' of genuine microscopic dimensions have yet to be created. The cost of senor nodes is similarly variable, ranging from hundreds of dollars to a few cents, depending on the size of the sensor network and the complexity required of individual sensor nodes. Size and cost constraints on resources such as energy, memory, computational speed and bandwidth.

Normally, the question asked with regard to research in WSN are:(i) what are the prospective application domains and concrete applications (ii) Are the existing systems sufficient or same additional hardware requirements are needed to support these applications and(iii)What type of software(ex. operating systems, programming abstractions, tools etc) is needed to support these applications ? Since WSN have a wide variety of applications with vastly varying requirements and characteristics, it is difficult to discuss its specific application requirements, research challenges and directions. Therefore it is of the opinion that Sensor network design space and its various dimensions should be characterized so that the excellent framework for discussing and structuring the coordinate research would be available. No double this provides a conceptual basis for the development of flexible software frameworks which could be adapted to meet different application needs effectively. In this paper an attempt is made to specify important dimensions of sensor network design space and could be easily justified that the existing sensor network applications occupy different points in the design space.

2.Design Space

The earliest research in WSN was motivated by military applications and a number Projects (e.g., smart Dust,NEST) was founded by Defense Advanced Research projects Defense Advanced Research Project (DARPA)[1].Later some civilian application domains of WSN were considerd viz., environmental and pecies.monitering, agricultural,production and delivery, healthcare etc.In order to target these application, it is suggested that (i) network may consist of heterogeneous and mobile sensors nodes (ii) the network topology may be as simple as a Star topology and (iii) networks may make use of the existing communication infrastructures. In order to meet this general trend toward diversification, some important dimensions of the sensor network design space are discussed in brief in this paper while discussing the dimensions, two principles are considered viz.(i) there should be a notable variability between application with respect to dimensions and (iii) a dimension should have a significant impact on the design and implementation of technical solutions.

Based on the above view points, the important dimensions of the design space are:

(i) Deployment (ii) Mobility (iii) cost, size, resource and energy (iv) Heterogeneity (v) Communication modality (vi)

Infrastructure (vii) Coverage (viii) Connectivity (ix) Network size and (x) lifetime.

In the physical environment the **Deployment** of sensor nodes may take several forms. For example, Nodes may be deployed at random (e.g., by dropping them from an aircraft) or installed at deliberately chosen spots. Deployment may be one-time activity,where the installation and use of a sensor network are strictly separate activities.However, deployment may also be continuous process,For example,some computationally more powerful "compute"[2] nodes may collect,process,and route sensor data from many more limited sensing nodes.But,the actual type of deployment affects important properties such as the expected node density ,node locations,regular patterns in node locations ,and the expected degree of network dynamics.Some sensors nodes may be equipped with special hardware such as a Global Positioning System(GPS) receiver to act as beacons for other nodes to infer their location.

In fact, Sensor nodes do change their location after initial deployment. Mobility can result from environmental influences such as wind or water and some nodes may act as gateways to long-range data communication networks(e.g.,GSM network, satellite networks,or the Internet).

Thus, the degree of **Heterogeneity** in a sensor network is an important factor since it affects the complexity of the software executed on the sensor nodes and the management of the whole system. In other words, mobility may be either an incidental side effect or a desired property of the system(e.g.,to move nodes to interesting physical locations),in which case mobility may be either active (i.e.,automative) or passive(e.g., attached to a moving object not under the control of the sensor node).Mobility may apply to all nodes within a network or only to subsets of nodes.

Mobility has a large impact on the expected degree of network dynamics, and hence influences the design of networking protocols and distributed algorithms.

As Sensor nodes are untethered autonomous devices, their energy and other resources are limited by size and cost constraints and, varying size and cost constraints directly result in corresponding varying limits on the energy available (i.e.,size,cost,and energy density of batteries or devices for energy scavenging), as well as on computing, storage and communication resources.Accordingly,the energy and other resources available on a sensor node may also vary greatly from system to system .Power may be either stored (e.g., in batteries) or scavenged from the environment(e.g., by solar cells).Sensor nodes are roughly in partitioned into four classes based on their physical size:brick,matchbox,grain,and dust.

In many prototypical systems available today, sensor network consist of a variety of different devices. Nodes may differ in type and number of attached sensors. While talking about of computational modality for wireless communication among sensor nodes, a number of communication modalities can be used such as radio,diffuse light, laser, inductive and capacitive coupling ,or even sound.

Perhaps the most common modality is radio waves, since these do not require a free line of sight, and communication over medium ranges can be implemented with relatively low power consumption and relatively small attennas.

Inductive and capacitive coupling only works over small distances, but may be used to power a sensor node[3]. Most passive radio frequency identification (RFID) system use inductive coupling, for example. Sound or ultrasound is typically used for communication under water or to measure distances based on time-of flight measurement. Sometimes, multiple modalities are used by a single sensor network system. The communication modality used obviously influences the design of medium access and communication protocols, but also affects other properties that relevant to the application.

The various **Communication modalities** can be used in different ways to construct an actual communication network. Two common forms are so-called infrastructure-based networks on one-hand and adhoc networks on the other hand .In infrastructure –based networks, sensor nodes can only be directly with so-called base-station devices. If there are multiple base station, these have to be able to communicate with each other .The number of base station depends on the communication range and area covered by the sensor nodes. Mobile phone networks are an example of this type of network. However, in adhoc networks, nodes can directly communicate with each other without an infrastructure. Nodes may act as routers, forwarding messages over multiple hops on behalf of other nodes. Since the deployment of an infrastructure is a costly process ,and the installation of an infrastructure may often not be feasible, adhoc network are preferred for many applications. Note that combination of adhoc and infrastructure –based networks are sometimes used, where clusters of sensor nodes are interconnected by an infrastructure-based wide area network.

While discussing Network topology ,the important property of a sensor network i.e., its diameter (which is the max number of hops between any two nodes in the network) has to considered in its simplest form, a sensor network forms a single hop network, with every sensor node able to directly communicate with every other node.Acordingly structure-based network with s a single base-station forms a star network with a diameter of two. A multihop network may from a arbitrary graph, but often an overlay network with a simpler structure is constructed such as tree or a set of connected stars. The topology affects many networks characteristics such as latency, robustness, and capacity .The complexity of data and processing also depends on the topology.

The coverage area of sensor node is defined as Network coverage measures the degree of coverage of the area of interest by sensor nodes. With sparse coverage, only the parts of interest are covered by the sensor nodes. With dense coverage, the area of interest is completely (or almost

completely)covered by sensors. With redundant coverage, multiple sensors cover the same physical location. The degree of coverage influences information processing algorithms. High coverage is key to robust systems and may be exploited to extend the network lifetime by switching redundant nodes to power-saving sleep modes.

The **Connectivity** of a network is defined as if there is always a network connection(possibly over multiple hops)between any two nodes, the network is said to be connected. Connectivity is intermittent if the network may be occasionally partitioned. If nodes are isolated most of the time and enter the communication range of other nodes occasionally then we say that communication is sporadic. Connectivity mainly influences the design of communication protocols and methods of data gathering.

Actually the number of nodes participating in a sensor network is mainly determined by requirements relating to network connectivity and coverage, and by the size of the area of interest .The network-size may vary from a few nodes to thousands of sensor nodes to thousand of sensor nodes or even more. The network size determines the scalability requirement with regard to protocols and algorithms.

The required lifetime of a sensor network may range from some hours to several years depending on the application the necessary lifetime has a high impact on the required degree of energy efficiency and robustness of the nodes.Table 1 gives the compact form of the dimensions of the design space with regard to samples.

	Deployment	Mobility	Resources	Cost	Energy	Heterogeneity	Modality
Great Duck	Manual,one-time	Immobile	Matchbox	~200 USD	Battery, Solar	Weather stations Burrownodes, gateways	Radio
Zebra Net	Manual,one-time	All, Continuous, Passive	Matchbox	-	Battery,	Nodes, gateway	Radio
Glacier	Manual,one-time	All, Continous, passive	Brick	~1000 USD	Battery,	Homogenous	Radio
Herding	Manual,one-time	All, Continuous, Passive	Brick	-	Battery,	Homogenous	Radio
Bathymetry	Manual,one-time	All, Occasional, Passive	Brick	-	Battery,	Homogenous	Radio
Ocean	Random,iterative	All, Continuous, Passive	Brick	~15000 USD	Battery	Homogenous	Radio
Grape	Manual,one-time	Immobile	Matchbox	~200 USD	Battery	Sensor, gateway, base station	Radio
Cold chain	Manual,iterative	Partly (sensors), occasional, passive	Matchbox (sensors) brick(relays)	-	Battery	Sensors,relays,access boxes, warehouses	Radio

Table1: A Sample showing the important dimension of a Design Space

3.Architecture

By architecting sensor networks as vital databases, it is possible to provide a well-understood non-procedural programming interface suitable to data management, allowing the community to realize sensor net application rapidly. We emphasize here that in order to achieve energy–efficient and useful implementation, query processing operators should be implemented within the sensor network, and that approximate query results will play a key role.

Wireless sensor networks have received significant recent attention in both the networking and operating systems communities. The characteristics of sensor network described above also give rise to another intriguing architectural view of sensor networks; the sensor network as database. The view is complementary to the view of the network as having a data-centric routing system[5], in that routing is bottom-up mechanism, whereas a database view is top down data modeling and application development interface. Recall that nodes in a sensor network generate named data against which one or more users issues queries. This is quite similar to the traditional view of relational databases, in which disk blocks (whose individual identities are irrelevant to the application) contain data records against which queries are issued.

In this paper ,we explore the challenges in realizing this architectural view of the sensor network as a database. The compelling advantage of query-specification interface is that it defines an application-independent way of programming data collection from the sensor network. It is suggested that sensor network database(or a sensornet database,for short)should be architectured on two important ideas. The first is in-network implementations of primitive database query operaters such as grouping, aggregation, and joins. By "in-network" we mean group communication and routing protocols which, together with possible processing at intermediate nodes,implement each operator in application-independent way. It is emphasized that such implementation will require a novel routing mechanisms, which take into account network resource constraints as well as the order in which database operators are processed.

Second, unlike the strict semantics associated with traditional data models and query language, it emphasized that for relaxing the semantics of database queries to allow approximate results. The relaxing enables energy-efficient implementations even given the expected high level of network dynamics (such as packet loss, node failure etc.).A sensor network is a proxy for a continuous real-world phenomenon, and by nature samples that phenomenon discretely at some rate., with some degree of error. Hence it is not only convenient but indeed more accurate to present approximate but indeed more accurate to present approximate semantics, and expose a spectrum of tradeoffs between concise and precise communication.

In this section, we brief review the state of sensor network sub system, and provide the necessary background in database systems.

4. Sensor Network Subsystems

Prototype of sensor nodes are starting to appear on the horizon .One class of devices is exemplified by the mote[6].Motes contain 8-bit processor , a low baud-radio, several megabytes of memory ,and MEMS sensors of detecting temperature, ambient light, and vibration. A class of larger devices[6] contains PC-class processors, spread-spectrum radios, infrared dipoles, acoustic geophones, and electret microphones. In both these classes of devices, the radios represent key design constraints: communication using these radios requires significantly more energy than consumption

Applications
Collaborative Event Processing
Data –Centric Routing
Local Signal Processing
Packet Delivery(Flooding,Geogrphic,Routing)
Radio MAC layer, Topology Discovery
Localization and Time Synchronization
Devices (Sensors,Radio)

Figure 1: Sensor Network Software Subsystem

Figure 1 depicts an emerging modularization of sensor network software. Although drawn as a stack, we do not mean to suggest that this is the most appropriate modularization of sensor network software, or indeed that sensor network software, or indeed that sensor network software can even be "layered". As we illustrate later, it might be necessary to collapse layers or selectively break abstraction boundaries for efficiency or robustness reasons.

Term	Description
Data Model	Framework for data representation and data semantics
Tuple	A data record, usually consisting of several attributes
Source	Sensor nodes that generates a tuple
Table	A logical collection of similarly typed tuples. It can represent a infinte stream of tuples.
Operator	A function that takes one or more tables as input and output a table
Query	A composition(specifically, a tree)of operators

Figure 2: Glossary of Terms

Figure 1 allows us to place ongoing work in developing sensor network subsystem in context ,Working our way up the layers in figure 1,examples of layer related research include: an efficient operating system for senso. nodes[20]: low-level

network self-configuration systems [7],including systems for localizing nodes , and performing time synchronization[11] ; a data centric routing system [25] , and possibly collaborative signal processing systems[30] that can ,for example ,track moving targets.

5. Data Models

A prerequisite for discussing the database view of sensor networks is a data model, which is a framework for describing data representation and semantics. The most popular data model in use today is the relational model .In the context of a sensor network, this model is best described as follows .In our descriptions ,we assume, for ease of exposition, a sensor network where nodes do not move. Each sensor produces one or more tuples.The node that generates the tuples is termed the source .For example, a temperature sensor might produce a tuple of the form< nodelocation, timestamp, temperature>. Similarly, at a node that uses acoustics and vibration signal patterns to detect vehicles ,signal processing software might generate a software might generate a tuple of the from <nodelocation,timestamp,vehicle–type, detection Confidence>. A collection similarly-typed tuples from a group of sensors forms a **"Snapshot"**. In database terminology, this snapshot constitutes a relational table, which is horizontally partitioned across the sensors in the group. For example, the tuples generated by a collection of temperature sensors from a temperature table.

It is important to note that the table we discuss in the sensor network context are all virtual tables.Accesses to these virtual tables are automatically translated into corresponding data-collecting operations on each relevant sensor nodes,e.g.,Get Temperature, Get light Intensity,etc.Virtual tables can be unbounded ,representing ,for example ,streams of data.

The goal of the sensornet database design should be to preserve location transparency. A sensor network application writer should be able to get live temperature information by issuing database queries against a temperature table without any knowledge of actual topology of the network.. Managing the location and routing of these tuples is left to the infrastructure. This greatly eases the task of the application developers, and-more importantly-ensures that application code continues to function when data locations and/or routing schemes change.

Note that each tuple can have a key that identifies where the tuple was generated .In our example above, this is the node location, but more generally it can be unique node identifier. This identifier is used to correlate multiple readings from a single node, for example, using the join operation. It might also be useful for network monitoring. However, such an identifier does not compromise our requirement for location transparency as long as applications do apply physical interpretations to the identifiers (e.g., assuming that a node is up by checking if there exist tuples with the specified identifier).

One final note on data modeling. Especially outside the database community, the term "relational database" often evokes notions of strong guarantees on storage consistency and availability. This paper does not discuss challenges in the storage of tuples or in designing mechanisms to guarantee availability of tuples (e.g., availability of a tuple generated within a time window for sequence –centric operations on that window).

6. Database Operators

The basic elements of our paper is that core relational database operators like aggregation, grouping, selection and join form appropriate building blocks for application development on sensor networks. The following paragraphs describe some of these traditional database operaters in a sensor network context. We stick to an SQL-style multiset(or bag) semantics, in which duplicate tuples are not eliminated by default; this is typically the desired semantics for aggregation–centric applications.Note that the algebra of these relational operaters is closed,meaning that the result of any of these operaters is closed ,meaning that the result of any of these operaters is relational table, which can serve as input to further operaters.

Aggregation is an operation that is fundamental t a data-rich, large-scale, yet energy-constrained ,sensor network.By aggregation we mean the summarization of a column(or arithmetic expression over multiple columns) into a single numerical value. "The average temperature on the third floor " is an example of an aggregate defined on a temperature table consisting of tuples from sensors in an in-building sensor network. Most commercial database provide common aggregation operators such as SUM, COUNT, AVERAGE, MIN, MAX, and STDDEV (standard deviation). We anticipate aggregation queries will be very prevalent in sensor networks.

In traditional databases, the join operator is used to correlate data from multiple tables. A join can be defined as a selection over the cross-product of a pair of tables; a join of tabels R and S is denoted by R &S. One simple implementation of a join is to generate all pairs of tuples, and then extract those which satisfy the selection predicate. However it is quite common to implement joins in a more efficient fashion that does not forms all pairs A common join predicate is an equality match across columns of the two tables (an equi-join). For example, consider a temperature table with tuples of the form<nodelocation, timestamp, temperature>. Also, assume that some sensor nodes with temperature sensors also have light sensors, each of which produces tuples of the form <nodelocation,timestamp,temperature>.Also assume that some sensor nodes with temperature sensors have light sensors ,each of which produces tuples of the form <nodelocation,timestamp,lightlevel>.A equi-join of these two tables on the node location column would produce a table with the tuples of the form: <nodelocation, timestamp, lightlevel, temperature>,where tuples are only defined for nodes that have both temperature and light sensors.

There are several other relational operators like grouping (partitioning a table according to a predicate),selection(extracting

tuples based on a predicate),projection(extracting one or more columns from a table),union, difference, duplicate elimination ,and distinct aggregates that we do not discuss for brevity.

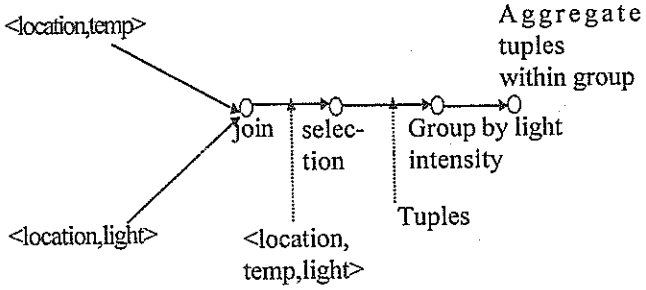


Figure 3:Complex Query Example

Finally, it is natural to write complex queries that compose multiple operators. Consider an in-building network that contains sensors nodes with light and temperature sensors. An example of a complex query defined on this network is:find the average temperature in different iso-light-intensity regions within a range of light intensities [10,15].Figure 3 describes how such a query could be accomplished the operaters described above.

7. Sensornet Database: Overview:

A careful survey of the literature reveals,that, The COUGAR project at Cornell University[5] is one of the first attempts to model a sensor network as a database system. It focuses on the interaction between the sequence data produced in sensor networks and stored data is backend relational databases . It extends both the SEQ sequence data model and the relational data model by introducing new operators between sequence data and relational data. COUGAR is implemented as an Cornell's PREDATOR object-Relational database system. It models sensors as columns with Abstract Data types(ADTs).User invoke sensors function by calling ADT function on sensor columns in queries. COUGAR does not currently focuses on exploiting the special characteristics of sensor networks, nor does it explore the interaction between query processing and networking. Rather, from an architectural point of view it simply layers(novel)database functionality on top of a traditional network model. We intended to leverage the data modeling work that has been done by the COUGAR group, and instead focuses on the architectural and algorithmic issues of efficiently integrating query-processing logic into sensor networking subsystems.

Finally,from the available literature we find there is a need for sensor network data analysis and mining, in the context of a particular application(the "smart" kindergarten).Our paper takes this step further and identifies specific challenges in realizing one aspect of this middleware, a relational database.

8. Operators

What we discussed so far lays the groundwork for discussing the research issues in designing sensornet databaes. We now begin to highlight some of these research issuses by considering the implementation of two database operaters:join and aggregation.

(i) Join

In the sensornet database, the complexity of the join can vary with the particular query. The simplest example of a join, one which joins the temperature and light tables by node location can be accomplished locally. That is, each individual node can perform the join on the temperature and light tuples that it generates before transmitting the joined tuple to the query originator.

More generally, however, the tuples generated at different nodes might be joined at a single node. Consider, for example, a multimodal vehicle identification sensor network in which some nodes have vibration sensors ,other acoustics sensors ,and yet others imagers(nodes may also have more than on sensor).A vibration sensor generates a tuple of the form<event Type, VibrationAmplitude,cofidencelevel,target location>.Other sensors produce similar tuples, perphapsdifferently typed. To correlate events from different sensors, one might wish to perform are equijoin on the event Type column.

The database literature has studied several generic join implementation methods, such as nested- loop, merge-sort, and hash join[15]. Some of these methods only apply to equi-join.(however, these conventional methods have a drawback, that makes them unsuitable for sensor network environments. These methods are blocking .For example, the hashjoin algorithms commonly used in database systems[9] cannot produce any tuples until one of the tables is fully scanned .Blocking is infeasible in sensor networks because the tables can contain unbounded streams of data,and the amount of memory available on each sensor node is limited relative to the potential sizes of sensornet database tables.

Database join algorithms can be modified with two basic techniques to become applicable to the sensor net context: pipelining and partitioning.

ii) Pipelining

It builds and maintains two hash tables (keyed by the columns(s) used for the join),one for each input table. When an input tuple arrives, it looks up matching tuples from the other input's hash table and outputs any matching results, then inserts itself into its own hash table .It is "symmetric" because the action for each tuple from either table is the same.

A generalization of symmetric hash-joins is the family of join methods called ripple joins[17].These join methods statistically sample the two tables to be joined ,in order to produce a stream of joined tuples.The relative rates at which the two tables are sampled adapt to match the variance produced by the data in each .When used together with an aggregation operater,they provide online aggregation.

These pipelined join methods because they are non-blocking will be the methods most directly applicable to sensor

nets. In addition to the memory constraints imposed by the sensor nodes, there are two reasons for preferring pipelined joins. We have argued that on-line query refinement will be important in sensor nets used for monitoring. Pipelined joins, because they provide streamed partial answer can enable query refinement. Futhermore, pipieling like ripple joins form a low-energy approach to obtain approximate answers can be used together with sampling.

iii) Partitioning and Interactions with Routing

Especially for a geographically constrained join(e.g., select records from a certain rejoin of the network and then perform a join),it might be possible to elect a node(e.g., the one closest to the centroid of the region)to perform the join .More generally ,this approach points to a technique used in parallel database systems called partitioning. Here tuples are partitioned based on their join-column values(either by range or by hashing),and redistributed on the fly across multiple nodes;the work of joining the individual partitions is done in parallel by each of [10].This idea is applicable in the sensor net database as well ;partitions can be defined by value,geographically,or by the sensor type ,and a node(or nodes)can be designated to perform the join for the partition. The goal here is both to leverage parallelism, and to exploit aggregate RAM space across multiple nodes, since joins can be memory–intensive ,and the sensor nodes may be memory –constrained.

A obvious research challenge is to develop techniques for partitioning joins in an energy-efficient way. Geographic partitioning can be energy efficient(in that tuples are locally joined).However, if the join is not along a node location column, geographic partitioning may not be applicable .A possible approach is to partition a column by hash values, using data-centric storage schemes like CAN,Chord,Pastry and Tapestry. Like traditional parallel hash joins, these schemes partition a key space across a collection of nodes. However ,traditional databases did this on a fully-connected cluster interconnect, whereas data-centric storage schemes are scalable over arbitrary topologies in the wide area.Data-centric storage can require transporting tuples over significant distances;howevere if the key space is partitioned across nodes within a loosely bounded geographical region, the overhead of this technique might be acceptable.

While these approaches are somewhat simplified ,they point out an important issues: the realization of relational operators in a sensornet database can be posed as a routing problem .In these examples ,we discussed relatively simple instances of this problem .

(iv) Aggregation

The next class of operators we study are the aggregation operators. The mechanics of computing aggregates is conceptually simple; a query is flooded throughout the network or to be specified geographic region, and the responses are routed on the reverse path trees, possibly being aggregated across several nodes. However, achieving this in the context of sensor networks proves to have surprising richness.

9 A Taxonomy of Aggregates

Aggregation on multiple nodes is not new-is has been extensively explored in the parallel database literature, particularly in the context of parallel systems with user –extensible interfaces for defining adhoc aggregation functions . A taxonomy of aggregates was developed to categorize the different classes of aggregate in terms of their partitioning across multiple nodes in a cluster. We use and extend that taxonomy here to organize the various types of aggregation function in sensornet database.

In any multi-node aggregation scheme, the basic idea is for each node to aggregate some subset of the data, and then pass some partially-aggregated state to other nodes;the partial state is itself aggregated more from multiple sources. Eventually, some node receives a set of partially-aggregated state that covers entire table, and compute a final answer. In sensor networks, one key performance goal is to extend the lifetime of the network can be usefully categorized by the sizes of the partial state records that get passed around.

As an example, the AVERAGE aggregate is computed by each node sending the SUM and COUNT of it readings to its parent, with parents sending the SUM of SUMs and COUNT of COUNTs upwards recursively. The root finalizes the aggregate by dividing the total SUM by the total COUNT.Hence the partial state for AVERAGE is two numbers(partial COUNT and partial SUM),and twice the size of the base readings.

In table 1 we represent a simple taxonomy of aggregation functions,and the amount of partial state they must communicate.The first three classifications were initially presented in the context of traditional databases[16];we devised the other entries to capture the sensor network case.As in[16] ,we are as general as possible in per taxonomy helps us discuss aggregation techniques for related aggregates in a unified way.

One key challenge in computing aggregates in a sensornet database is energy-efficiency. In particular, the network-wide aggregate (where each node responds with its value) can incur significant communication. Energy-efficiency might not be an issues if these aggregations were infrequent; however, we believe that aggregation will be a frequently-used query operation. This is especially true in interactive settings: user studies of information analysis have shown that the first request is often for a "big picture" of the data, which is used to decide what other questions to ask.

10 Energy-Efficient Aggregation

Energy-Efficiency can be achieved using approximate aggregates. We have argued in section3 that a sensornet database can provide approximate result to queries.Approximate aggregates are useful for on-line monitoring, can reduce the communication costs,and simplify or obviate networking mechnanism for in –network error recovery. This approach brings up an important consideration in the design of approximate aggregates. The measure of goodness of such

mechanisms is not the number of packets successfully delivered by sensornet database, but the information quality of the delivered result (ie.,how close the approximate result is to be true result).This information quality may be significantly affected by packet loss only under certain circumstances(eg.,when the distribution of values is highly variable) and only for certain kinds of aggregates(eg.,MIN). There are several possible techniques fro computing approximate aggregates. We now discuss each technique briefly. We intend to investigate these technique in our research.

sensitivity of the aggregate to loss.

Some of the distributive aggregates Like MIN or MAX are, of course, not amenable to sampling since they are highly sensitive to packet loss. For these, we can use a class of approaches that we call hypothesis testing. To answer certain aggregates like MAX,the query originator can pose a hypothesis answer, and see if anybody refutes it

This limits communications costs to aggregations of "refutations". This is potentially a multi-round protocol and there is a trade-off between good guesses(which require few

Class	Partial state size	Examples and Descriptions
Distributive	Sizeof(agg)	COUNT,MIN,MAX,SUM Partial stae is partial aggregate
Algebraic	C sizeof(Agg)	Average and STDEV state is constant size,on the order of the size of an aggregate
Holistic	|records|	MEDIAN and RANK .All Are needed to compute the aggregate
Content-sensitive	∝ f(records)	Any holistic aggregate enhanced with compression of state records.
		Also many approximate "signature" of the dataset, e.g., wavelet approximations of the source distri bution.[14] state is proportional to the content (e.g.,entropy) of the data in the partition
Unique	∝ |distinct records|	DISTINCT variants of holistic aggregates

Table 2:Classes of aggregates

The first of these is uniform sampling. This approach is application to algebraic aggregates like AVERAGE, and has been proposed in for online aggregation in traditional databases In this approaches,tuples in table are uniformly sampled and the resulting average is assumed to represent the actual average(the approach also applies to distributive aggregates like COUNT, with minor modifications).It is possible ,using the weak law of large numbers, to obtain confidence intervals for the approximation. In the networking context this fails, because packet loss might invalidate the statistical assumptions that these intervals depends on. The technique itself might still be applicable in the networking context; simulations can perhaps give us an idea of how the error in the count depends on loss levels. Table 2 provides class of aggregates.

A variant of this approach that is applicable to counting is a class of probalistic counting methods that uses logarithmic sampling.In these approaches ,the number of respondents (or the size of memory needed for the counts ,depending on these scheme)scales logarithmically with the size of the network .These approaches generally provide looser error bounds but use significantly less memory or communication. Another class of approximate counting methods leverages the particular structure of result propagation and is applicable to some distributive and algebraic aggregates. Recall that the result of a query are sent up the reverse path tree towards the orginator.Instead of sending ,for example ,a partial SUM to its parent, a node can evenly distributive the sum among all nodes within its radio range that are siblings of its parent. We call this approach flow-based because it splits up a count or value into many "flows" and thereby reduces the responses)and sensitivity to drops(less comm.=more sensitivity) .More generally we think counting based schemes are amenable to hypothesis testing. Thus, an n-tile is a hypothesis of the from "there are exactly |nodes|/n readings whose value is greater than a value x".It may be possible to generalize this idea ,by noting that determining the shape of distribution(which is basis of estimating aggregates) can be done by trying to count discreet segments of the distribution-i.e., build a histogram.

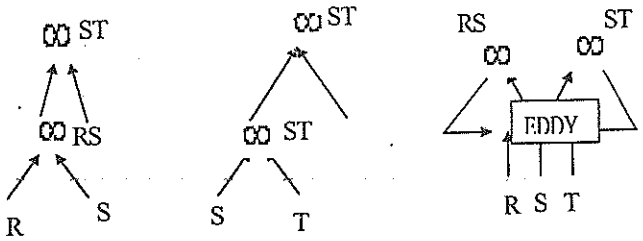


Figure 4:Three equivalent query plans: two traditional static plans one with an eddy.

Each plan has three input tables R, S and T, and two join operators combining R with S With T.The eddy version is able to adaptively reorder the join operators, effectively choosing among the static plans dynamically.

Finally, for aggregate where the size of the partial state is a function of the number of records, data compression techniques are applicable .In the database literature, there has been analogous work on communicating loosely-compressed data "synopses"(eg.,
[2]).Also applicable in this context is multi-resolution communication of aggregates using wavelets. With these techniques, the performance improvements clearly depend on

the underlying data distribution.

In the database literature, the statistical quality of approximate results can be robustly described via confidence intervals for aggregate estimators run over i.d.samples of the database .Such a robust statistical characterization of approximate result quality for sensor networks u\is a much more complex challenge ,since it may require modeling network losses in tandem with sensor sampling rates, noise models, and so on. One way to address these issues would use simulation and implementation to observe the phenomena causing approximation in these networks (e.g., losses), and also to see empirically the relative perturbation of answer quality when reliable protocols are fortified. We expect that these simulations will validate the usefulness of lightweight mechanism and approximation. However, beyond these experiments, we believe that it be necessary to do statistical research on mathematically characterizing the approximation quality results.

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STUDY OF DIELECTRIC AND STRUCTURAL PROPERTIES OF PURE AND CERIUM DOPED $BATIO_3$

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Abstract

Dielectric and structural properties of Barium titanate ($BaTiO_3$) and cerium doped $BaTiO_3$ with general formula $Ba_{1-x}Ce_xTiO_3$ where x= 0.0, 0.01, 0.02, 0.03 and 0.04, sintered at 1200°C, 1230°C and 1250°C for four hours were studied. The samples were prepared by the standard solid state reaction method. I-V characteristic of the samples showed ohmic behavior for the pure and Ce-doped $BaTiO_3$. As the temperature increases, the current density of the samples showed semiconducting behavior. Temperature dependence dielectric constant showed decrease in transition temperature with the increase in doping content. Frequency dependence dielectric showed that dielectric constant remains the same at the lower frequency region but in the higher frequency region it increased sharply. The value of dielectric constant increases as the doping amount is increased. Loss tangent showed a good agreement with the dielectric constant where loss tangent increases with the increase in doping agent. As the doping amount increases, the resistivity of the samples decreases. From the XRD it is shown that the samples contain a single phase $Ba_{1-x}Ce_xTiO_3$ with a cubic structure with lattice parameter that decrease with Cerium concentration.

Introduction

The discovery of ferroelectric Barium titanate ($BaTiO_3$) opens the present era of ceramic dielectric materials. Barium titanate ($BaTiO_3$) having perovskite structure with tetragonal symmetry at room temperature and possesses relatively large dielectric constant and electro-optic coefficient. Barium titanate has become the basic ceramic capacitor dielectric material in use today. $BaTiO_3$ ceramics have a strong piezoelectric effect. These ceramics find wide applications in device such as microphone, ultrasonic and underwater transducer, multi-

layer capacitors and spark generators. Barium titanate ($BaTiO_3$) are ABO_3 type (A=mono or divalent, B=tri-hexavalent ions), have been examined for search of ferroelectric properties which has wide range of applications. They play an important role in improvement of performances [1 2]. This exhibits semiconducting properties together with a positive temperature coefficient of the ohmic resistance, for which reason it is used as a positive temperature coefficient (PTC) resistor. The ferroelectric states of $BaTiO_3$ form as Ti ionic displacements change the crystal structure from cubic to tetragonal when the temperature is cooled down to 130°C Shrabanee et. al. observed for Ca modified $BaSn_{0.15}Ti_{0.85}O_3$ ceramics that the transition temperature shifts to below room temperature side as the concentration of Ca is increased in $(Ba_{1-x}Ca_x)(Sn_{0.15}Ti_{0.85})O_3$ and DC Resistivity decreases with increasing temperature hence exhibiting its semiconducing behavior at higher temperature. Barium titanate ($BaTiO_3$), among ferroelectric materials have enormous attention due to its simple crystal structure, high stability and extremely high dielectric constant, low leakage current and anisotropic optical behavior [3, 4]. However, the doping mechanism in this $BaTiO_3$ based system is not yet clear and needs deep research. The effect of CeO_2 doped $BaTiO_3$ ceramic materials have shown promising dielectric properties such as relatively high permittivity and high endurance. Cerium can exist in two oxidation states, 4+ and 3+.In view of this we have synthesized and studied various properties of a group of new compounds having a general formula $Ba_{1-x}Ce_xTiO_3$ where x= 0.0, 0.01, 0.02, 0.03 and 0.04.Here we have studied the electric properties such as I-V characteristics, frequency and temperature dependent dielectric constant, loss tangent, resistivity and their structural property.

Experimental procedure

Conventional ceramic process is used to prepare doped $BaTiO_3$ ceramic samples. The general formula $Ba_{1-x}Ce_xTiO_3$ where x=0.0,0.01,0.02,0.03 and 0.04 with $BaTiO_3$ samples preparation appropriate amount of BaO, TiO_2 and CeO were ground and a homogeneous mixture was obtained before calcinations. Following milling for 2 hours, the mixed raw powder was calcined at 900°C for 4hours.Then the powder was ball-milled for 2 hours. The milled powder was used to form tablets. The tables were prepared by pressure of 60MPa. Finally, the tablets were sintered at temperature 1200°C, 1230°C and 1250°C for 4 hours. The capacitance (ε) and tangent loss (tanδ) were measured by a Hewlett Packard Impedance analyzer, model no-4192A.The XRD measurement was carried out to determine the structure of the prepared samples. A PHILIPS X Pert PRO X-ray diffraction system with CuKα radiation was used to get X-ray data.

Results and discussion

Figure-1 shows the representative XRD pattern of $Ba_{1-x}Ce_xTiO_3$ with x=0.0. We observed position of the diffraction peak look identical for all the samples and thus have confirmed that all the studied samples are single phase with a very small amount of impurity phase detected as $BaTi_2O_5$ with the manifestation of very weak intensity between (100) and (110) fundamental peak. All the reflection peaks were indexed and the lattice parameters were determined accurately using Nelson-Riley method. Lattice parameters slightly decrease with the increase of Cerium doping with a value of 4.0122Å for x=0.0 to 4.0040Å for x=0.04 which can be interpreted due as to smaller ionic radii of dopant Cerium with higher ionic radii of substituted Barium.

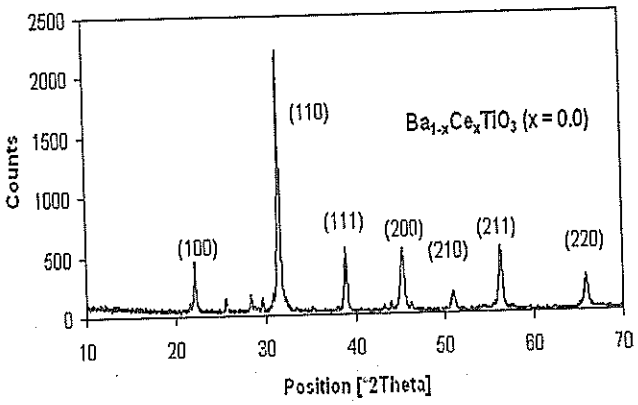
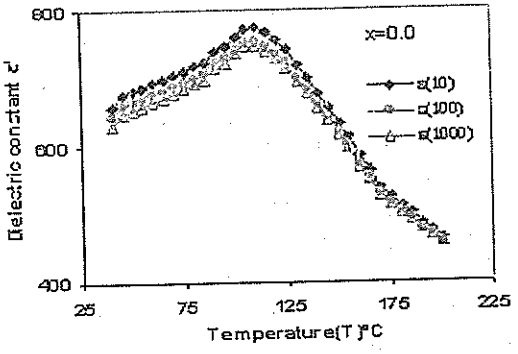


Figure-1: XRD patterns of $Ba_{1-x}Ce_xTiO_3$ (where x=0.0) compound

Figure-2 shows the variation of the dielectric constant at three frequencies (10,100,1000kHz) of the composition $Ba_{1-x}Ce_xTiO_3$ where x=0.0, 0.01, 0.02, 0.03 and 0.04 with temperature. The samples follows the rule of ferroelectrics that is the dielectric constant increases with the rise of temperature upto maximum value (ε_{max}) and we got Curie temperature (T_c) where it undergoes from ferroelectric to paraelectric phase transition. The dielectric constant corresponding to maximum value (ε_{max}) increase with doping of Cerium compared with undoped sample having high value of ε′ for sample x=0.01,0.02 and 0.04. The ferroelectric-paraelectric phase transition temperature decreases with the increase of doping concentration with T_c=110°C for x=0.0 to 40°C for x=0.03. The sample x=0.04 does not manifest any sign of phase transition implying that its T_c is below room temperature. It is observed from Fig-2 that ε′ vs T curves measured at three frequencies (10, 100, 1000 kHz) are superimposed. It means that ε′ is independent of applied ac field which has also been reflected from the frequency dependent dielectric constant measurement.



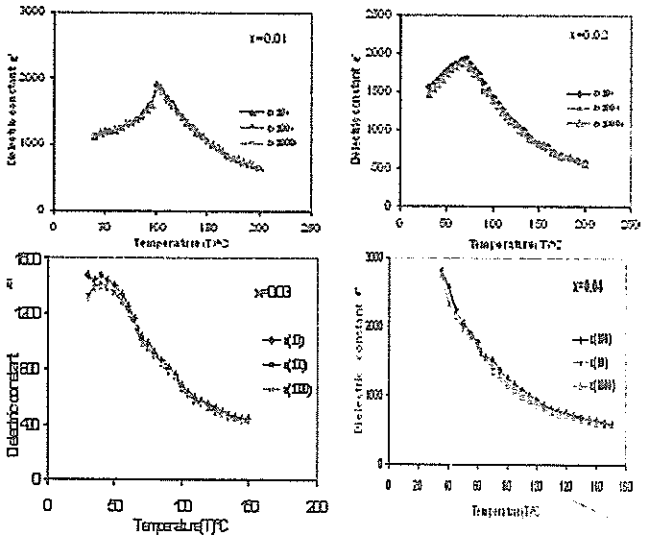


Figure-2 The variation of the dielectric constant with temperature at three frequencies (10, 100 and 1000kHz) of $Ba_{1-x}Ce_xTiO_3$ (where x=0.0, 0.01, 0.02, 0.03, and 0.04) compounds.

Figure-3 shows the variation of the dielectric constant measured at room temperature of the composition $Ba_{1-x}Ce_xTiO_3$ where x=0.0, 0.01, 0.02, 0.03 and 0.04 with frequency (1kHz-10MHz) sintered at1200°C. Frequency dependence dielectric constant shows that dielectric constant remains the same up to the frequency of around 3 MHz regions but in the higher frequency region it increased sharply. The value of dielectric constant ε′ of the sample sintered at 1200°C increases with increase of Cerium doping. It is also observed that the value of dielectric constant ε′ decreases with the increase of sintering temperature. For T_s=1200°C the sample x=0.03 shows very high dielectric constant of 4575.

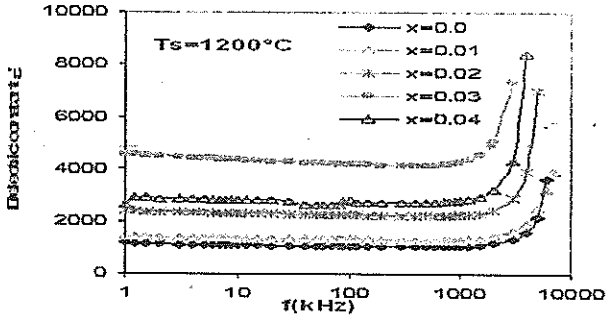


Figure-3 The variation of the dielectric constant with frequency sintered at 1200°C of $Ba_{1-x}Ce_xTiO_3$ (where x= 0.0, 0.01, 0.02, 0.03 and 0.04) compounds.

Figure-4 shows the variation of the loss tangent measured at room temperature of the composition $Ba_{1-x}Ce_xTiO_3$ where x=0.0, 0.01, 0.02, 0.03 and 0.04 with frequency (1kHz-10MHz) sintered at1200°C. Loss tangent shows a good agreement with the dielectric constant where loss tangent increases with the increase in doping concentration

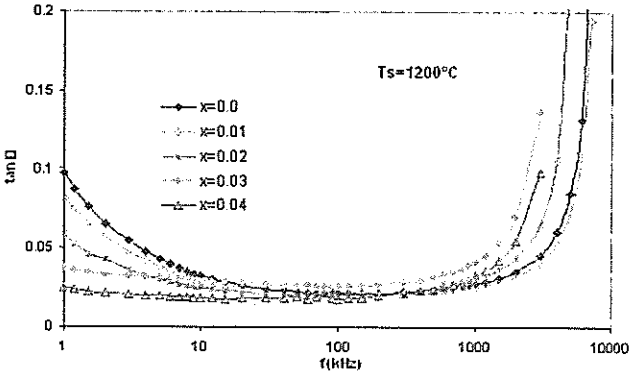


Figure-4 shows the variation of the tangent loss with frequency sintered at 1200°C of $Ba_{1-x}Ce_xTiO_3$ (where x=0.0, 0.01, 0.02, 0.03, and 0.04) compounds.

Figure -5 shows a representative I-V characteristics curve of $Ba_{1-x}Ce_xTiO_3$ with x=0.0 measured at different temperature from 26°C to 150°C. I-V characteristic of all the samples showed ohmic behavior for the pure and Ce-doped $BaTiO_3$. As the temperature increases, the current density of the samples showed semiconducting behavior. It is seen that the I-V behavior is consistent in the higher voltage region. Thus in the higher voltage region the slope is close to unity, this is ohmic behavior [7, 8].

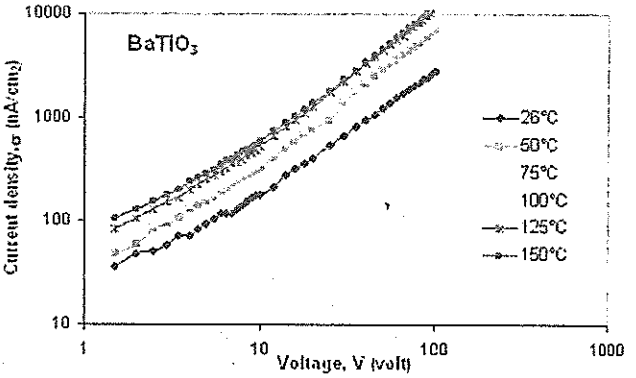


Figure-5: The I-V characteristics curve of $Ba_{1-x}Ce_xTiO_3$ with x=0.0 measured at 26°C to 150°C

Conclusion

Polycrystalline $Ba_{1-x}Ce_xTiO_3$ compounds with x=0.0, 0.01, 0.02, 0.03, and 0.04 are single phase. The transition temperature shifts to below room temperature with the increase in doping concentration. Frequency dependence of dielectric shows that dielectric constant remains constant up to 3 MHz beyond which it increases sharply. Dielectric constant increases with dopant concentration and decreases with the increasing sintering temperature. The ε_{max} has been observed for the sample x=0.03 sintered at 1200°C. Loss tangent has been found to increase with the increase in doping concentration. The current-voltage characteristics of the samples showed ohmic behavior at all temperature up to 150°C

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COSMOLOGY, GEOLOGY, ARCHAEOLOGY AND EARTH SCIENCES

alien. The protagonist is an anthropologist who finds it difficult to stay detached in his study of the planets native population. These people humanoid in appearance are androgynous. They are normally neuter and only develop genitalia which can be male or female at a certain point in their sexual cycle. Through shared hardships and a painfully achieved new awareness of the importance of mutual respect, the anthropologist eventually comes to understand the true nature of Gethenian society. Throughout the course of the novel, the protagonist believes himself to be talking with a man, but he comes to discover his error and eventually falls in love with his companion. In essence ,Le Guin was pointing out that gender is no longer an issue when two people come to love each other.

SCIENCE IN SCIENCE FICTION OF LE GUIN

Science Fiction writers envisioned humans colonizing outer space decades before the Russians sent Sputnik into Orbito. Since then,dozen of not hundreds of science friction stories ,novels and films have portrayed human colonies on other planets or on gaint spaceships travelling throughout the galaxy . These include Ursula K Le Guin's .The Left hand of darkness (1969) and Pamela sargent's venus of dreams (1986).

Space stations could be considered the first attempt to 'Colonise' outer space. So in a sense ,outer space colonies have already been established but so far they have been fairly modest in scope. The location is relatively close to home & limited to an earth orbit.

Ursula K Guin visualized extra terristrials and their relation with earthlings. Once space exploration has shown almost conclusively that no human spicies exist and never have existed . But modern space exploration searching for advanced extra terrestrial life in the universe. A section of scientists believe that we are not alone in the universe, that is , life can also exist else where.

THE THEME OF CLONING IN GUIN'S NOVEL

Cloning is the process of making a genetic twin or duplicate of a living organism. The nucleus from one of the organism's cell is implanted in an egg cell (from a different organism) whose nucleus has been removed. The combined cell is stimulate so it begins to divide , and is them implanted is an organic or artifical womb.

Cloning has long fascinated science fiction writers and the general public. Often in SF movies a man is cloned , creating an instant double. Ursula Guins Nine Lives (1969) is a classic exploration of cloned relationship. Kate wil helm , a well known women science fiction writer's 'Where late the sweet birds sang' also present with a theme of cloning is science.

GENDER

Gender issues in science fiction are not frequently raised but are of great importance. The 1970s saw a number of female SF writers coming to prominence including such important novelists as Ursula K Guin & Octovia Butler. A number of these writers used SF as means of describing the plight of an oppressed gender , or the means by which they may be redeemed. More recently, Elizabeth Moon has produced a series of Militaristic Space operas which feature a strong and intelligent female as the chief protagonist. Science fiction is perhaps one of the better genres for the successful exploration of gender issues ,as it allows writers to develop allegorical scenarios or subverted environments that enable them to explore the issues in a more explict and pointed way than other genres will allow. An important study of the role of women can be found in Margaret At Wood's the Handmaid's Tale (1985). The novel explores the themes of women's fertility and sex for reproduction only not pleasure. In the novel women are depicted as the property of men . The novel is the story of her sad flight and eventual escape , a solution of sorts, from the authorities . The book has a particularly feminist outlook making it an excellent of Gender SF in the Vein of Angela carter or Doris Lessing. The novel bears dystopic vision of a possible future . The Handmaid's Tale won the governor general's Awards for 1985 and the first Arthur C Clarke Award in 1987. It was also nominated for the 1986 Nebula Award, the 1986 Booker prize and the 1987 Prometheus Award.

As the inclusion of women within science fiction and fanstasy more broadly has became obvious, the specificity of the perception has evolved. some distinguish between science fiction as a men's genre and fantasy as a women's genre .Others have refined this distinction still further attempting to distinguish between hard science fiction (e.g. based on physics or astronomy) as a men's genre and soft science fiction (e.g.,based on biology or sociology) as a women's genre.

ECOLOGY BIODIVESITYAND ENVIRONMENT

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INFLUENCE OF ACADEMIC LEARNING ENVIRONMENT ON ACADEMIC ACHIEVEMENT OF HIGH SCHOOL STUDENTS BY CLASSES

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Introduction

One of the major aims of the education is the development of wholesome personality. Family is the socio-biological unit that exerts the greatest influence on the development and perpetuation of the individual's behaviour. Next to home, school is the most important experience in the process of development of children. Both the environments, share influential place in child's life and also contribute to the development of children. School is the second home to children. Teachers and parents have greater responsibility to foster mental health status of the students. At times in adverse conditions the school may also substitute the home situations and meets the emotional needs of those neglected in the home. Pupils perception, or attitude towards the school climate or environment has got considerable influence over their mental health. School atmosphere, includes favourable attitude towards school teacher, co-students, curriculum, methods of teaching, facilities available in the classroom and teacher-student interaction.

School environment as perceived by students has an advantage of characterizing the setting through the eyes of the actual participants. Students have a good advantage point to make judgments about classrooms because they have encountered several learning environments and have enough time in a class to form accurate impressions.

In the school system, classroom is the most vital one for the transactional business going on between school and the society. The uniqueness of the classroom is due to the type of membership enjoyed by its members. The membership is not only mandatory but members are also more or less similar in age and achievement level. As a work group, the classroom group assembles together for the purpose of learning, which is held deliberately and in a planned manner. Naturally in that teaching learning situation, social interaction, the main theme behind the formation of any group, occurs compulsorily as well as accidentally. The process of social interaction implies that type of relationship between persons where the behaviour of one is the stimulus to the behaviour of other thus it becomes reciprocal.

Thus the present study is designed to study the influence of school learning environment, home learning environment and academic achievement of high school students by classes and also to study the relationship between school learning environment, home learning environment, academic achievement and socio-economic status of the family of high school students.

The population of the study consisted of high school children from 8th, 9th and 10th class students with an age range of 12-16 years studying in high school of Dharwad city. A preliminary survey was carried out in year 2005 to collect information regarding the total number of private and government schools in Dharwad city. There were 27 aided and 12 unaided high schools in Dharwad. Out of these 8 coeducational schools were selected. From each of the selected high school and from each of the class (8th, 9th, and 10th) only one section of the students were selected randomly. From the selected section a minimum of 5 each boys and girls from all three classes were randomly selected. Thus the total sample for the study consisted 240 children.

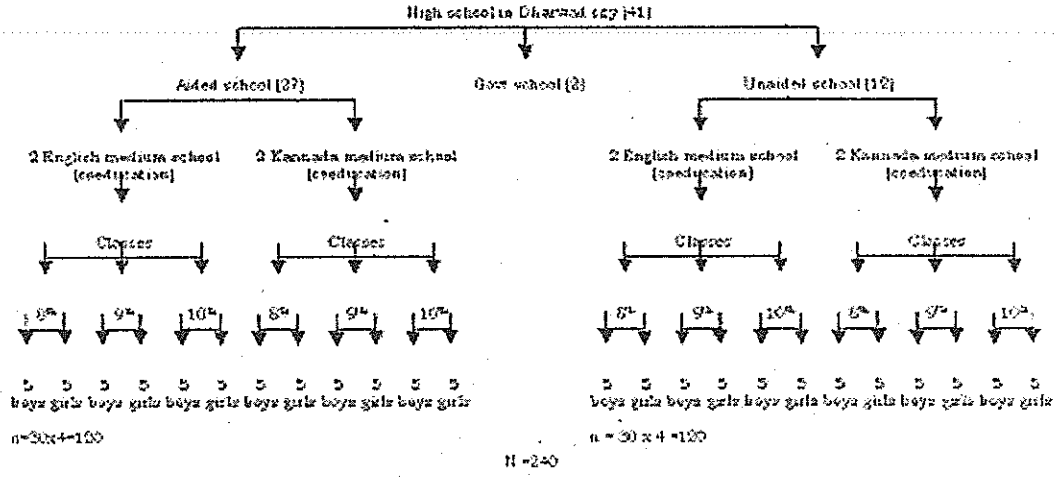


Fig. 1. Selection of the sample

Tools used for the study

1. Academic learning environment

1. Academic learning environment
a. School learning environment schedule
b. Home learning environment schedule
2. Academic achievement
3. Socio-economic status schedule a combination of items developed by Aaron *et al.* (1969), Venkataramaiah (1983) and Hauser (1994).

a. School learning environment schedule

A full pledged schedule was developed to study the school learning environment. The schedule consists of 130 items with 10 components, viz., goal orientation, study habits, school environment of the students, students involvement in school activities, physical facilities in the school, teaching materials used by school, teacher-student interaction, equality, and method of teaching and qualification of teacher. Each of the statement with a response as 'yes' or 'no' with score of 2 and 1 respectively. Spilt half method was used to test the reliability of the schedule. The reliability of the tool was = 0.65.

b. Home learning environment schedule

Home learning environment schedule was developed to know the home learning environment of high school students. The developed version has 37 items categorized into five components viz., parental encouragement and care, facilities provided at home, parental guidance and support, parenting and co-curricular activities. All statements are positive and score of 2 and 1 for 'yes' or 'no' responses are given respectively. Spilt half method was used to test the reliability of the schedule. The reliability of the tool was= 0.63.

Data collection was made by using pre-tested questionnaires. Prior permission of the principal or Headmaster's was taken from the eight high schools to conduct the study. Among each section 5 boys and 5 girls were selected randomly. After establishing a rapport with subjects, school learning environment schedule and home learning environment schedule was self administered on students. All the selected students from classes 8^{th} to 10^{th} were clubbed in one classroom and tool was administered on students. The students were instructed to give the responses.

Students't' test was carried out to know the differences in the school learning environment and home learning environment of high school students by classes. Karl Pearson's product moment correlation coefficient analysis was used to measure the relationship between school learning environment, home learning environment, academic achievement and socio-economic status of the family of high school students.

Results and Discussion

The table 4.5 indicate that ninth class students had highest scores while tenth students had lowest scores. The F-ratio showed non significant difference between classes which indicates students did not differ by class. It is noticed from the same table that, that eighth and ninth class students differed significantly on academic achievement in which ninth class students were higher on academic achievement. Tenth class students were significantly highest on academic achievement in comparison with eighth and ninth class students.

It is observed from the table that, tenth class students had higher mean scores than eighth and ninth class students on academic achievement. Statistical analysis indicated that, there was non significant difference, implies that the academic achievement of students of different classes did not differ significantly. Above results of the study revealed that, as the age advanced the students academic scores increased. This may be because of motivation or goal orientation.

The table 4.5a revealed that, the eighth class students had significantly higher mean scores in all the components of school learning environment, than ninth and tenth class students. Eighth class students had significantly better study habits. They were more cooperative with their classmates. They also had higher qualified teachers than ninth class students.

When eighth and tenth class students were compared, eighth class students were significantly more goal oriented. They had better study habits and were more cooperative with their peers. They were significantly better on involvement in school activities and were better treated by their teachers. They reported more satisfaction with teaching materials than tenth class students. This indicated that, eighth class students had better school learning environment than tenth class students.

When ninth and tenth class students were compared, students of ninth class were significantly better on involvement in school activities. They were more cooperative with their classmates than tenth class students. The reason for this trend may be because, majority of the tenth class students attended tuition classes rather than schools. Hence the perception of these students towards school learning environment tended to be decreased than eighth and ninth class students. Similarly Telli (2002) reported that ninth grade students had more positive perceptions towards biology classrooms. They also perceived that they had greater student cohesiveness, task orientation were more cooperative and provided equal opportunity and involvement for all the students.

The results showed that (table 4.5b) students of eighth class had significantly better co-curricular activities than students of tenth class. Tenth class students were lowest on co-curricular activities in comparison with eighth and ninth class students, ninth class students received significantly more encouragement and care by their parents, guidance and support and had better facilities in home in comparison with eighth and tenth standard students. This may be due to the fact that students of tenth class gave more attention to only curricular aspects than extra reading or co-curricular activities to gain knowledge. This might be because of aspiration for good marks in Board examination.

Table 4.6 indicates that here was a positive relationship be-

tween home learning environment and school learning environment among students of eighth and tenth classes. Gutman and Midgley (2000) reported that, significant interactions were found between family and school factors. They reported that the combination of both family and school factors was most effective in supporting the academic achievement of poor African American students during the transition to middle level schools.

It is observed from the same table that, there was positive relation between school learning environment and academic achievement of eight and tenth classes. This indicates that, if the school learning environment is good, the children fare better. Academic achievement is a product of various factors namely family and school backgrounds and the development of personality.

The results of the present study also revealed that, there was a non significant negative relation between school learning environment and academic achievement among ninth class students. However, Moos (1979) report that more academically mature students adjust and perform better even in less structured learning environment.

In the present study it has been observed that home learning environment was positively correlated to academic achievement only among tenth class students. Bradley *et al.* (1988) reported that, significant correlation were observed between home environment and children's achievement test scores and their classroom behaviour.

The same table 4.7 also revealed that, socio-economic status was positively related to school learning environment among high school students of all classes (8^{th}, 9^{th} and 10^{th} classes). Thus the results indicated that, an increase in socio-economic status lead to increase in school learning environment. This may be due to the fact that the students of high socio-economic group, seek admission to good schools, with good reputation as they can afford the fees and the educational materials. Parents who are educated may interact and involve better to provide good learning environment in school.

The table also revealed that home learning environment was positively and significantly related to socio-economic status among eighth class students. There was positive correlation observed between home learning environment and socio-economic status between tenth and ninth class students and socio-economic status also exhibited positive and significant influence on academic achievement of eight, ninth and tenth class students. Thus the result indicated that, an increase in socio-economic status of the family increased the home learning environment of high school students. This may be due to the fact that, high socio-economic status tends to have good facility in home. Parents can afford better educational facilities in home. Familial factors such as parents support, parents education and occupation, their involvement, parents interaction with children contribute good learning environment.

Conclusion of the study indicate that Eighth class students were significantly higher on study habits, cooperation, goal orientation and involvement and had better teaching materials. Whereas Ninth class students reported significantly higher cooperation and involvement in school activities than eighth and tenth class students. Both Eighth and ninth class students had significantly better co-curricular activities than tenth class students. While students of Tenth class had significantly higher academic achievement than eighth and ninth class students. In case of correlation home learning environment had positive and significant influence on school learning environment and academic achievement only among tenth class students. Socio-economic status of the family exhibited positive and significant influence on home learning environment of students of eighth class. Socio-economic status of the family also had positive and significant influence on academic achievement only among eighth class students.

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Table 1. Mean and SDs of school learning environment of high students by classes

Standard	N	Mean	SD
8^{th}	80	234.60	16.21
9^{th}	80	236.26	14.11
10^{th}	80	233.41	16.45
Total	240	234.76	15.60

ANOVA

Source	d.f.	Sum of square	Mean square	F	Sig
Between groups	2	327.90	163.95	0.67	0.51^{ns}
Within groups	237	57871.07	244.18		

NS – Non significant

Mean and SDs of home learning environment

Standard	N	Mean	SD
8th	80	67.97	4.31
9th	80	68.38	3.38
10th	80	67.30	3.67
Total	240	67.88	3.82

ANOVA

Source	d.f.	Sum of square	Mean square	F	Sig
Between groups	2	1519.52	759.76	5.71**	0.004
Within groups	237	31539.03	133.07		

** Significant at 0.01 per cent level

Mean and SDs of academic achievement

Standard	N	Mean	SD
8th	80	67.80	10.08
9th	80	71.93	12.18
10th	80	73.82	12.21
Total	240	71.18	11.76

ANOVA

Source	d.f.	Sum of square	Mean square	F	Sig
Between groups	2	47.23	23.61	1.63	0.19NS
Within groups	237	3433.50	14.48		

NS – Non significant.

Table 3. Comparison of mean scores of components of home leaning environment of by class

Sl. No.	Components	(A) 8th n=80		(B) 9th n=80		(C) 10th n=80		't' (AxB)	't' (BxC)	't' (AxC)
		Mean	SD	Mean	SD	Mean	SD			
1.	Parental encouragement and care	14.49	1.51	14.60	1.24	14.40	1.34	-0.52	0.39	0.98
2.	Facilities in home	10.44	1.45	10.55	1.21	10.36	1.29	-0.53	0.35	0.95
3.	Parental guidance and support	13.55	1.49	13.58	1.43	13.29	1.49	-0.11	1.12	1.25
4.	Parenting	21.74	1.69	21.88	1.67	21.95	1.87	0.52	-0.75	-0.27
5.	Co-curricular activities	7.68	0.63	7.71	0.38	7.40	0.77	0.39	2.46*	2.89
	Total home learning environment	67.97	4.31	68.38	3.38	67.30	3.67	0.65	1.07	1.93

* Significant at 0.05 per cent level
** Significant at 0.01 per cent level

Table 4. Correlation co-efficient between school learning environment, home learning and academic achievement of students

Classes	N	'r' between HLE x SLE	'r' between SLE x AA	'r' between HLE x AA
8th	80	0.02	0.12	0.11
9th	80	0.76	-0.05	-0.08
10th	80	0.11	0.09	0.25*
Total	240	0.09	0.05	0.08

* Significant at 0.05 per cent level

SLE – School learning environment
HLE – Home learning environment
AA - Academic achievement

Table 2. Comparison of mean scores of components of school learning environment of students by classes

Sl. No	Components	(A) 8th n=80		(B) 9th n=80		(C) 10th n=80		't' (AxB)	't' (BxC	't' (AxC)
		Mean	SD	Mean	SD	Mean	SD			
1.	Goal orientation	18.39	1.75	18.20	1.45	17.81	1.61	0.74	1.93	2.16*
2.	Study habits	29.65	2.56	28.64	2.31	28.25	2.42	2.63*	1.04	3.58**
3.	Co-operation	32.25	1.95	31.50	2.04	30.61	2.33	2.38*	2.55*	4.79**
4.	Involvement of students	25.50	2.01	25.24	1.89	24.50	2.28	0.85	2.04*	2.76*
5.	Physical facilities in school	26.23	3.54	25.69	2.97	25.40	4.04	1.04	0.51	1.37
6.	Teacher-student interaction	47.73	4.29	47.28	4.03	47.53	2.98	0.68	-0.45	0.34
7.	Equality	20.79	1.67	20.25	2.21	19.99	1.95	1.74	0.98	2.79*
8.	Method of teaching	14.96	1.35	14.93	1.40	14.73	1.22	0.17	0.96	1.16
9.	Qualification of the teacher	7.85	0.78	8.13	0.75	8.00	0.78	2.48*	1.03	-1.42
10.	Teaching materials	20.15	1.54	19.89	1.53	19.50	1.94	1.08	1.40	2.34*
	Total school learning environment	234.60	14.11	236.26	16.21	233.41	16.45	-0.69	1.17	0.46

*- Significant at 0.05 level

**- Significant at 0.01 level

Table 5. Correlation co-efficients between socio-economic status of the family, school learning environment, home learning environment and academic achievement of the students

Classes	N	'r' between SLE x SES	'r' between HLE x SES	'r' between AA x SES
8th	80	0.19	0.42**	0.25*
9th	80	0.22	0.11	0.16
10th	80	0.16	0.05	0.04
Total	240	0.18**	0.21**	0.14*

* Significant at 0.05 per cent level
** Significant at 0.01 per cent level
SLE – School learning environment
HLE – Home learning environment
AA - Academic achievement
SES – Socio –economic status

IMPACT OF ACADEMIC LEARNING ENVIRONMENT OF STUDENTS FROM AIDED CO-EDUCATIONAL HIGH SCHOOLS BEWEEN GENDER

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Introduction

The first post independence comprehensive study on the status of education in India completed in 1966 gave a major thrust to the idea of alround development of the child's personality and intellect. It elaborated on the need for physical, intellectual and spiritual development of the child in equal measure. Academic achievement seems to be the ultimate goal in every one's mind. In attempts to pursue this goal, all concerned seem to deny the existence of the role of the affective in student's performance. They appear to assume that intellectual performance is divorced from any feeling or perceptions the student might have.

School environment as perceived by students has an advantage of characterizing the setting through the eyes of the actual participants. Students have a good advantage point to make judgments about classrooms because they have encountered several learning environments and have enough time in a class to form accurate impressions.

In the school system, classroom is the most vital one for the transactional business going on between school and the society. The uniqueness of the classroom is due to the type of membership enjoyed by its members. The membership is not only mandatory but members are also more or less similar in age and achievement level. As a work group, the classroom group assembles together for the purpose of learning, which is held deliberately and in a planned manner. Naturally in that teaching learning situation, social interaction, the main theme behind the formation of any group, occurs compulsorily as well as accidentally. The process of social interaction implies that type of relationship between persons where the behaviour of one is the stimulus to the behaviour of other thus it becomes reciprocal.

It is not the environment of school alone. But home also occupies the first and the most significant place for the development of children. It does not only provide the hereditary transmission of basic potentials for the development, but also provides environmental condition, personal relationships and cultural pattern, favourble or unfavourable, positive and negative, as reflected from its structure, socio-economic and cultural status and the pattern of mutual relationship and emotional state among its members (Kundu, 1977). No other social institution enters the child's life until after the first few formative years as home. The influence is throughout the life span. Therefore parents become the most potent force in shaping the overall personality of children.

Children living in rural or urban areas are exposed to different environment. Generally children from low socio-economic status attend government schools while, children of well-to-do families attend private schools or public schools. These two types of schools have another major difference – difference in medium of instruction.

Thus the present study was an attempt to investigate the academic learning environment of coeducational high school students from aided schools by gender and its influence on academic achievement.

Methodology

The population of the study consisted of high school children from 8th, 9th and 10th class students with an age range of 12-16 years studying in aided and unaided co-educational high school of Dharwad city. A preliminary survey was carried out in year 2005 to collect information regarding the total number of private and government schools in Dharwad city. There were 27 aided and 12 unaided high schools in Dharwad. Out of these 8 coeducational schools were selected (4 aided and 4 unaided). From each of the selected high school and from each of the class (8th, 9th, and 10th) only one section of the students were selected randomly. From the selected section a minimum of 5 each boys and girls from all three classes

were randomly selected. Thus the total sample for the study consisted 120 children.

Tools used for the study

1. Academic learning environment

1. Academic learning environment
a. School learning environment schedule
b. Home learning environment schedule
2. Academic achievement

a. School learning environment schedule

A full pledged schedule was developed to study the school learning environment. The schedule consists of 130 items with 10 components, viz., goal orientation, study habits of students, school environment of the students, involvement of students in school activities, physical facilities in the school, teaching materials used by school, teacher-student interaction, equality, and method of teaching by schools and qualification of teacher. Each of the statement with a response as 'yes' or 'no' with score of 2 and 1 respectively. Spilt half method was used to test the reliability of the schedule. The reliability of the tool was = 0.65.

b. Home learning environment schedule

Home learning environment schedule was developed to know the home learning environment of students and its influence on academic achievement of high school students. The developed version has 37 items categorized into five components viz., parental encouragement and care, facilities provided at home, parental guidance and support, parenting and co-curricular activities. All statements are positive and score of 2 and 1 for 'yes' or 'no' responses are given respectively. Spilt half method was used to test the reliability of the schedule. The reliability of the tool was= 0.63.

Data collection was made by using pre-tested questionnaires. Prior permission of the principal or Headmaster's was taken from the aided coeducational high schools to conduct the study. Among each section 5 boys and 5 girls were selected randomly. After establishing a rapport with subjects, school learning environment schedule and home learning environment schedule was self administered on students. All the selected students from classes 8^{th} to 10^{th} were clubbed in one classroom and tool was administered on students. The students were instructed to give the responses.

Students 't' test was carried out to know the differences in the school learning environment and home learning environment and academic achievement between girls and boys of aided coeducational high schools.

Results and Discussion

Significantly no gender differences were observed in case of students of aided schools on components of school learning environment. This indicates that gender differences did not exist.Similarly, Nair (2001) reported that, female and male students perceived their classroom environments similarly. However, Das (1996) reported that, boys from single sex education had better perception of classroom environment than girls from single sex education. Upadhyay (1983) reported that, gender of the pupil was one of the several factors which the classroom environment determined as favourable or unfavourable, as gratifying or discouraging to the pupil. Comparison of mean scores of components of home learning environment between boys and girls among aided schools revealed that boys and girls of aided schools did not differ significantly on any of the components though boys of aided schools scored higher on all the components than girls. But, Kagan (1956) reported that both boys and girls perceived their mother's as friendlier and their fathers as more punitive and dominant. The elder childs perception was more likely than the younger ones to view the same-sex parent as more punitive and dominant. Khare (1996) reported that significant correlation between home environment and academic achievement in boys and girls.

Academic achievement of aided school students did not differ significantly between boys and girls This result is supported by Ahmed (1998) who revealed that the influence of gender on academic motivation was found to be statistically non-significant. Similarly gender differences were not seen in parenting styles also. There might have been no difference in treatment or encouragement, guidance and support by their parents. Similarly Suman and Umapathy (2003) reported that, there was no significant difference between girls and boys in achievement motivation.

Conclusion of the study indicate that boys and girls of aided schools did not differ significantly on any of the components of school learning environment, home learning environment. Academic achievement also did not differ significantly between boys and girls. This indicates that gender differences did not exist.

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Table1: Comparison of socio-economic characteristics between gender among aided co-educational high school students

Sl.No	Socio-economic characteristics	Aided boys (n=60)		Aided girls (n=60)		't' value
		Mean	SD	Mean	SD	
1.	Age of the child	14.20	0.88	14.13	0.85	0.42
2.	Father's education	14.85	3.68	14.67	3.81	0.27
3.	Father's occupation	16.25	4.43	16.22	4.05	0.04
4.	Mother's education	11.10	5.16	10.28	5.39	0.85
5.	Mother's occupation	1.77	1.57	1.90	1.66	-0.45
6.	Size of the family	1.43	0.91	1.40	0.89	0.20
7.	Economic status of the family	87.73	24.25	91.32	22.92	-0.83

Table 2 : Comparison of mean scores of components of school learning environment of high school students by gender among aided schools

Sl. No.	Components	Aided boys (n=60)		Aided girls (n=60)		't' value
		Mean	SD	Mean	SD	
1.	Goal orientation	18.42	1.50	18.22	1.62	0.70
2.	Study habits	29.30	2.55	28.88	2.79	0.85
3.	Co-operation	31.37	2.09	31.40	2.03	-0.09
4.	Involvement of students	25.68	2.00	25.12	2.21	1.47
5.	Physical facilities in school	26.88	2.28	26.80	2.36	0.19
6.	Teacher-student interaction	47.75	3.08	48.12	2.26	-0.74
7.	Equality	20.60	1.81	20.53	1.89	0.19
8.	Method of teaching	14.63	1.23	14.73	1.32	0.41
9.	Qualification of the teacher	7.87	0.72	7.95	0.79	-0.60
10.	Teaching materials	19.48	1.94	20.02	1.52	-1.67
	Total school learning environment	240.60	12.54	242.95	9.95	-1.67

Table 3 : Comparison of mean scores of home learning environment of high school students between boys and girls of aided schools

Sl. No.	Components	Aided boys (n=60)		Aided girls (n=60)		't' value
		Mean	SD	Mean	SD	
1.	Parental encouragement and care	14.58	1.29	14.62	1.14	-0.15
2.	Facilities in home	10.68	1.02	10.60	1.32	0.39
3.	Parental guidance and support	13.72	1.35	13.68	1.21	0.14
4.	Parenting	22.25	1.42	21.70	1.66	1.95
5.	Co-curricular activities	7.75	0.54	7.58	0.70	1.46
	Total home learning environment	69.15	3.05	68.07	3.26	1.88

Table 4 : Comparison of mean scores of academic learning environment high school students between boys and girls of aided schools

Sl. No.	Variables	Aided boys (n=60)		Aided girls (n=60)		't' value
		Mean	SD	Mean	SD	
1.	School learning environment	240.60	12.34	242.95	9.95	1.15
2.	Home learning environment	69.15	3.05	68.07	3.26	1.88
3.	Academic achievement	69.71	11.97	72.40	12.52	-1.20

HEAVY METAL NICKEL (II)-A LEAST STUDIED ENVIRONMENTAL POLLUTANT

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Introduction: Nickel is silvery-white. hard, malleable, and ductile metal. It is of the iron group and it takes on a high polish. It is a fairly good conductor of heat and electricity. In its familiar compounds nickel is bivalent, although it assumes other valences. It also forms a number of complex compounds. Most nickel compounds are blue or green. Nickel dissolves slowly in dilute acids but, like iron, becomes passive when treated with nitric acid. Finely divided nickel adsorbs hydrogen. The most common oxidation state of nickel is +2, though 0, +1, +3 and +4 Ni complexes are observed. It is also thought that a +6 oxidation state may exist, however, results are inconclusive. The unit cell of nickel is a face centered cube with a lattice parameter of 0.352 nm giving a radius of the atom of 0.125 nm.

Application: The major use of nickel is in the preparation of alloys. Nickel alloys are characterized by strength, ductility, and resistance to corrosion and heat. About 65 % of the nickel consumed in the Western World is used to make stainless steel, whose composition can vary but is typically iron with around 18% chromium and 8% nickel. 12 % of all the nickel consumed goes into super alloys. The remaining 23% of consumption is divided between alloy steels, rechargeable batteries, catalysts and other chemicals, coinage, foundry products, and plating. Nickel is easy to work and can be drawn into wire. It resist corrosion even at high temperatures and for this reason it is used in gas turbines and rocked engines /1/. Morel is an alloy of nickel and copper (e.g. 70% nickel, 30% copper with traces of iron, manganese and silicon), which is not only hard but can resist corrosion by sea water, so that it is ideal for propeller shaft in boats and desalination plants.

Nickel in the environment: Most nickel on earth is inaccessible because it is locked away in the planet's iron-nickel molten core, which is 10 % nickel. The total amount of nickel dissolved in the sea has been calculated to be around 8 billion tonnes. Organic matter has a strong ability to absorb the metal which is why coal and oil contain considerable amounts of nickel. The nickel content in soil can be as low as 0.2 ppm or as high as 450 ppm in some clay and loamy soils. The average is around 20 ppm. Nickel occurs in some beans where it is an essential component of some enzymes. Another relatively rich source of nickel is tea which has 7.6 mg/kg of dried leaves. Nickel occurs combined with sulfur in millerite, with arsenic in the mineral niccolite, and with arsenic and sulfur in nickel glance. Most ores from which nickel is extracted are iron-nickel sulphides, such as pentlandite. The metal is mined in Russia, Australia, New caledonia, Cuba, Canada and South Africa. Annual production exceeds 500.000 tonnes and easily workable reserves will last at least 150 years. Nickel is present at very low levels in the environment and in air is attached to small particles. In the United States between 1977 and 1982, average nickel concentrations in air ranged from 7 to 12 ng/m^3 /2/. Subsequently, the U.S. Environmental Protection Agency (EPA) estimated that the average nickel concentration in air in the U.S. decreased to 2.2 ng/m^3, based on air quality information obtained from 1996 /3/. Cigarette smoking can increase the amount of inhaled nickel by as much as 4 µg per pack of cigarettes.

The Threshold Limit Value (TLV), as defined by the American Conference of

Governmental Industrial Hygienists (ACGIH), is the concentration of a substance to which most workers can be exposed without adverse effect /4/. The TLV can be expressed as a Time Weighted Average (TWA), as a Short-Term Exposure Limit (STEL), or as a ceiling limit (CL). The TLV-TWA for air differs among different nickel compounds as well as among different agencies. The ACGIH increased the 8-h TLV-TWA for nickel carbonyl from 000.1 to 0.05 ppm /5/, whereas NIOSH still recommends the 001 ppm value /6/. Soluble nickel compounds have ACGIH 8-h TLV-TWA of 0.1 mg/m^3.

Nickel Absorption and Transport: *Nickel enters the body when breathing air containing nickel, drinking water or eating food that contains nickel, or when skin comes into contact with nickel. Contrary to insoluble nickel compounds, the soluble salts of nickel are readily absorbed by the pulmonary and digestive tracts, and less by the skin. Inhaled nickel carbonyl is rapidly absorbed by the lungs and enters red blood cells where the compound undergoes conversion to Ni^{2+} and carbon monoxide. In nickel refinery workers, some inhaled nickel was slowly absorbed, as evidenced by sustained hypernickelemia many years after cessation of exposure. During hemodialysis, traces of Ni^{2+} in hemodialysis fluid can be absorbed into the plasma, owing to the chelating action of plasma albumin. Oral or parenteral exposures to nickel can potentiate hand eczema in nickel-sensitive persons. Only the small nickel particles in air can enter deep into the lungs. The volatility and lipid solubility of nickel carbonyl enable it to cross cell membranes. In tissue cytosol, nickel is bound several proteins and peptides. A small amount of nickel can enter the blood-stream from skin contact. In human plasma, Ni^{2+} is transported in blood bound to albumin or histidine or to a plasma metalloprotein called nickeloplasmin /2,7/.*

Nickel Excretion: Nickel is not a cumulative toxicant and most of the absorbed metal is excreted rapidly. In humans, nickel in the bloodstream leaves in the urine. Most ingested nickel leaves quickly in the feces, but a small amount can enter the blood and leave in the urine. /2, 7/. The urinary halftime to nickel via inhalation varies from 17 to 39 h, whereas only 8 h is required following oral intake. Nickel is also excreted in sweat (at a concentration 10 to 20 times higher than

in urine), through the hair, and via human breast milk. Most nickel in food remains unabsorbed in the alimentary tract and is lost in feces /8 /.

Health effects of nickel: There are five priority substances which are selected by WHO for the nickel risk assessment. They are nickel powder, nickel sulfate, nickel chloride, nickel carbonate and nickel nitrate. Nickel powder (T; R48-23) has been classified in chronic toxicity classification as per environmental risk assessment report on nickel. $NiSO_4$, $NiCl_2$, $NiCO_3$ and $NiNO_3$ are classified as carcinogen class I (by inhalation), reproductive toxicants class II (may cause harm to unborn children) and chronic toxicants (T; R48-23). If particle size of nickel powder found to be less that 0.1 mm, it is classified as T; R52-53 (harmful to the aquatic environment)/9/.

Nickel related diseases: Nickel mostly affects skin and respiratory system. In skin, it affect either by primary sensitization (work or piercing) or secondary exposure at work (tools or contaminated items). 90% of occupational skin diseases are eczema or dermatitis. Contact dermatitis caused by irritants or sensitizers. Both eczema and dermatitis resulted in swollen, blisters, flaking, thickening and even bleeding. In case of respiratory diseases, rhinitis, sinusitis, perforation of nasal septum and asthma are very common. Nickel cancers are very common and seen in nickel refining operators due to dust and fume (sulfides and oxides). Possibly, soluble nickel induces lung and nasal sinus cancers. Nickel induced cancer is also observed in welding, electroplating, battery manufacturing and stainless steel industries /2/.Some Of the foodstuffs naturally contain small amounts of nickel. Chocolate and fats are known to contain severely high quantities of nickel. Nickel uptake will boost when people eat large quantities of vegetables from polluted soils. Plants are known to accumulate nickel and as a result the nickel uptake from vegetables will be eminent. Smokers have a higher nickel uptake through their lungs.

Humans may be exposed to nickel by breathing air, drinking water, eating food or smoking cigarettes. Skin contact with nickel-contaminated soil or water may also result in nickel exposure.

An uptake of too large quantities of nickel has the following consequences:

- Higher chances of development of lung cancer, nose cancer, larynx cancer and prostate cancer
- Sickness and dizziness after exposure to nickel gas
- Lung embolism
- Respiratory failure
- Birth defects
- Asthma and chronic bronchitis
- Allergic reactions such as skin rashes, mainly from jewellery
- Heart disorders

Nickel fumes are respiratory irritants and may cause pneumonitis. Exposure to nickel and its compounds may result in the development of a dermatitis known as "nickel itch" in sensitized individuals. The first symptom is usually itching, which occurs up to 7 days before skin eruption occurs. The primary skin eruption is erythematous, or follicular, which may be followed by skin ulceration.

Carcinogenicity- Nickel and certain nickel compounds have been listed by the National Toxicology Program (NTP) as being reasonably anticipated to be carcinogens. The International Agency for Research on Cancer (IARC) has listed nickel compounds within group 1 (there is sufficient evidence for carcinogenicity in humans) and nickel within group 2B (agents which are possibly carcinogenic to humans). OSHA does not regulate nickel as a carcinogen. Nickel is on the ACGIH Notice of Intended Changes as a Category A1, confirmed human carcinogen /8/..

Ni(II) Induces Oxidative Stress: *The cumulative production of ROS/RNS through either endogenous or exogenous insults is termed oxidative stress and is common for many types of cancer cell that are linked with altered redox regulation of cellular signaling pathways. Oxidative stress induces a cellular redox imbalance which has been found to be present in various cancer cells compared with normal cells. The redox imbalance thus may be related to oncogenic stimulation. The reactive oxygen species (ROS) generated could non selectively damage DNA, possibly resulting in genetic changes in active genes. DNA mutation is a critical step in carcinogenesis and elevated levels of oxidative DNA lesions (8-OH-G) have been noted in various tumours, strongly implicating such damage in the etiology of cancer. Nickel may bind to DNA-repair enzymes and generate oxygen-free radicals to cause protein degradation in situ. This irreversible damage to the proteins involved in DNA repair, replication, recombination, and transcription could be important for the toxic effects of nickel / 10/.*

Conclusion: We can conclude from the various studies cited, that nickel is a potent toxic and carcinogenic agent. The results of a series of studies also suggest that nickel induces oxidative stress in humans and experimental animals.

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EMERGING FRONTIER AREAS OF IT, BT, NT

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WiMAX- AN ENHANCER FOR EFFECTIVE IMPLEMENTATION OF E-GOVERNANCE IN INDIA

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INTRODUCTION

E-Governance denotes the application of IT (Information Technology) to the process of government functioning in order to bring about better governance which has been innovatively termed as SMART (Simple, Moral, Accountable, Responsive and Transparent).

E- Governance seeks to realize processes and structures for harnessing the potentialities for information and communication technologies at various levels of the government for the purpose of enhancing good governance. With E-Governance gaining in its ambit the words

"Good Governance" "SMART" are gaining impetus in usage. 'Good Governance' connotes the widest meaning of the three phrases. It encompasses the entire process of public administration, the processes underlying the formulation of public policies, the HRD efforts required for re-skilling the government machinery, prioritization, efficient management of public resources and above all re-designing the various instruments used to realize the concept of a welfare state. 'SMART Government' is an acronym for Simple, Moral, Accountable, Responsive and Transparent Government. It is the image of an ideal government through the eyes of its constituents. E-Government is a subset of the concepts of Good Governance and SMART Government. It is the very specific task of using the tools offered by Information Technology in various aspects of the process of governance with the objective of achieving efficiency, transparency, accountability and user-friendliness in all the transactions that the citizens and businesses conduct with the Government – that is, providing digital interface in the G2C and G2B interactions. E-Governance aims to make the interaction between government and citizens (G2C), government and business enterprises (G2B), and inter agency relationships (G2G) more friendly, convenient, transparent and cost effective.

The Government of India has planned a national level initiative - National e-Governance Plan, NeGP for increased transparency, efficiency and effectiveness for delivery of citizen services. The nature and scale of e-Governance initiatives thus planned would supposedly reflect the aspiration level of the government in progressing towards a truly welfare state.

•**National e-Governance Plan (NEGP):** 26 Mission Mode Projects and 8 support components to be implemented at the Central, State and Local Government Levels.

•**State Wide Area Networks (SWANs):** Would extend data connectivity of 2 Mbps upto the block level in all States and Union Territories in the country. Block level nodes in turn, will have a provision to extend connectivity further to the village level using contemporary wireless technology. Proposals from 20 States/UTs already sanctioned.

•**Common Service Centres (CSCs):** 100,000 CSCs to be established in rural areas to provide government services, connecting rural citizens to World Wide Web. It would provide electronic services to government/pvt. at village level. Various Govt. Dept. are advised to design/evolve their Mission Mode Projects laying adequate emphasis on Services and Service levels in respect of their interface with citizens and businesses.

Each state is unique in terms of requirement and application and objectives that it wants to achieve by implementing an effective e-Governance project. However, there is one common objective which all states would like to achieve is 'empowerment' of common citizen. Significantly enough, this is equally paramount for the all concerned. India is a rural country with 80% population residing in rural areas, and any initiative in launching 'e-Governance' should target and aim at total coverage of States so that all the citizens can have equal and fair access to the applications falling under aegis of such a initiative.

Types of users and applications

The e-Governance network shall primarily address two types of users and applications. The users being State Administrations and Village Information Centres (VICs). State Administrations are in fact those users that would be located in the state's administrative agencies such as District Collectorate, Block office, Police HQ etc. The users in such locations shall involve such applications that are expected to improve the overall efficiency and effectiveness of the administrative machinery.

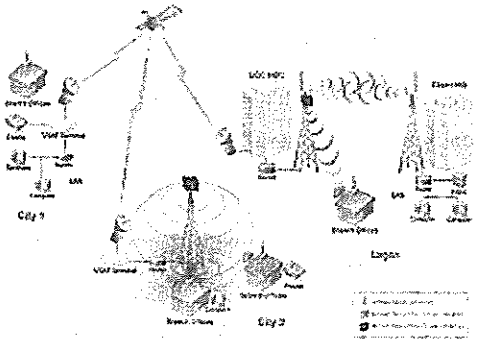
The main applications used by them include Video Conferencing, Voice/telephony, Email, and File transfers. Village Information Centers (VICs) play an important role in the furtherance of e-Governance activities. The VIC Kiosks shall be the access point for the common man in the network. The various services to be accessed by a villager/citizen from the kiosk include land records, birth/death registration, land/ property registration, public distribution system, weather and climatic forecasts, bill payments/tax payments etc., and several other applications.

Apart from the State administrative applications, the network shall also be used for other important applications such as Disaster Management including Flood Management, Emergency situations like landslides, earthquakes, fire, industrial

accidents etc.; Tele-education, which plays a vital role in imparting basic education/Adult education/family welfare programs; and, Telemedicine, which promotes and uplift the primary healthcare within the state.

WiMAX:

Enhancing Networks



Wireless technology comes in handy when we talk about the Common Service Centres (CSCs) and kiosks - the gateway for information to our rural counterparts. Laden with WiMAX technology, these information windows can serve rural India with services such as online payment of bills to browsing the Internet for crop information. Wireless technology is not only the need of a specifi c market. It is in great demand amongst the tech savvy urban Indian who needs an anytime anywhere access.

WiMAX has the potential to provide India with widespread broadband access that can usher in economic growth,better education and health care,and improved entertainment services.

Indian Scenario

The major initiative for WiMax is set to be from the state-owned telecom provider, Bharat Sanchar Nigam Ltd (BSNL). The company has already announced plans to install WiMAX base stations in 1,000 blocks across India by the end of this fi nancial year and to provide high-speed internet access to 25,000 villages through CSCs.

According to a BSNL offi cial "Villages will be equipped with infrastructure such as PCs, printers, software and staff for delivery of e-governance services pertaining to health, education and agricultural information," BSNL has also partnered with Intel to promote WiMAX-based broadband access in rural India. Under the pact, Intel will review state-owned BSNL's road map for the WiMAX rollout in the country and develop basic standards for the rollout and applications.

Private players have also not given a cold shoulder to WiMAX road either.

Motorola is strengthening its presence in the hinterlands through extensive broadband wireless access (BWA).

Portable or Mobile Coverage

Much of the focus and interest of the WiMAX community is the scenario in which the subscriber has a seemingly ubiquitous broadband wireless connection that can provide connectivity in a portable environment and even mobile environment. This service offering would require WiMAX enabled data cards for PCs and potentially lead to embedded solutions and new types of devices. This usage scenario is the most appealing, since it implies broadband access and other voice/data services anytime and anywhere. At the sametime, a portable/mobile solution is also more challenging to implement and it will not be the fi rst WiMAX solution that enters the market place.

The WiMAX Forum is projecting that by 2012 India will have 27.5 million WiMAX users, which would be 20% of global WiMAX subscribersOf the projected 27.5 million WiMAX users in 2012, the forum forecasts that 70% will use mobile and portable WiMAX devices to access broadband Internet services.

CONCLUSION

WiMax — the faster, longer range version of WiFi (the technology to wirelessly access the Net) — might just turn out to be something that will allow India to to harness broadband for its objectives of effective implementation of e-Governance in the nation.

Hence WIMAX can be the solution to solve the problem of effective implementatio,n of e-Governance in India.

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NANO STRUCTURED ZNO PREPARED BY MICRO WAVE HEATING

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Introduction

Zinc oxide is a wide band (3.37ev) semiconductor and is also a low cost material, represents an important basic material for various applications. It is a well known constituent of pigment and paint and pharmaceutical industry and is being used for over many decades. The ZnO in its nano size too has wide number of applications, thus it is extensively studied and a number of research papers and patents are being published. In its nano size, it exhibits a stable exciton having a binding energy of 60meV. Due to its promising physical and chemical properties, it has a wide range of technologically important applications, such as photo catalyst [1], Light emitting diodes (LED) [2], Field effect transistors [3], varistors [4], gas sensors [5], solar cells [6,7], UV lasers [8,9] a Piezoelectric nano generators [10] and so on. ZnO is also a bio-safe and biocompatible material.

Modern materials chemistry attempts the design and fabrication of nanostructure system with tunable physical and chemical properties for advanced applications. Morphology and particle size of

the materials varies with the method of synthesis. Various techniques developed hitherto for the synthesis of ZnO include hydrothermal method [11], thermal evaporation [12, 13], chemical bath deposition [14], ultrasonic irradiation [15], template free aqueous route [16], non-hydrolytic route [17], carbothermal synthesis [18] and precipitation method [19]. Microwave induced preparation of ZnO micro particles also has been reported in the literature [20, 21]. Expensive raw materials, complex process control and high temperatures are unfavorable for an industrialized process. Here, we report a microwave technique to synthesize nanoparticles of ZnO, which is simple, fast, clean, environmental friendly and low cost using a kitchen Microwave oven with the yield of ZnO in gram quantities. Zinc glycolate used as precursor is decomposed in microwave to obtain pure ZnO. This is well characterized by various physico-chemical techniques.

Experimental

Synthesis

Zinc nitrate ($Zn(NO_3)_2.6H_2O$,0.1M) (S D. Fine Chemicals, India), and commercial Ethylene glycol(5ml) are taken in a round bottom flask and mixed thoroughly in rotary evaporator at 90° C for 2 hours. 5ml of this solution is taken in a porcelain crucible and placed in a beaker (500ml.), covered with a watch glass. It is then placed at the center of the rotating plate of a kitchen microwave oven. It is irradiated with microwave at 850 watts for 2 minutes. Reaction occurs within 30 seconds with a bang sound. A puffy, whitish, highly porous, fine powder of ZnO is obtained which is thoroughly washed with Millipore water and acetone. The sample is dried in a hot air oven around 70° C. This is designated as ZnO-I. This is further purified by treating with hot (50°C) 1M KOH solution on stirring, centrifuged and thoroughly washed with Millipore water and acetone and dried. This is designated as ZnO-II.

Characterization

Powder XRD

Powder XRD patterns of the as prepared sample and purified sample were taken in Philips XRD ('X' PERT PRO X-ray diffractometer) using Cu K_α radiation (λ=1.5406Å). The d-values are compared with JCPDS file no. PDF 00-005-0664.

UV-visible absorption

UV-visible absorption spectra in solid mode were recorded with Shimadzu UV-visible spectrometer (Model 2100).

IR spectra

The IR absorption spectra were obtained using FT-IR SPECTRUM 1000 Perkin Elmer Spectrometer with pressed pellets of dry samples, using KBr powder as the diluent.

Scanning electron microscopy

The samples are sonicated in acetone for few minutes and few drops of this are taken on a stub having carbon tape. A thin layer of gold is sputtered before mounting the sample. Scanning electron microscopy images were obtained using JEOL JSM 840A scanning electron microscope.

High Resolution Transmission electron microscopy Few drops of sonicated samples in acetone are taken on to Carbon coated copper grid and dried. The TEM and HREM pictures are obtained in Tecnai F30.

Surface area measurements

Brunauer-Emmet Teller (BET) surface area measurements by nitrogen adsorption was obtained on a preheated, evacuated samples overnight in NOVA 1000 QUANT CHROME Gas Sorption (version 3.0) Analyzer.

Thermal Analysis

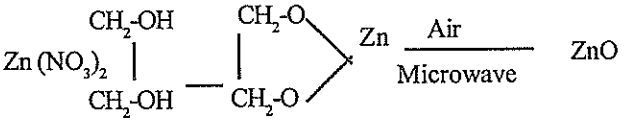
Thermal analysis was carried out for well dried samples in NETZSCH TG 209 FI Thermo Gravimetric analyzer in nitrogen atmosphere at a heating rate of 5°/min.

Results and discussion

In the synthesis process the zinc nitrate concentration was kept constant approximately at 0.1mole, the volume of ethylene glycol was varied from 5ml-9ml. It is found that 5ml of ethylene glycol is more ideal to get pure zinc oxide. During the rotary evaporator treatment, the zinc nitrate decomposes and forms zinc glycolate. This is found to be a good microwave absorber and easily decomposes to zinc oxide within a

short period of time (30secs), in order to get a highly crystalline material; it is further heated to about 90 seconds in micro wave oven.

The possible reaction is shown below,



Zinc nitrate +Ethylene glycol → Zinc glycolate $\xrightarrow[\text{Microwave}]{\text{Air}}$ Zinc Oxide

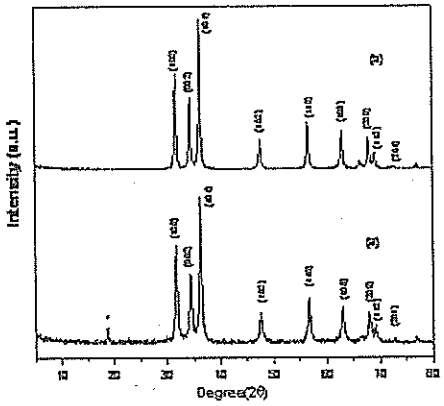


Fig.1 Powder XRD Pattern of (a) ZnO-I and (b) ZnO-II (* Impurity peak)

From the Powder XRD (Fig. 1) ZnO-I, shows a small impurity peak around 18.89°. This was removed by treating with 1M KOH around 50° for 1 hour. During this process only impurities are removed (without dissolving ZnO). Further we get pure zinc oxide (ZnO-II).

Figure 1 shows the powder XRD pattern for both ZnO-I and ZnO-II. The pattern matches with JCPDS file no PDF-005-0664 of ZnO wurzite structure.

From the slow scan XRD pattern the full width at half maxima (FWHM) was determined for (101) peak. The crystallite size obtained using Scherer formula

$$L_{(hkl)} = \frac{0.96\,\lambda}{\beta \cos\theta}$$

β = FWHM in radians

θ = angle of scattering

$L_{(hkl)}$ = coherence length

Assuming the particle to be spherical, the estimated size is 53nm using the formula, S = (4/3) L

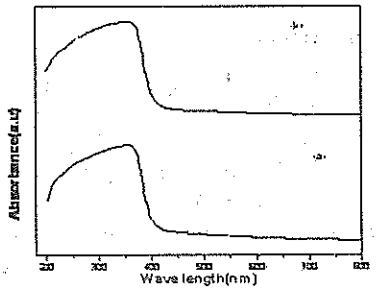


Fig.2 UV-Visible Spectrum of (a) ZnO-I, (b) ZnO-II

Fig. 2 shows the UV-Visible spectra for both ZnO-I and ZnO-II, the spectra is similar in nature having an absorption edge at 400nm corresponding to 3.1ev. However this is a red shift compared to the bulk sample, whose band gap is 3.37ev. However, this trend is not usually seen, when the particle size is in the nanometer scale

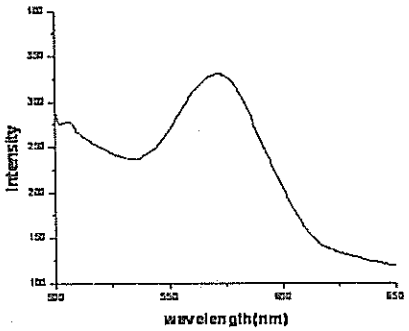


Fig.3 Fluorescence spectra of ZnO-I (Ext: 400nm)

Fig.3 is the fluorescence spectra of ZnO-I, obtained on excitation at 400nm and emission spectra of green fluorescence peak is observed around 572nm. This might have originated from oxygen vacancies and other defects

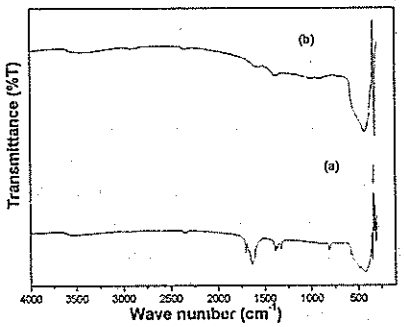


Fig.4 IR Spectrum of (a) ZnO-I and (b) ZnO-II

Figure 4 shows the IR spectra of ZnO-I and ZnO-II. In ZnO-I we see bands around 1800 and 1300cm^{-1} due to some organic impurities. And the same is absent in the ZnO-II indicating the absence of impurities. The band around 480cm^{-1} indicates the Zn-O stretching frequency.

Figure 5 shows the pore size distribution for both the samples. We find there is a wide distribution of pore size (1-4nm) in the case of ZnO-I, where as a narrow distribution of pore size of about 2nm in case of ZnO-II. These results indicate that the samples are microspores in nature.

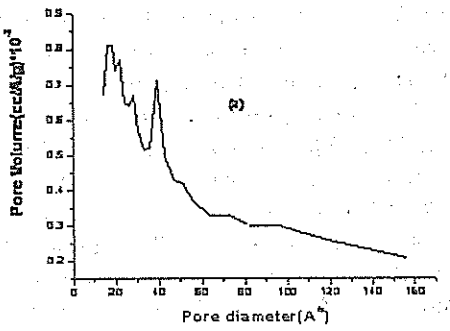
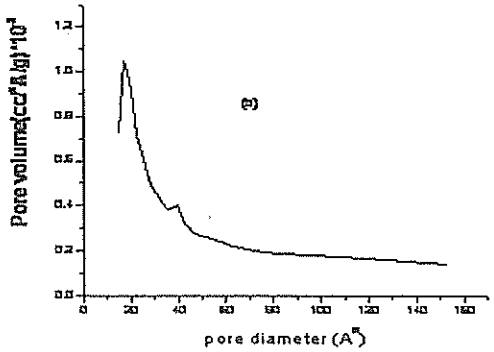


Fig.5 BJH Curve of (a) ZnO-I (b) ZnO-II



The thermal analysis of the samples is shown in Figure 6 up to 1000°C. There is a higher loss of weight (14%) in ZnO-I compared to ZnO-II (10%). This higher loss in weight in ZnO-I is due to the presence of small amount of water and also the organic impurity, in ZnO-II the weight loss is only due to the presence of water.

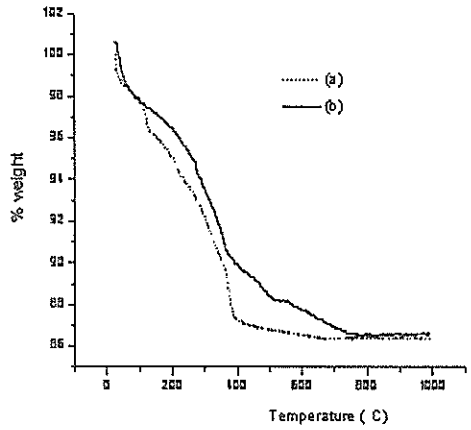


Fig.6 Thermo gravimetric analysis of (a) ZnO-I (b) ZnO-II

Further we have analyzed the samples for Carbon and Hydrogen. The results along with surface area of the samples are shown in table I. This is in conformity of IR results shown above. However the surface area of ZnO-II is less than ZnO-I which is a surprise.

Table I: Surface area and C and H analysis of ZnO-I and ZnO-II

Compound	Specific surface area(m^2/g	%C	%H
Zno-I	31.37	2.84	1.0656
Zno-II	23.6	0.6852	0.5069

Figure 7 shows the SEM pictures of both the samples. Puffy highly agglomerated fine spherical particles of size around 10-15nm are seen in the case of ZnO-I (Fig.7a). In the case of ZnO-II, the particles are slightly bigger and they have arranged in the form of fine mosaic structure with well separated boundaries (Fig.7b).

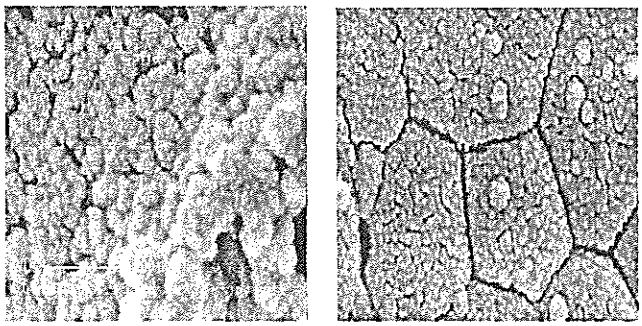


Fig.7 SEM pictures of (a) ZnO-I and (b) ZnO-II

Figure 8 shows the TEM pictures of both the samples along with the HREM and the corresponding ED Pattern, the well distributed particles with almost spherical in shape are seen. From the corresponding HREM pictures one can see the neat hexagonal pattern and also indicate the single crystallinity of the sample.

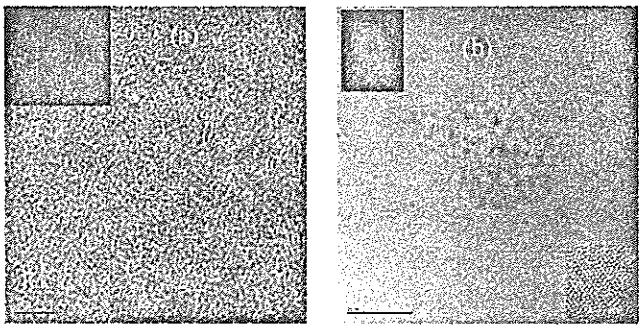


Fig.8 TEM Pictures of (a) ZnO-I (b) ZnO-II Inset shows the ED pattern and Lattice Fringes

Conclusion

A novel method of microwave heating technique is used to synthesize large quantities of pure ZnO in a very short time. The particles are found to be spherical, having the size around 5-10nm.It shows a green emission attributed to the oxygen vacancies.

Acknowledgment

I thank UGC for granting Minor Research Project to carry out this work. Thanks are due to Mr.E.Jarali (IISc) for getting many spectroscopic data. I take this opportunity to thank our principal Prof. H.K Kumara Raj Urs for all the encouragement. I sincerely thank my lab mates from SSCU for their help in carrying out the work. I also thank my family members for all the encouragement.

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RESEARCH INFORMATION SYSTEMS IN THE FIELD OF COMPUTER SCIENCE / INFORMATION TECHNOLOGY

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Abstract :
A fast growing Automation of Industries and organizations have led to the development of softwares. Many Research activities are under taken in the development of software Analysis, Design and Applications. In this paper an attempt is made to review the Research Methodology in particular Computer Science and IT related area.

What is Research?

Everywhere, our knowledge is incomplete and problems are waiting to be solved. We can problems by asking relevant questions and seeking answers to them o the problem. *The word research* is used in everyday speech which makes confusing term for students especially graduate students who must learn to use the word in its specialized denotation.

Research here as the systematic process of collecting and analyzing information (data) in order to increase our understanding of the phenomenon with which we are concerned or interested. Although this conception of research may seem somewhat remote and academic, many people rely on a truncated form of it each day to solve smaller problems than those resolved by the more elaborate methodology of formal research. It is with formal research, however, that we are concerned in this text.

Doing Research is a thinking we do most of the days. We can say creating new knowledge. If we have any critical problem for that we start to find solution similarly doing good research means to find proper and sufficient data. From that data come to proper conclusions.

System developers should think to design a perfect computer system complete bug free and fulfil all requirements, but the system would be still failure. It did not satisfy end users.

PhD students should submit a thesis. Thesis has two meanings. One is report anything from 100 to 500 more pages. Second one is argument termed as viva a face to face meeting with examiners.

- Research originates with a question or problem.
- Research requires a clear expression of a goal.
- Research follows a specific plan of procedure.
- Research usually divides the principal problem into more manageable sub problems.
- Research accepts certain critical assumptions.
- Research requires the collection and interpretation of data in attempting to resolve the problem that initiated the research.
- To contribute personal needs.

Characteristics of Formal Research

1. Research originates with a question or problem. The world is filled with unanswered questions, unresolved problems. Everywhere we look, we observe things that cause us to wonder, make us to ask questions. And by asking questions, we strike the first spark igniting a chain reaction that terminates in the research process. An questioning mind is the beginning of research. There is

so much that we do not know that we do not understand! Look around you. Consider the unresolved situations that evoke these questions: Why? What's the cause of that? What does it all mean? These are everyday questions. With questions like these, research begins.

2. Research requires a clear expression of a goal. A clear, unambiguous statement of the problem is critical. This statement is an exercise in intellectual honesty. The Researcher asks himself, "What precisely do you intend to do?" This is basic and is required for the success of any research undertaking. Without it, the research is on shaky ground indeed.

3. Research requires specific plan: Research is not an excursion into happy expectation, hoping that the data necessary to solve the problem will somehow it turns up. It is carefully planned attack, a search & discover mission explicitly planned in advance. *Practical Research: Planning and Design,* three words are the important ones. The overall research effort must be explicitly planned & logically designed. Depending on the specific research question, different designs & methods will be more or less appropriate.

In the section immediately preceding this one, you considered the goal for research; that was what you intended to do. Here, you state the plan, the design; this is how you propose to reach that goal. You must not wait until you're chin deep in the project to plan and design your strategy; In the formative stages of the research project, much can be decided: Where are the data? Do any existent data address themselves to the research problem? Even if the data exist, is it reasonable that you have access to them? Presuming that you have access to the data, what will you do with them after they are in your possession? I might go on and on. Each of the questions above must have an answer early in the research process.

4. Research usually divides the principal problem into more manageable sub problems. The whole is composed of the sum of its parts. That is a universal natural law; that is also a good precept to observe in thinking about one's principal goal in research.

Suppose you want to get from your town to a town 50 miles away. Your principal goal is to get from one location to the other as expeditiously as possible. You soon realize, however, that at the outset some sub problems must be considered. Here is a the problem and its attendant sub problems:

Main problem:	How do I get from Town A to Town B?
Subproblems:	What is the most direct route? How far do I travel on which way? What is the number of the exit I take in leaving?

To proceed logically, one should closely inspect the principal problem because research will soon cause the appropriate and, in fact, necessary subproblems to float to the surface. By resolving them, we finally resolve the main problem.

If researchers don't take the time or trouble to isolate the lesser problems within the major problem, their research projects become cumbersome and unwieldy. From a design standpoint, therefore, it is expedient to reduce the main problem to a series of logical subproblems that, when resolved, will resolve the main problem.

5. Research accepts certain critical assumptions. In research, assumptions are equivalent to axioms in geometry-self-evident truths, the sine qua non of research. The assumption must be valid or else the research cannot proceed. For this reason, careful researchers — certainly in academic research — set forth a statement of the assumptions as the bedrock upon which the study must rest. In your research, therefore, it is important that others know what you assume with respect to your project. For, if one is to judge the quality of your study, then the knowledge of what you assume as basic to the very existence of your study is vitally important.

A distinction should be made here between a hypothesis and an assumption. A *hypothesis* is a conjectural supposition that is posited in order to facilitate the search for facts but that is held in abeyance until the data are available and have been interpreted. At that point, the data either support or do not support the hypothesis. An *assumption* is quite a different matter. An assumption is a condition that is taken for granted, without which the research situation would be impossible. In the Einstein example given above, we assume that the astronomers who went to observe the aberration of the star's light were competent to do so and that their instruments were critical enough to make the sensitive measurements necessary to detect the slight aberrational difference caused by the gravitational pull so that a valid conclusion could be drawn from them.

Assumptions are usually so self-evident that, many times, we consider it unnecessary to mention them; but, careful researchers do, so that those inspecting the research procedure may see every component and evaluate it accordingly.

For the beginning researcher, it is better to be over explicit than to take too much for granted.

6. Research requires the collection and interpretation of data in attempting to resolve the problem that initiated the research. Having now isolated the problem, divided it into appropriate subproblems, posited reasonable questions or hypotheses, and recognized the assumptions that are basic to the entire effort, the next

step is to collect whatever data seem appropriate and to organize them in meaningful ways so that they can be interpreted.

Consider the library of books that have been written on the assassination of President John F. Kennedy. Different historians have studied the same events: One may interpret them one way, and another may arrive at an entirely different conclusion. Which one is right? Perhaps they both are; perhaps neither is. Both may have merely posed new problems for other historians to try to resolve. Different minds frequently see different meanings in the same set of facts. This is an axiom of interpretation that all researchers must recognize.

7.To contribute personal needs : Some people do research for the PhD degree as personal challenge. They take it as challenge and will try to meet. It. Some do Research which helps them in future career. To maintain dignity some people do.

What Research is Not?

The word research has been so loosely employed in everyday speech that few people have any idea of its real meaning. Here are a few guidelines as to what research is not? accompanying each guideline is an illustration depicting the popular concept often held about research.

1. Research is not mere information gathering.

2. Research is not mere transportation of facts from one location to another.

3. Research is not merely rummaging for information.

4. Research is not a catchword used to get attention.

Sources of Research Ideas

1. Suggestions from staff of department. By discussing or circulating your topic we may get the ideas and topics.

a. Your interests

b. What subject you like and why?

c. What is your motivation

2. Past Researcher work may also helpful in finding solution to your interested research area. You can request the guide to get the students good dissertation or thesis. Even your guide also can give you some ideas.

3. Recent conference papers & Journals can also help you for further research needs.

4. Media like TV and news paper also help us to notice recent happenings in your research topic.

5. Needs of customer can also allow you to develop new product in IT.

Selecting Topic

a. Is your research something new to users?

b. Is your research contribute some new knowledge?

c. Is the research and its outcome meets your scope?

d. Can I complete the goal in time?

e. Do you have sufficient resources?

f. Will the Research be Ethical?

Participants and Research Ethics

When you design the research it must meet the ethical aspects. The ethical clearance must be clear before starting the work. These vary from institution to institution. There will be an ethical member committee. If the project is approved we can start. If they are unhappy with any part then we have to redesign it.

a. Rights of people directly involved

b. For experiments the people are called as subjects

c. For Surveys these are called as Respondents

d. The case study they are called as informants or participants

Right not to participate

If some one do not want to participate he can withdraw at any moment. We cannot force him we should respect his decision. It may affect our research but we are helpless. It is our problem not their problem.

Right to Withdraw

Initially some one may agree to participate and then they can withdraw at any moment. Again we cannot do anything it is their right to withdraw. Some may refuse to answer some questions.

Give Proper Information: If participants agree to participate then they should be informed about the following

1. The purpose of Research, why it is conducted?

2. The person who is undertaking research his Name, Address contact details must be mentioned

3. If your are taking interview how long it take how many questionnaires are likely to be mentioned

4. Will they get any expenses or incentive

5. They must be informed about right to participate & right to withdraw

6. Produce the written detail information is good.

The participants in he research have rights to protect to the identity and their address and location. If you want to use the name sin your research then use code names. If necessary you can changed the gender. In small industry it might be easy to find who gave the information. In big IT industry it is difficult to find out. The way of discussion may harmful to the employee so you should maintain secret.

Responsibility of Ethical Researcher

Respect the participants

Do not ask unnecessary questions : When you have designed the Questionnaire ask only related to the topic questions. In between do not ask the interviewee age and personal questions. It is better to omit such questions.

The Ethical researcher will record data accurate and fully. Keep the data secure that some one should not access it. You should know how to protect your data from password security, hackers, power failures, poor

backup, insecure networks and viruses.

Follow appropriate professional codes of conduct: The codes are protected from ethical committee. If you want to access then codes you have to pay to he body person. It is worth to find in Internet.

Interview

Interview is a particular kind conversation between peoples. Here one person who want to conduct interview usually want to gain information. Purpose, and the interviewee knows this and agrees with it. It is also understood that the interviewee's words can normally be treated as on the record, so they can be used by the researcher later. Only it the interviewee specifies that some responses are not to be made publicly available are they treated as off the record.

Interviews can be suitable data generation methods when a researcher needs

- Obtain detailed information
- Ask questions that are complex, or open ended, or whose order and logic might need to be different for different people;
- Explore emotions, experiences or feelings that cannot easily be observed or described via pre-defined questionnaire response;
- Investigate sensitive issues, or privileged information, that respondents might not be willing to write about on paper for a researcher that they have not met.

Planning and Conducting Interviews

Because we all regularly carry out conversation with other, it is tempting to think that we can all naturally carry out interviews. However, successful research interviews need planning and a particular set of skills, as explained below,. This section concentrates on the-to-one interviews. They following section explains additional issues that arise in group interviews.

Types of interviews

Interviews can be divided into three types.

- **Structured interviews**: These use pre-determined , standardized, identical questions for e very interviewee. You read out the questions and note your interviewee's responses, often using, pre-coded answers. Although there will be some social interaction between you and the respondent, In effect, you are asking your interviewees to complete a questionnaire, but you are doing the writing for them (or even entering their responses straight into a computer, if you use a laptop). For structured interviews, you should read Chapter 15 on questionnaires, which will help you plan a structured set questions. The remainder of this chapter concentrates on the other two types of interviews.

- **Semi-structured interviews**: you still have a list of themes to be covered and questions you want to ask, but you are willing to change the order of questions depending on the flow of the conversation and you might ask additional questions if your interviewee brings up issues you had not prepared questions for.

The interviewees are able to speak with more detail on the issues you raise, and introduce issues of their own that they think relevant to your themes.

- **Unstructured interviews**: the researcher has less control. You start things off by introducing a topic and then let the interviewees develop their ideas, talking freely about events, behavior or beliefs, while you try not to interrupt.

Both semi-structured and unstructured interviews allow interviewees to 'speak their minds' and so are used where the primary purpose is 'discovery; rather than 'checking'. They are therefore used for in-depth investigations, especially those aimed at exploring personal feelings. They are not useful, though, for situations where you want to draw research conclusions that are generalizations about the whole population (whatever this may be in relation to your research topic), because you will not have responses about the same topics from all your interviewees, ad the time required means that you will usually only have a small number of cases from which to draw conclusions.

Researcher's role and identity

It has been shown that people respond differently depending on how they perceive the person asking the questions, that is, the data generated can depend on the perceived role and identity of the researcher. For example, they might answer you differently depending on whether they think you are a student or a journalist or a police detective. Your sex, age, ethnic origin, accent and status can also all influence the respondents when they decide what information to give you. You can, and should, aim to be professional, polite, punctual, receptive and neutral, but you cannot do much about many aspects of yourself that might influence your respondents.

Interview Preparation

We have to plan before conducting interview and the questions which we want to ask. Before visiting the interviewee study the background and proceed. Ex: if you want to interview the employee then study about his company and his job designations. It will be useful to conduct interview.

1. This helps to create image in the eye of interviewee
2. Some time you can send the questions in advance also that the interviewee can get time to prepare well.
3. Discuss with your willing friend.

Scheduling

Before taking interview you have to make an agreement with interviewee about your purpose and duration is well and good. Do not cross more than 2-3 interviews per

day. It may make you tired. Also try to cover within 2 hours. (do not go for longer time period).The venue should be comfort both. Meet some where there is no disturbance.

Recording

The discussion with the interviewee should capture in tape record, video or audio. Making Notes is also one way. We cannot keep all in our memory.

Field Notes : Some time the interviewee may refuse to make notes that time we have to respect his wish. But later write up as soon as possible.

Audio Tape recording : The complete record of interview you will get and you can concentrate on the questions which you have. Afterwards it will be helpful to listen and collect which points you require. Some interviewee may refuse this.

Video tape recording : The events happened with voice can be recorded in this. It is expensive and bulky. Many interviewee may refuse.

Seating Arrangements : When you are conducting the interview set up the comfort seating arrangements. If you are interviewing in some ones private office then sit in front of clock.

Before that check the equipments which are charged or not. keep everything ready if possible keep spare of batteries. Keep audio, pen, note book, pads laptop etc ready with you. You may need anything at any time. So be prepared with your equipments

Interview

It begins with introductions and purpose of interview and the topic of research.

Initially start slowly with easy questions. Later you can ask more questions on his response. Try to ask open questions Cleary like why? how and what?. Also ask about paper articles, news and advertisement on you research topic. More preciously ask about the recent happenings on your topic. Some time keep some gap in between questions so he can get time to recollect his memory. Do not rush on asking the questions consciously.

You should ask the questions very smoothly in sweet tone. So that the interviewee can answer you more comfortably. Do not use high pitch. Keep the respect of Interviewee - if some time he refuses for some questions then do not force him.

Group Interviews

In group you can interview 3 or 6 people at a time. Do not ask the questions to a particular person instead you make them to discuss in between and collect the information.

Advantages of group Interview

1. You can get new and challenging ideas from them.
2. This can become a survey.
3. You can get different views.

Disadvantages

1. Some members may dominate
2. Some people may reluctant to express their own views in front of others.
3. Some juniors may not speak in front of seniors.
4. It is very hard to keep the notes
5. Recording will be helpful in this case.

Internet based interviews

This used very limited. It helps to the persons for online and groups interviews. Voice recording is not possible instead questionnaires can be prepared and sent in bulk. Who replied will be unknown to the interviewer. honesty is not maintained.

- It is less expensive.
- Time saving
- We loose facial expressions.

Email can be helpful by introducing them selves and sending the topic. To get the address you have to approach the news groups or mailing lists. How to do online interview? The Internet Research and Ethics is the topic which gives the details about this.

Evaluating Interview based Research

1. They are good in dealing topics and know the topic in depth.
2. They have to build social relations to carry out
3. Flexibility is their for both
4. Some may complete the questionnaires before they talk

Disadvantages

1. Time consuming
2. They may mislead
3. Some interviews act artificially as they are in front of video recorder.
4. Require good social skills of talking
5. Analyzing and evaluating may be difficult because of length.

Literature Review

One of the most important early steps in a research project is the conducting of the literature review. A literature review is designed to identify related research, to set the current research project within a conceptual and theoretical context. When looked at that way, almost no topic is so new or unique that you can't locate relevant and informative related research. Here are some tips about conducting the literature review.

First, concentrate your efforts on the scientific literature. Try to determine what the most credible research journals are in your topical area and start with those. The paper is sent to these reviewers with no identification of the author so that there will be no personal bias (either for or against the author). Based on the reviewers' recommendations, the editor can accept the article, reject

it, or recommend that the author revise and resubmit it. Articles in journals with blind review processes are likely to have a fairly high level of credibility. Second, do the review early in the research process. You are likely to learn a lot in the literature review that will help you determine what the necessary tradeoffs are. After all, previous researchers also had to face tradeoff decisions. What should you look for in the literature review? First, you might be able to find a study that is quite similar to the one you are thinking of doing. Since all credible research studies have to review the literature themselves, you can check their literature review to get a quick start on your own.

Second, prior research will help ensure that you include all of the major relevant constructs in your study. You may find that other similar studies routinely look at an outcome that you might not have included.

Third, the literature review will help you to find and select appropriate measurement instruments. You will readily see what measurement instruments researchers used themselves in contexts similar to yours. Finally, the literature review will help you to anticipate common problems in your research context.

HOW CAN I WRITE A GOOD LITERATURE REVIEW?

You should use the literature to explain your research - after all, you are not writing a literature review just to show what other researchers have done. You aim should be to:

1. Show why your research needs to be carried out,
2. How you came to choose certain methodologies or theories to work with,
3. How your work adds to the research already carried out, etc.

Read with a purpose: you need to summarize the work you read but you must also decide which ideas or information are important to your research (so you can emphasize them), and which are less important and can be covered briefly or left out of your review.

You should also look for the major concepts, conclusions, theories, arguments etc. that underlie the work, and look for similarities and differences with closely related work. This is difficult when you first start reading, but should become easier the more you read in your area.

Write with a purpose: your aim should be to evaluate and show relationships between the work already done and between this work and your own. In order to do this effectively you should carefully plan how you are going to organize your work.

A lot of people like to organize their work chronologically (using time as their organizing system). Unless developments over time are crucial to explain the context of your research problem, using a chronological system will not be an effective way to organize your work. Some people choose to organize their work alphabetically by author name: this system will not allow you to show the relationships between the work of different researchers, and your work, and should be avoided!

Conclusion :

The Interview method of finding the required data for Research will be suitable in solving the problems social science problems. It finds more difficulties in natural Science subjects as most of the investigation depends on the Experimental data, which may depend on more parameters.

There may be problems while interviewing politicians, higher officials, topic related to criminals, which might be risky to life of Researcher. There may be chances of loosing sources of data which were stored in electronic media recorded in the interviews. Besides these to conduct an interview a lot of ground work is required apart from censoring.

Acknowledgement

We are very much thankful to Dr. S. C. Shirwaikar HOD, Wadia College, Pune, Maharastra, Dr. Mohan Kale, Pune University for their constant co-operation and having useful discussions.

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MILE STONES IN THE FIELD OF SCIENCE

Mrs. SHYAMALA. V.,

S.B.ARTS & K.C.P. SCIENCE COLLEGE,BIJAPUR – 586 103, KATNATAKA, INDIA

In science, the Nobel Prize is the ultimate honor that can be bestowed on a person. The Nobel prizes in Science were first awarded in 1901.

Since then, 12 women in Science were awarded the prize. Among them, Madam Marie Curie received the honor in 1903 along with her husband in physics and again in 1911 in chemistry.

Marie Curie while calling science "the clear light of truth", she suggests her audience to "take the torch of knowledge and built the palace of the future". Marie curie once wrote to her brother "you must believe yourself to be born with a gift for some particular thing; and you must achieve that thing, no matter what the cost". You know my dear friends; it is not an exaggeration if I say that she has given her own life to obtain this highest honor. Although she could not know it at that time, she was destined to become the greatest women

scientists in the history.

• This paper aims to bring out problems & prospects faced by women scientists in the world:

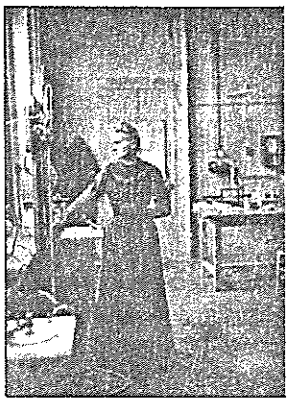
• The lady Nobel Laureate Madam Marie Curie who brought highest credit to the field of science.

• Rosalind Franklin, the Dark Lady of DNA, who is basic reason for Watson & crick to obtain Nobel Prize.

• Gender Discrimination in the life history of Women Scientists.

THE LADY NOBEL LAUREATE MADAM MARIE CURIE

Nuclear Physist and /chemist (1867 – 1934)



Madam Marie Curie is the scientific icon remembered for her pioneering work in the field of "Radiation Research. She discovered Raduim & Polinium and was first person to coin the term "Radio activity". For her unique and distinguished work in the field, she was awarded Nobel Prize along with her husband Pierre Curie in 1903. After that she continued her research work on Radio activity.

Like any other radio active materials, radium is a dangerous chemical substance to handle. The radiation it gives off can kill living cells. This property is desirable in treating cancer. Killing cancer cells can help a patient to recover from the disease.

When Curie undertook her investigation of radioactivity, she involved in the tedious process of isolating radium from ore. A year later that is during 1905 she along with her husband could reduce the ore into two bonded elements Barium and Radium. In the process, she developed some odd burns on her hands and consulted doctor. Fearing that the burns may eventually become cancerous, the doctor advised Marie Curie to stop experiment. But Marie Curie insists on continuing the research work and comments to her husband Pierre that if radio active material is capable of killing healthy tissue, it might someday be used to destroy cancerous tissue. That time, she could not foresee that research on radio activity would eventually cast her own life.



She was also first woman in France to obtain her doctoral degree. But on 19 April 1906, tragedy struck: Pierre slipped and fell in the street and his head was crushed under the wheels of a heavy wagon, killing him instantly. Some how, in spite of this heavy blow, Marie managed to come back by bringing her attention back to her research. Respect for her work continued to grow, especially her work of developing methods for Radim extraction and in 1911 she was awarded her second Nobel Prize, this time entirely on her own right. Her enthusiasm in working with Radium & Radio activity processes made her to develop leukemia and died eventually in 1934.

ROSALIND FRANKLIN – THE DARK LADY OF DNA INSTRUMENTAL FOR WATSON & CRICK TO OBTAIN NOBEL PRIZE

X- ray crystallographer & Molecular biologist (1920 - 1958)



Roslind Franklin alias Dark Lady of DNA as the scientific world knows, has buildings named after her in London & Cambridge. Rosalind Franklin's X- ray studies of molecules played crucial role in the 1953 discovery of the structure of DNA. In fact, she was responsible for much of the research and discovery work that led to the understanding of the structure of Deoxyribonucleic acid, DNA; the master molecule of life.

Franklin's 27 months of her career life at king's college, London was highly painful and miserable. Though Director of king's Biophysics Unit J.H. Randall sent Franklin a letter telling her that she would be in charge of DNA research, allowed Wilkins to think that DNA would remain his testimony and that Franklin would assist him. Wilkins could not withstand the academic ableness of Franklin and wanted to overpower her in the field. For reasons unknown, Wilkin showed one of Franklin's unpublished DNA photographs[now famous as " Photograph 51"] to Watson & Crick. Wilkins hoped to publish the same with Watson & Crick, but after seeing photograph they scooped him as well as Franklin. With out an unauthorized peek at her unpublished data, Watson & Crick probably would neither have published their famous paper on the structure of DNA in 1953 nor won their noble prizes in 1962.

Photo 51a

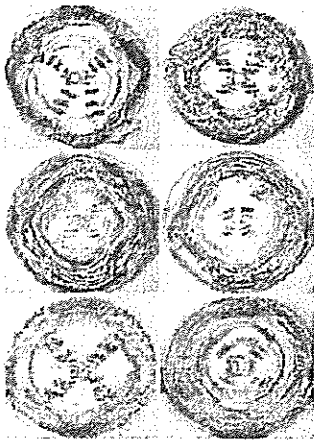
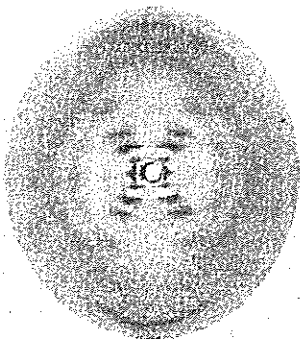


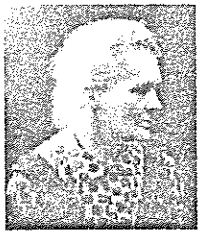
Photo 51



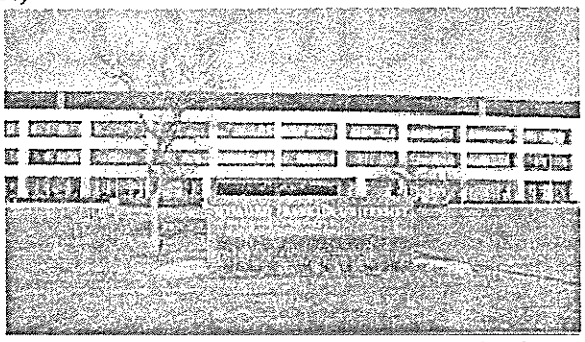
Franklin did not share the Noble prize; she died in 1958 at the age of 37. At last, her continuous research work with radiation exposure was root cause for ovarian cancer, which engulfed her fully at the prime young age of 37. Still, in her short span of life, she authored or co-authored 37 books and besides her contribution of the study of DNA. She won international respect for her work on carbonaceous solids and virology. Every scientist of this globe should, in reality, take pride in placing Franklin as par with all other Nobel Laureates.

GENEDER DISCIMINATION IN THE LIFE OF WOMEN SCIENTISTS:

Traditionally science has been a male-dominated occupation. However, through out History, there has been exceptional women who have risen above society's restriction and contributed greatly to the advancement of science.



Madam Marie Curie who was recipient of Nobel Prize for two times was not an exception for this gender discrimination. While she received the award for the second time, believing that she had an affair with another physicist, Paul Langervin (which is other wise purely personal) the press criticized for awarding the prestigious award to her. Also around the same time, Marie Curie's application to join "French Academy of Science" was rejected by a single vote and the academy remained a male only institute. (Mc Clafferty 2006)



Now, about Rosalind Franklin, she was always after facts, she published 17 books in the process. Actually, **she never did receive the credit she should have got for her role in discovering the structure of DNA, the carrier of genetic material.** Among her other achievements were, being the first to produce photographs that clearly illustrated DNA's helical structure

It is all because of one of Franklin's colleague at king's college: Wilkins's did not get along with Franklin. This may have influenced Wilkin's decision to share some of Franklin's work [with out her permission] with Watson and crick of the University of Cambridge in Jan 1953. Franklin was apparently unaware that they have used her research work. Both she & Wilkins published combined pieces on DNA in that same issue of Nature. Franklin eventually published five additional articles related to the prize winning work. But, the credit went to Watson & Crick.

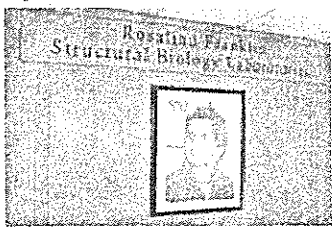
Watson



Crick.



The difficulty in working with Wilkins's led Franklin to leave king's college, but the college insisted that she cease work on DNA. Thus she left her work on DNA. Using a technique called X-ray crystallography and she took up research on Tobacco Mosaic virus. It would be surprising to state here that at King's College, Franklin being a women was not allowed to eat lunch in the common room where men took lunch. She was always made to feel at king's college that she was a women in a "Man's World". Wilkins always expected Franklin to be his assistant rather than a colleague working as an equal.



Wilkins



CONCLUSION:

It is very important to think and remember the great women who have paved the way and who continue to set an example for the development of globe with their unique, outstanding and distinguished contribution. Thus, providing inspiration and motivation for the empowerment of many more extraordinary women who are dedicating their life to achieve equality for generations of women to come. It is a matter of appreciation that women also continue to effect change across the globe.

With this final node, let me conclude.

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ECONOMICS & MANAGEMENT SCIENCES

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PRODUCTION AND MARKETING ACTIVITIES OF SUCCESSFUL AND UNSUCCESSFUL SHGs IN GADAG DISTRICT

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Introduction

Self-help groups are emerging as major agents of development and empowerment of weaker sections in the third world. In India, since the beginning of the ninth plan most of the development programmes are channelled through SHGs. In all the parts of the country, the Self-help groups are organized by governmental and non-governmental organizations (NGO's) to facilitate them by providing revolving fund, organizational base and training, credit etc. It is worth while to call SHGs a mass movement on national scale for development and empowerment of the poor and down troden in the country. To analyse the production and marketing activities undertaken and profile of the study was design with the following objectives.

1. To analyse the production and marketing activities undertaken by successful and unsuccessful SHGs in selected activities and
2. To analyse the profile of members of successful and unsuccessful SHGs

Material and methods

The study was conducted in Hulkoti and Hombla villages of Gadag district in Karnataka. Two villages were selected based on highest number of SHGs operating in two villages. From each village four successful and four unsuccessful SHGs were selected based on number of effective groups. In each group president, secretary and 5 members were the respondents. Thus, the total sample size of the study was 112. The data was collected from the respondents through personal interview technique and analyzed by using frequency and percentage.

Results and Discussion

Production and marketing activities of successful and unsuccessful self-help group members

Production

The information in table 1 shows about products prepared by the members of successful and unsuccessful SHGs. The members were producing products like pickles, papad, bakery products, chutney powder, broom stick, bun sale, vegetable vending, doll making biscuit preparation and masala powder making (0.89% each) and roti, agarbatti (3.57 and 4.46% each, respectively) and soap powder/detergent, shavige (2.68% each). All the members were preparing products in their own house only except shavige where in members were producing in rented house.

Regarding quantity of products produced by members per month was 20 kg each of pickle and papad, bakery products (30-35 kg), roti (21,000 rotis), shavige (950 kg), soap powder/ detergent (45 kg), broom stick (1500 pieces per season), bun sale (60 pockets of 4 bun), doll making (15 dolls), biscuit (65 kg) and masala powder (25 kg).

Highest number of labours were involved in shavige making with 8 labours getting wages of Rs. 20 per day generally.

This could be because of the familarity of the women with these activities complemented by the easily mastered skills involved and the remunerative nature of the jobs and also being the traditional jobs, which were suitable to the local conditions and for which raw material are available easily.

Marketing

The details about marketing of products revealed by table 2 indicated that majority of the members sold their products through wholesaler, local market, bazaars and exhibitions respectively. Only bakery products were sold through own shop.

Regarding bangle sale they were selling 30-35 dozen per month in their house and bazaar.

Regarding duration/period of marketing of the products it was daily, weekly, monthly and seasonally. Persons responsible for marketing were through self only. The bazaar was started by KVK. Income earned by marketing of different products per month was pickle (Rs. 720), papad (Rs. 800), bakery products (Rs. 2,500), roti (Rs. 13,125), chutney powder (Rs. 1,200), agarbatti (Rs. 400), soap/detergents powder (Rs. 1,755), shavgi (Rs. 2,397), broom stick (Rs. 7,500 for two seasons), bun sale (Rs. 250), vegetable vending (Rs. 860), bangle sale (Rs. 225) and doll sale (Rs. 756).

This might be due to facilitation by K.H. Patil Krishi Vigyan Kendra which has started a novel method of marketing. Products were sold on Wednesday at Hulkoti, Saturday and Sunday evening at Gadag as they have the opportunity to sell their products at identified premises. The results are in line with the Bharathi (2005), Devalatha (2005).

Profile of self-help group members

Age

The sample was predominantly of middle aged women which might be due to the married women engaged in economic activity of the family, who have free time and being more responsible citizens than their younger counterparts and older women were discouraged due to their poor health and stamina.

In successful SHGs, it was observed that majority of respondents (64.28%) were middle aged while 33.93 per cent were young aged and remaining (1.79%) were old aged.

In unsuccessful SHGs, it was observed that majority of respondents (67.89%) were middle aged while 28.57 per cent were young aged and remaining (3.57%) were old aged. The information in table 3, revealed that majority of the respondents (66.07%) were middle aged, while 31.25 per cent were young aged and the remaining (2.68%) were old age.

Education

It was observed in successful SHGs that majority of the members (39.29%) were functionally literates, 16.07 per cent had primary education, 14.28 per cent had middle school education 10.71 per cent had high school education, 8.93 per cent of them had completed college and illiterates and graduation were 5.36 per cent each.

In unsuccessful, it was observed that 35.72 per cent of the members were functionally literate followed by 19.64 per cent with middle school education, primary school and high school education (14.29% each), 10.71 per cent of the members were illiterates and 5.36 per cent of the respondents had completed their college education. This was due to their learning from the other members who are educated in the group.

Marital status

In successful SHGs, majority (91.07%) of them were married, 5.36 per cent of them belonged to widow category and 3.57 per cent of them were unmarried respectively.

In unsuccessful SHGs, majority (94.64%) of them were married, 3.57 per cent of them belonged to unmarried category and 1.79 per cent of them were in the widow category. Women tend to leave their village (home town) once they were married and as SHG is a long-term activity and leaving the group in between could affect its process. Hence, the result that most women were married members.

Family type

In successful, it is observed that 85.71 per cent of the women beneficiaries belonged to nuclear families and 14.29 per cent to joint families.

In unsuccessful, majority (82.14%) of women beneficiaries belonged to nuclear families and 17.86 per cent to joint families. The predominance of nuclear family due to realization of the advantages of nuclear families in terms of running the family, less responsibilities, privacy etc. the findings of the present study are in line with Prasad (1998) and Prita (2001).

Family size

Regarding family size of respondents of successful SHGs, it was observed that 55.37 per cent of respondents belonged to medium (4-6 members) 21.43 per cent belonged to large family (7-9 members), 14.29 per cent belonged to small (1-3 members) and 8.93 per cent belonged to very large families (> 9 members).

In unsuccessful SHGs, it was observed that 57.14 per cent of respondents belonged to medium (4-6 members) 23.21 per cent belonged to small (1-3 members), 17.86 per cent belonged to large (7-9 members) and only 1.79 per cent belonged to very large families (> 9 members). This might be due to their awareness regarding the increased cost of living and difficulties in maintenance of big family and they might have found it beneficial to have medium families to lead a better and comfortable life.

Occupation

In successful SHGs it was observed that 48.22 per cent of respondents were practicing agriculture and 32.14 per cent of the respondents practicing both (agriculture and non agriculture) and 19.64 per cent of the respondents practicing non agriculture.

In unsuccessful SHGs 39.29 per cent of the respondents were practicing agriculture followed by 33.93 per cent of them practicing non agriculture and 26.78 per cent of them practicing agriculture and non agriculture. It is mainly because of the prevalence of more number of agriculturists in the study area were marginal farmers.

Income

In successful SHGs, 57.14 per cent of beneficiaries belonged to semi medium income (Rs. 11,001-22,000) 17.86 per cent belonged to low income (up to Rs. 11,000) 16.07 per cent belonged to high income (>Rs.33,001) and only 8.93 percent of beneficiaries belonged to medium income (Rs.22.001-33,000) level.

In unsuccessful SHGs, 71.42 per cent of respondents belonged to low income (up to Rs.11,000) 25.00 per cent belonged to semi medium income (Rs.11,001-22,000) and equal percentage (1.79%) of respondents belonged to medium income (Rs.22.001-33,000) and high income (>Rs.33,001) respectively. Due to possession of some land, in addition to this their husbands were working, they had undertaken dairy activity, sheep and goat rearing as income generating activities.

Land holding

Regarding land holding of respondents of successful SHGs, it was observed that 35.71 per cent of respondents had small farms followed by 23.22 per cent of women beneficiaries were marginal farmers, 21.43 per cent of respondents were landless, equal per cent (7.14%) of members were having semi medium and big farms respectively and 5.36 per cent of members were of medium farm category.

In unsuccessful SHGs, it was observed that 50.00 per cent of respondents were belonging to marginal farmers, while 28.57 per cent of members were belonging to landless, 19.64 per cent of women beneficiaries were having small farms and 1.79 per cent of women members were belonging to small medium farm category respectively. This is due to the reason that in rural areas majority of the people still perceive that expanding agriculture by purchasing land would be the best option.

Material possession

Agriculture

It was observed in successful SHGs 64.28 per cent of members had bullock cart followed by 60.71 per cent having plough, bullocks (37.50%), seed drill (35.71%), sprayer/duster (26.78%), power tiller (7.14%) and tractor (5.35%).

In unsuccessful SHGs, majority (48.21%) of members had plough, equal percentage (14.28%) of respondents had bullock cart and bullocks respectively. Only 12.50 per cent of members had seed drill. This is due to purchasing ability of the members

Non-agriculture

It was observed in successful SHGs, that 73.21 per cent of members had radio, while 64.28 per cent of members had bicycle followed by 62.64 per cent of respondents had television and 25.00 per cent of members respondents had scooter respectively.

In unsuccessful SHGs, it was observed that 37.50 per cent of women beneficiaries had radio, 28.57 per cent of members had television, 21.43 per cent of respondents had bicycle followed by 3.57 per cent of members had scooter. Might be the reason for majority purchasing it from their loan through SHG

Organizational participation

In successful SHGs, it was observed that 100 per cent of the respondents never participated in co-operative societies or milk co-operatives, 91.07 per cent of members never participated in zilla panchayat followed by 7.14 per cent participating occasionally and 1.79 per cent regularly, 87.50% per cent of respondents never participated in village panchayat and mahila mandal followed by 7.14 per cent who participated regularly in village panchayat and 8.93 per cent in mahila mandal, 5.36 per cent participated occasionally in village panchayat followed by 3.57 per cent who participated occasionally in mahila mandal.

As in case of unsuccessful SHGs, 100 per cent of the members never participated in zilla panchayat and co-operative society or milk co-operatives, 96.43 per cent of members never participated in village panchayat, only 3.57 per cent of members participated regularly, 91.07 per cent of the members never participated in mahila mandal followed by 5.36 per cent participated occasionally and 3.57 per cent participated regularly.

These might be due to majority of respondents having low social participation. Inability of women respondents to devote their time, lack of awareness of activities of various social institutions and lack of social mobility due to family restrictions and self confidence resulted in poor organizational participation by the rural women.

Extension contact

In successful SHGs it was observed that 96.43 per cent of members never visited gram sevek, 67.86 per cent of the members never visited agricultural extension officer, 85.72 per cent of the members have never visited BDO, 37.50 per cent of the members have visited NGO functionaries regularly, 89.29 per cent of the members have never visited RSK, extension guide (100%) followed by 60.71 per cent of the members who visited regularly KVK.

In case of unsuccessful SHGs from the table it was observed that cent per cent of members never visited gram sevek, BDO, AO, RSK and extension guide. 92.86 per cent of the members never contacted AAO/AA, followed by AEO (91.07%), NGO functionaries (75.00%) only 64.29 per cent of the members visited KVK occasionally. The possible reason could be lack of interest and their ignorance.

Extension participation

The data observed from table 7 shows that in successful SHGs, it was observed that 75.00 per cent of the respondents participated in training, 71.43 per cent of respondents never participated in extension meeting, 57.14 per cent of members participated in field day regularly, 71.43 per cent of members participated in krishimela regularly. 57.14 per cent members participated in demonstrations regularly. Nearly half (42.86%) of members participated in field visit regularly. Half of the members never participated in group discussion, while 50 per cent of the respondents participated regularly in educational tour.

In unsuccessful SHGs, it was observed that 69.64 per cent of the members attended training regularly, 96.43 per cent of members never attended extension meeting, 44.64 per cent of members attended field day regularly, 37.50 per cent members participated in demonstrations regularly. 73.21 per cent of members never participated in field visit. 89.29 per cent of members never participated in group discussion, and 64.29 per cent of members never participated in educational tour.

Mass media utility

From the table 8, in successful SHGs, it was observed that 78.57 per cent of the members watched TV regularly followed by 60.71 per cent of the members who listened radio regularly, 60.72 per cent of the members have no reading habit of news papers followed by 82.14 per cent members who never read agricultural magazines followed by others (73.21%)

In unsuccessful SHGs, it was stated that 51.79 per cent of the members watched TV regularly, 57.14 per cent of the members never listened radio, 76.79 per cent of the members had no reading habit of news papers followed by agricultural magazines (87.50%) and others (82.14%). This might be due to reason that after joining SHG their social participation is increased so also the, awareness, and also interest of the respondents.

Achievement motivation

The data from table 9, in successful SHGs, 76.78 per cent of the respondents belonged to medium category of achievement motivation followed by high (16.07%) and low achievement motivation (7.15%).

In unsuccessful SHGs, 71.43 per cent of the respondents belonged to medium category of achievement motivation followed by (17.86%) low achievement motivation and high achievement motivation (10.71%). This might have resulted in the adoption of various activities as subsidiary occupation under successful and unsuccessful SHGs resulting in good returns.

Risk orientation

The data from table 10, in successful SHGs, majority of the respondents (80.36%) had fallen in medium risk orientation followed by high risk orientation (16.07%) and low risk orientation (3.57%) categories.

In unsuccessful SHGs, 60.71 per cent of the respondents belonged to medium category followed by 30.36% of the respondents to low and 8.93 per cent of the members to high category. This might be due to the risk bearing capacity of individuals depending upon the personal, psychological and socio-economic characteristics of the person.

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Table 1. Activities undertaken by the successful and unsuccessful SHG members

Sl. No	Activity	Successful SHG (n=56)		Unsuccessful SHG (n=56)		Total (n=112)	
		F	%	F	%	F	%
I	*Farm Activities*						
	Agriculture	27	48.21	22	39.28	49	43.75
	Dairy	25	44.64	15	26.79	40	35.71
	Sheep rearing	14	25.00	9	16.07	23	20.53
	Goat rearing	10	17.86	8	14.29	18	16.07
II	Non Farm Activities						
	Pickle making	1	1.79	-	-	1	0.89
	Papad making	1	1.79	-	-	1	0.89
	Bakery items	1	1.79	-	-	1	0.89
	Roti making	4	7.14	-	-	4	3.57
	Chutney making	1	1.79	-	-	1	0.89
	Vermicelli making	3	5.36	-	-	3	2.68
	Masala powder	1	1.79	-	-	1	0.89
	Flour milling	1	1.79	-	-	1	0.89
	Broom stick making	1	1.79	-	-	1	0.89
	Tailoring	4	7.14	1	1.79	5	4.46
	Bangle sale	2	3.57	1	1.79	3	2.68
	Agarbatti	4	7.14	1	1.79	5	4.46
	Soap/detergent	3	5.36	-	-	3	2.68
	Petty shop	3	5.36	1	1.79	4	3.57
	Vegetable vending	1	1.79	-	-	1	0.89
	Beauty parlour	1	3.57	-	-	1	0.89
	Flower selling	2	1.79	-	-	2	1.79
	Doll making	1	1.79	-	-	1	0.89
	Book shop	1	1.79	-	-	1	0.89
	STD shop	1	1.79	-	-	1	0.89
	Cane juice shop	1	1.79	-	-	1	0.89
	Bun sale	-	-	1	1.79	1	0.89
III	**Not undertaken activity**	2	3.57	10	17.86	12	10.71

Table 3a. Sources of fund used by the successful and unsuccessful SHG members

Sl. No.	Source	Successful SHG member{n=56}		Unsuccessful SHG member{n=56}		Total {n=112}	
		F	%	F	%	F	%
1	Bank	9	16.07	-	-	9	8.04
2	SHG	47	83.93	56	100	103	91.96
3	Money lender	-	-	-	-	-	-
	Total	56	100	56	100	112	100.00

Table 3b. Utilization of funds to different activities by members

Sl. No.	Utilization by members	Successful SHG {n=56}		Unsuccessful SHG {n=56}		Total {n=112}	
		F	%	F	%	F	%
1	Health	22	39.28	28	50	50	44.64
2	Education	18	32.14	22	39.28	40	35.71
3	House construction/repair	8	14.28	12	21.42	20	17.85
4	Agriculture activities	49	87.50	26	46.42	75	66.96
5	Social functions	9	16.07	5	8.92	14	12.50
6	Livestock	12	21.42	7	12.5	19	16.96
7	Small business	8	14.28	3	5.35	11	9.82
8	Plant protection measures	26	46.42	4	7.14	30	26.78
9	Purchase of machinery	3	5.35	-	-	3	2.67
10	Labour charges	20	35.71	5	8.92	25	22.32
11	House hold expenditure	20	35.71	37	66.07	57	50.89

Table 3. Distribution of respondents according to their socio-economic and psychological characteristics of self-help group members

Sl. No.	Particulars	Successful SHG {n=56}		Unsuccessful SHG [n=56}	
		Frequency	%	Frequency	%
1	**Age:**				
	Young (18-30)	19	33.93	16	28.57
	Middle (31-50)	36	64.28	38	67.89
	Old (>51)	1	1.79	2	3.57
2	**Education:**				
	Illiterate	3	5.36	6	10.71
	Functionally literate	22	39.29	20	35.72
	Primary school	9	16.07	8	14.29
	Middle school	8	14.28	11	19.64
	High school	6	10.71	8	14.28
	College	5	8.93	3	5.36
	Graduation	3	5.36	-	-
3	**Marital status:**				
	Married	51	91.07	53	94.64
	Unmarried	2	3.57	2	3.57
	Widow	3	5.36	1	1.79
4	**Family type:**				
	Nuclear	48	85.71	46	82.14
	Joint	8	14.29	10	17.86
5	**Family size:**				
	Small (1-3 members)	8	14.29	13	23.21
	Medium (4-6 members)	31	55.37	32	57.14
	Large (7-9 members)	12	21.43	10	17.86
	Very large (> 9 members)	5	8.93	1	1.79

6	**Occupation:**				
	Agriculture	27	48.22	22	39.29
	Non agriculture	11	19.64	19	33.93
	Both	18	32.14	15	26.78
7	**Income:**				
	Low (up to Rs.11,000)	10	17.86	40	71.42
	Semi medium (Rs.11,001-Rs.22,000)	32	57.14	14	25
	Medium (Rs.22,001-Rs.33,000)	5	8.93	1	1.79
	High income (>Rs.33,001)	9	16.07	1	1.79
8	**Land holding:**				
	Landless (nil)	12	21.43	16	28.57
	Marginal farmers (upto 2.5 acres)	13	23.22	28	50
	Small (2.51-5.00 acres)	20	35.71	11	19.64
	Semi medium (5.01-10.00 acres)	4	7.14	1	1.79
	Medium (10.01-25.00 acres)	3	5.36	-	-
	Big (>25.01 acres)	4	7.14	-	-

Table 4. Distribution of respondents according to material possession

Sl.No	Particulars	Successful SHG (n=56)		Unsuccessful SHG (n=56)	
		Frequency	%	Frequency	%
I	**Agriculture**				
	Bullock cart	36	64.28	8	14.28
	Bullocks	21	37.50	8	14.28
	Plough	34	60.71	27	48.21
	Seed drill	20	35.71	7	12.50
	Power tiller	4	7.14	-	-
	Tractor	3	5.35	-	-
	Sprayer/Duster	15	26.78	-	-
II	**Non Agriculture**				
	Radio	41	73.21	21	37.50
	Television	39	62.64	16	28.57
	Scooter	14	25	2	3.57
	Bicycle	36	64.28	12	21.43

Table 9. Distribution of respondents according to achievement motivation

Categories	Successful SHG(n=56)		Unsuccessful SHG(n=56)	
	F	%	F	%
Low (Up to 16)	4	7.15	10	17.86
Medium (17-24)	43	76.78	40	71.43
High (Above 24)	9	16.07	6	10.71

Table 10. Distribution of respondents according to risk orientation

Categories	Successful SHG(n=56		Unsuccessful SHG(n=56	
	F	%	F	%
Low (< X – 0.5 S.D)	2	3.57	17	30.36
Medium (< X – 0.5 S.D to X + 0.5 S.D)	45	80.36	34	60.71
High (> X + 0.5 S.D)	9	16.07	5	8.93

Table 2. Priority given by the members of successful and unsuccessful SHGs

Sl. No.	Activity	Successful SHG				Unsuccessful SHG			
		I	II	III	Weightage	I	II	III	Weightage
		F (%)	F %	F (%)		F(%)	F (%)	F(%)	
1	**Farm activities**								
	Agriculture	15 (26.78)	11 (19.64)	1(1.79)	68	8 (14.28)	11 (19.64)	3 (5.36)	49
	Dairy	19 (33.93)	6 (10.71)	-	69	12 (21.43)	3 (5.36)	-	63
	Sheep rearing	3 (5.36)	9 (16.07)	2 (3.57)	29	-	3 (5.36)	6 (10.71)	12
	Goat rearing	-	8 (14.28)	2 (3.57)	18	-	3 (5.36)	5 (8.92)	11
2	**Non farm activities**								
	Pickle making	1 (1.79)	-	-	3	-	-	-	-
	Papad making	1 (1.79)	-	-	3	-	-	-	-
	Bakery products	1 (1.79)	-	-	3	-	-	-	-
	Chutney powder	1 (1.79)	-	-	3	-	-	-	-
	Vermicelli	2 (3.57)	1 (1.79)	-	8	-	-	-	-
	Masala powder	1 (1.79)	-	-	3	-	-	-	-
	Broom stick	-	-	1 (1.79)	1	-	-	-	-
	Tailoring	3 (5.36)	1 (1.79)	-	11	1 (1.79)	-	-	3
	Bangle sale	-	1 (1.79)	-	2	-	1 (1.79)	-	2
	Agarbatti	1 (1.79)	-	-	3	1 (1.79)	-	-	3
	Soap/detergent	1 (1.79)	-	-	3	-	-	-	-
	Petty shop	3 (5.36)	-	-	9	-	1 (1.79)	-	2
	Vegetable vending	1 (1.79)	-	-	3	-	-	-	-
	Beauty parlour	1 (1.79)	-	-	3	-	-	-	-
	Flower selling	1 (1.79)	1 (1.79)	-	5	-	-	-	-
	Doll making	1 (1.79)	-	-	3	-	-	-	-
	Book shop	1 (1.79)	-	-	3	-	-	-	-
	STD shop	1 (1.79)	-	-	3	-	-	-	-
	Cane juice shop	1 (1.79)	-	-	3	-	-	-	-
	Roti	1 (1.79)	2 (3.57)	1 (1.79)	8	-	-	-	-
	Flour milling	1 (1.79)	-	-	3	-	-	-	-
	Bun sale	1 (1.79)	-	-	3	-	-	-	-

Table 1. Details of different products prepared by SHG members

Sl. No.	Entrepreneurial activities under taken	Location	Persons responsible for production	Quantity of product produced in (kg)	No. of labours	Wages/ day Rs.	Income earned Rs./month
1	Pickle (1)	SHG members house	Family members	20 kg/month	-	-	720
2	Papad (1)	SHGmembers house	Family members	20 kg/month	-	-	800
3	Bakery products (1)	Own shop	Family members labours	30-35 kg/ month	1	50/day	2500
4	Roti (4)	Own house	Labours	21,000 pieces/month	10	20/day	13125
5	Shavige (1) Shavige (2)	Rent house Own house	SHG member SHG member	750 kg/ month 135 kg+ 65 kg/ month	4 4	20	1401 996
6	Chutney powder(1)	Own house	SHG members	60 kg/month	2	20	1200
7	Agarbatti(5)	Own house	Family members	15 kg/month	-	-	400
8	Soap/ Detergents powder(3)	Own house	SHG members	45 kg/ month	2	20	1955
9	Broom stick(1)	Own house	Family members	1500 pieces	1	25	7500/ for two seasons
10	Bun sale(1)	Own house	-	60 pockets of 4 buns	-	-	250
11	Vegetable vending(1)	Own shop	-	150 kg/ month	-	-	860
12	Doll making(1)	Own house	Herself	15 dolls/month	-	-	756
13	Biscuit preparation(1)	Own house	Family members	65 kg/month	1	20	1108
14	Masala powder(1)	Own house	Family members + labours	25 kg/month	1	20	700

Table 2. Details of marketing of products undertaken by SHG members

Sl. No.	Entrepreneurial activities under taken	Mode of marketing	Quantity sold (kg)	Duration /period	Persons responsible for marketing	Income earned Rs./month
1	Pickle (1)	Wholesaler, local market, bazars, exhibitions	20 kg/month	Daily, weekly	self	720
2	Papad (1)	Wholesaler, local market, bazars, exhibitions	20 kg/month	Daily, weekly, monthly	self	800
3	Bakery products(1)	Own shop	30-35 kg/ month	Daily, weekly, monthly	self	2500
4	Roti (4)	Wholesaler, local market, bazars, exhibitions	21000 pieces/ month	Daily, weekly	self	13125
5	Shavige (1) Shavige (2)	On the spot, bazars, exhibitions, local market On the spot, bazars, exhibitions, local market	750 kg/month 135 kg+ 65 kg/ month	Daily, weekly, monthly, seasonally	self self	2397
6	Chutney powder(1)	Wholesale, bazars, exhibitions	60 kg/month	Weekly	self	1200
7	Agarbatti(5)	Own shop, bazars	15 kg/month	Daily, weekly	self	400
8	Soap/ Detergents powder(3)	Own shop, bazars	45 kg/ month	Daily, weekly	self	1755
9	Broom stick(1)	Wholesaler	1500 pieces	Seasonally	KVK	7500/ for two seasons
10	Bun sale(1)	Wholesaler	60 pockets of 4 buns	Weekly	self	250
11	Vegetable vending(1)	Own shop, bazar	150 kg/month	Daily, weekly	self	860
12	Bangle sale(3)	Own house, bazar	30-35 dozen/month	Daily, seasonally	self	225
13	Doll sale(1)	Local market	15 dolls/month	Monthly	self	756

Table 5. Distribution of successful and unsuccessful respondents according to their organizational participation

Sl. No.	Particulars	Successful SHG (n=56)						Unsuccessful SHG (n=56)						Total (n=112)					
		Regular		Occasionally		Never		Regular		Occasionally		Never		Regular		Occasionally		Never	
		F	%	F	%	F	%	F	%	F	%	F	%	F	%	F	%	F	%
1	Village panchayat	4	7.14	3	5.36	49	87.5	2	3.57	-	-	54	96.43	6	5.35	3	2.68	103	91.97
2	Co-operative society – milk co-operatives	-	-	-	-	56	100	-	-	-	-	56	100	-	-	-	-	112	100
3	Mahila mandal	5	8.93	2	3.57	49	87.5	2	3.57	3	5.36	51	91.07	7	6.25	5	4.46	100	89.29
4	Zilla panchayat	1	1.79	4	7.14	51	91.07	-	-	-	-	56	100	1	0.89	4	3.57	107	95.54

Table 6. Distribution of respondents according to their extension contact

Extension contact	Successful SHG (n=56)						Unsuccessful SHG (n=56)						Total (n=112)					
	Regular		Occasionally		Never		Regular		Occasionally		Never		Regular		Occasionally		Never	
	F	%	F	%	F	%	F	%	F	%	F	%	F	%	F	%	F	%
Gram sevak	2	3.57	-	-	54	96.43	-	-	-	-	56	100	2	1.79	-	-	110	98.21
AEO	14	25	4	7.14	38	67.86	-	-	5	8.93	51	91.07	14	12.50	9	8.03	89	79.47
BDO	4	7.14	4	7.14	48	85.72	-	-	-	-	56	100	4	3.57	4	3.57	104	92.86
AO	6	10.71	4	7.14	46	82.15	-	-	-	-	56	100	6	5.36	4	3.57	102	91.07
AAO/AA	-	-	-	-	56	100	-	-	4	7.14	52	92.86	-	-	4	3.57	108	96.43
NGO functionaries	21	37.5	18	32.14	17	30.36	14	25	-	-	42	75	35	31.25	18	16.07	59	52.68
RSK	6	10.71	-	-	50	89.29	-	-	-	-	56	100	6	5.36	-	-	106	94.64
Extension guide	-	-	-	-	56	100	-	-	-	-	56	100	-	-	-	-	112	100
KVK	34	60.71	22	39.29	-	-	20	35.71	36	64.29	-	-	54	48.21	58	51.79	-	-

Table 7. Distribution of respondents according to their extension participation

Extension participation	Successful SHG (n=56)						Unsuccessful SHG (n=56)						Total (n=112)					
	Regular		Occasionally		Never		Regular		Occasionally		Never		Regular		Occasionally		Never	
	F	%	F	%	F	%	F	%	F	%	F	%	F	%	F	%	F	%
Training	42	75	14	25	-	-	39	69.64	15	26.79	2	3.6	81	72.32	29	25.89	2	1.79
Extension meeting	12	21.43	4	7.14	40	71.43	2	3.57	-	-	54	96.43	14	12.50	4	3.57	94	83.93
Field day	32	57.14	18	32.14	6	10.72	25	44.64	11	19.64	20	35.72	57	50.89	29	25.89	26	23.22
Krishimela	40	71.43	16	28.57	-	-	38	67.86	18	32.14	-	-	78	69.64	34	30.36	-	-
Demonstrations	32	57.14	14	25	10	17.86	21	37.5	20	35.71	15	26.79	53	47.32	34	30.36	25	22.32
Field visit	24	42.86	12	21.43	20	35.71	10	17.86	5	8.93	41	73.21	34	30.37	17	15.17	61	54.46
Group discussion	18	32.14	10	17.86	28	50.00	6	10.71	-	-	50	89.29	24	21.43	10	8.93	78	69.64
Educational tour	28	50	11	19.64	17	30.36	4	7.14	16	28.57	36	64.29	32	28.57	27	24.11	53	47.32

Table 8. Distribution of respondents according to their mass media utility

Particulars	Mass media utility																	
	Successful SHG (n=56)						Unsuccessful SHG (n=56)						Total (n=112)					
	Regular		Occasionally		Never		Regular		Occasionally		Never		Regular		Occasionally		Never	
	F	%	F	%	F	%	F	%	F	%	F	%	F	%	F	%	F	%
TV	44	78.57	8	14.29	4	7.14	29	51.79	17	30.35	10	17.86	73	65.18	25	22.32	14	12.50
Radio	34	60.71	10	17.86	12	21.43	15	26.79	9	16.07	32	57.14	49	43.75	19	16.96	44	39.29
News papers	14	25	8	14.28	34	60.72	9	16.07	4	7.14	43	76.79	23	20.54	12	10.71	77	68.75
Agricultural magazines	10	17.86	-	-	46	82.14	5	8.93	2	3.57	49	87.50	15	13.39	2	1.79	95	84.82
Others	15	26.79	-	-	41	73.21	7	12.5	3	5.36	46	82.14	22	19.64	3	2.68	87	77.68

A STUDY ON ACTIVITIES UNDERTAKEN AND FUND UTILIZATION PATTERN BY SUCCESSFUL AND UNSUCCESSFUL SHGS

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Introduction

India is a country with vast population having persisting unemployment problem. In rural areas the poor are dependent on money lenders for their financial needs, either for marriage, illness or any other emergency need in the family. Money lenders always exploit the situation. The formal credit system of banks by and large is beyond the reach of the poor, so rural employment generation is the greatest challenge for our country. Government has to make the rural people to realize that Self-help groups (SHGs) are the main medium for rural employment generation. Encouragement and support by the government will solve the problem of rural unemployment which can be achieved by realizing the need for rural employment through SHGs.

The role played by Self Help Groups in the field of empowering women particularly in the rural areas is being recognized. In India, there is a silent revolution made by the SHGs to uplift the economic condition and empowerment of women. The SHGs are characterized in empowerment of women through focusing attention on women below the poverty line to provide self employment by imparting training in different activities and improving the available local skills, improving the status of women in the family as well as in the society, creating better awareness in health, education and environment among rural people, promoting and ensuring human rights of women at all stages of their life. It offers not only economic opportunities but also a change to learn new skills, make wider social contacts and experience. It creates an environment through positive economic and social policies for full development of women to enable them to realize their full potential. Thus the SHGs certainly play an important role in women empowerment. Since the overall empowerment of women is crucially dependent on economic empowerment, these SHGs could generate income and employment to build their empowerment. To analyze the various activities undertaken and fund utilization pattern following the study was design with the following objectives.

Objectives

1) To understand the various activities undertaken, and priority given by members of successful and unsuccessful SHGs.
2) To study the fund utilization pattern of successful and unsuccessful SHGs.

Material and methods

An Ex-post facto research design was used for the present study, the investigation was carried out in two villages i.e., Hulkoti and Hombla villages of Gadag district, Karnataka state, from these villages eight successful and eight unsuccessful SHGs were selected for study, based on highest number of SHGs operating in two villages. The collected data were scored, tabulated and analyzed using appropriate statistical tools *viz.*, frequency and percentage.

Results and Discussion

Income generating activities adopted by successful and unsuccessful SHGs

The data in table (1) revealed the different income generating activities adopted by members as farm activities, non farm activities and members who have not undertaken any activity. The total number of members exceeds the sample number as a member might have more than one income generating activity.

Farm activities

The data in table (1) reveals that 43.75 per cent of SHG members had undertaking agriculture as main activity, 35.71 percentage of SHG members adopted dairy enterprise followed by 20.53 and 16.07 per cent of SHG members adopted sheep and goat rearing respectively. The major income generating activities adopted were agriculture and dairy. This might be due to the fact that they were having marginal farm, up to 2.5 acres of land and also it being inherited from forefathers and mainly they depended on agriculture for livelihood.

In successful SHGs, it was observed that 48.21 per cent of members were under taking agriculture followed by dairy (44.64%), sheep (25.00%) and goat (17.86%) rearing respectively.

In unsuccessful SHGs, it was observed that 39.28 per cent of members were undertaking agricultural enterprises followed by dairy (26.79%), sheep (16.07%) and goat (14.29%) rearing respectively.

Non-farm activities

The information in table (1) indicates that equal per cent of SHG members were undertaking agarbatti and tailoring (4.46% each) enterprises followed by petty shop and roti making (3.57% each), soap/detergent, bangle sale and vermicelli making (2.68% each), flower selling (1.79%) followed by pickle making, papad making, bakery items, chutney powder making, masala powder, flour milling, broom stick making, vegetable vending, beauty parlour, doll making, book shop, STD shop, cane juice shop and bun sale (0.89% each respectively). The possible reasons for taking up dairy, sheep and goat rearing may be due to the predominant nature of dry land agriculture in the study area and the dairy being the complementary activity to agriculture, the small and marginal farmers and agricultural labours tend to have one/two dairy animals to support the farming and as livelihood activity. Also, the agricultural labours and other landless people keep sheep and goats for their livelihood. Hence, these activities were

traditionally known to people. Also, these are remunerative and give better profits as compared to other activities.

In successful SHGs, it was observed that equal per cent of members were undertaking roti making, tailoring and agarbatti making (7.14% each) followed by petty shop, vermicelli making, soap/detergent (5.36%), flower selling and bangle sale (3.57%), pickle making, papad making, bakery items, chutney powder making, masala powder, flour milling, broom stick making, vegetable vending, beauty parlour, doll making, book shop, STD shop cane juice shop (1.79% each respectively).

In unsuccessful SHGs, it was observed that SHG members were undertaking income generating activities like tailoring, bangle sale, agarbatti, petty shop and bun sale (1.79% each respectively).

Members not undertaken any activity

The data in table (1) revealed that 10.71 per cent of SHG members had not undertaken any activity.

Priority given by the successful and unsuccessful SHG members

Farm activities

The information provided in table (2) reveals that in successful SHGs, it was observed that nearly 48.21% of the SHG members were undertaking agriculture enterprise as main activity, in that, 26.78 per cent of the members had given first priority followed by 19.64 per cent with second priority and 1.79 per cent third priority. Dairy was followed by 44.64 per cent of the members in that 33.93 per cent of them gave first priority and remaining 10.71 per cent gave second priority. Sheep rearing was practiced by 25 per cent of the members among that 5.36 per cent of members gave first priority, 16.07 per cent second priority and 3.57 per cent third priority. Regarding goat rearing 17.85 per cent of members were practicing, in that, 14.28 per cent gave second priority followed by 3.57 per cent third priority. Based on the weightage worked out the top three income generating activities in farm activities were dairy, agriculture and sheep rearing in that order.

This might be due to predominant nature of dryland agriculture in the study area and dairy being the complementary activity to agriculture, the small and marginal farmers and agricultural labours tend to have one or two dairy animals to support the farming and as livelihood activity. Also agricultural labours and landless people keep sheep rearing for their livelihood. Hence, these activities were known to people. Also, these are remunerative and give better profits as compared to other activities.

In unsuccessful SHGs, 39.28 per cent of the members practiced agriculture, in that, 14.28 per cent of the members gave first priority followed by 19.64 per cent with second priority and 5.36 per cent with third priority. Dairy was practiced by 26.79 per cent of the members, wherein, 21.43 per cent gave first priority followed by 5.36 per cent second priority. Sheep rearing was undertaken by 16.07 per cent of the members among them 5.36 per cent gave second priority and 10.71 per cent of members gave third priority. Goat rearing was undertaken by 14.28 per cent of the members, wherein 5.36 per cent of members gave second priority and 8.92 per cent of the members gave third priority. Based on the weightage worked out the top three income generating activities for unsuccessful SHGs were dairy, agriculture and sheep rearing in that order.

Non-farm activities

In successful SHGs, except bangle sale and broom stick the members had given first priority while broomstick was given third priority practiced by a member and bangle sale and petty shop II priority by one member in each of the income generating activities practiced by the members.

In unsuccessful SHGs, members had given first priority to tailoring and agarbatti, followed by bangle sale and petty shop with second priority by the members practicing them.

This might be due to most of the women practiced traditional jobs which were suitable to the local conditions and for which raw materials were available with in the village itself and training and exposure on above activities by the NGO as well as the encouragement from the family and personal desire. Also, these activities could be done at leisure in their home and are remunerative. In unsuccessful SHGs members had given first priority to tailoring and agarabatti making.

Fund utilization pattern of successful and unsuccessful SHGs

It is clear from table (3a) that majority (91.96%) of the respondents borrowed money from SHG only, followed by only 8.04 per cent of the respondents who borrowed money from bank, nobody borrowed money from money lenders. since they were house wives, they will be having more responsibility in running family and looking after daily household expenditure. This is due to the reason that they are getting money with low interest rate and no time bound to repay.

In successful SHGs it was observed that 83.93 per cent of the respondents borrowed money from SHG followed by 16.07 per cent of the respondents who borrowed money from bank In unsuccessful SHGs cent per cent of the members borrowed money from SHG only.

It can be seen in table (3b) that the respondents utilized loans to different activities. The activities include agriculture (66.96%) and house hold expenditure (50.89%) and 44.64 per cent of them spent on health care, 35.71 per cent of them revealed that a part of the loan was utilized for educating their children followed by plant protection measures (26.78%), labour charges (22.32%), house construction or repair (17.85%), livestock (16.96%) social functions (12.50%), small business (9.82%) and purchase of machineries (2.67%) respectively. Agriculture being the primary occupation in the study area they are using their profit on weeding, for pur-

chasing seeds and fertilizers, ploughing etc.

In successful SHGs it was observed that majority of the members (87.50%) were using fund on agricultural activities followed by plant protection (46.42%), health (39.28%) and equal per cent on labour charges and house hold expenditure (35.71% each), and for education (32.14%).

In unsuccessful SHGs, majority of the respondents were using their loan on house hold expenditure (66.07%) followed by health (50%), agricultural activities (46.42%), education (39.28%) and house construction/repair (21.42%). Since they were house wives, they will be having more responsibility in running family and looking after daily household expenditure.

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Table 1. Activities undertaken by the successful and unsuccessful SHG members

Sl. No	Activity	Successful SHG (n=56)		Unsuccessful SHG (n=56)		Total (n=112)	
		F	%	F	%	F	%
I	*Farm Activities*						
	Agriculture	27	48.21	22	39.28	49	43.75
	Dairy	25	44.64	15	26.79	40	35.71
	Sheep rearing	14	25.00	9	16.07	23	20.53
	Goat rearing	10	17.86	8	14.29	18	16.07
II	*Non Farm Activities*						
	Pickle making	1	1.79	-	-	1	0.89
	Papad making	1	1.79	-	-	1	0.89
	Bakery items	1	1.79	-	-	1	0.89
	Roti making	4	7.14	-	-	4	3.57
	Chutney making	1	1.79	-	-	1	0.89
	Vermicelli making	3	5.36	-	-	3	2.68
	Masala powder	1	1.79	-	-	1	0.89
	Flour milling	1	1.79	-	-	1	0.89
	Broom stick making	1	1.79	-	-	1	0.89
	Tailoring	4	7.14	1	1.79	5	4.46
	Bangle sale	2	3.57	1	1.79	3	2.68
	Agarbatti	4	7.14	1	1.79	5	4.46
	Soap/detergent	3	5.36	-	-	3	2.68
	Petty shop	3	5.36	1	1.79	4	3.57
	Vegetable vending	1	1.79	-	-	1	0.89
	Beauty parlour	1	3.57	-	-	1	0.89
	Flower selling	2	1.79	-	-	2	1.79
	Doll making	1	1.79	-	-	1	0.89
	Book shop	1	1.79	-	-	1	0.89
	STD shop	1	1.79	-	-	1	0.89
	Cane juice shop	1	1.79	-	-	1	0.89
	Bun sale	-	-	1	1.79	1	0.89
III	**Not undertaken activity**	2	3.57	10	17.86	12	10.71

Table 3a. Sources of fund used by the successful and unsuccessful SHG members

Sl. No.	Source	Successful SHG member{n=56}		Unsuccessful SHG member{n=56}		Total {n=112}	
		F	%	F	%	F	%
1	Bank	9	16.07	-	-	9	8.04
2	SHG	47	83.93	56	100	103	91.96
3	Money lender	-	-	-	-	-	-
	Total	56	100	56	100	112	100.00

Table 3b. Utilization of funds to different activities by members

Sl. No.	Utilization by members	Successful SHG {n=56}		Unsuccessful SHG {n=56}		Total {n=112}	
		F	%	F	%	F	%
1	Health	22	39.28	28	50	50	44.64
2	Education	18	32.14	22	39.28	40	35.71
3	House construction/repair	8	14.28	12	21.42	20	17.85
4	Agriculture activities	49	87.50	26	46.42	75	66.96
5	Social functions	9	16.07	5	8.92	14	12.50
6	Livestock	12	21.42	7	12.5	19	16.96
7	Small business	8	14.28	3	5.35	11	9.82
8	Plant protection measures	26	46.42	4	7.14	30	26.78
9	Purchase of machinery	3	5.35	-	-	3	2.67
10	Labour charges	20	35.71	5	8.92	25	22.32
11	House hold expenditure	20	35.71	37	66.07	57	50.89

Table 3. Distribution of respondents according to their socio-economic and psychological characteristics of self-help group members

Sl. No.	Particulars	Successful SHG {n=56}		Unsuccessful SHG [n=56}	
		Frequency	%	Frequency	%
1	**Age:**				
	Young (18-30)	19	33.93	16	28.57
	Middle (31-50)	36	64.28	38	67.89
	Old (>51)	1	1.79	2	3.57
2	**Education:**				
	Illiterate	3	5.36	6	10.71
	Functionally literate	22	39.29	20	35.72
	Primary school	9	16.07	8	14.29
	Middle school	8	14.28	11	19.64
	High school	6	10.71	8	14.28
	College	5	8.93	3	5.36
	Graduation	3	5.36	-	-
3	**Marital status:**				
	Married	51	91.07	53	94.64
	Unmarried	2	3.57	2	3.57
	Widow	3	5.36	1	1.79
4	**Family type:**				
	Nuclear	48	85.71	46	82.14
	Joint	8	14.29	10	17.86
5	**Family size:**				
	Small (1-3 members)	8	14.29	13	23.21
	Medium (4-6 members)	31	55.37	32	57.14
	Large (7-9 members)	12	21.43	10	17.86
	Very large (> 9 members)	5	8.93	1	1.79

6	**Occupation:**				
	Agriculture	27	48.22	22	39.29
	Non agriculture	11	19.64	19	33.93
	Both	18	32.14	15	26.78
7	**Income:**				
	Low (up to Rs.11,000)	10	17.86	40	71.42
	Semi medium (Rs.11,001 - Rs.22,000)	32	57.14	14	25
	Medium (Rs.22,001 - Rs.33,000)	5	8.93	1	1.79
	High income (>Rs.33,001)	9	16.07	1	1.79
8	**Land holding:**				
	Landless (nil)	12	21.43	16	28.57
	Marginal farmers (upto 2.5 acres)	13	23.22	28	50
	Small (2.51-5.00 acres)	20	35.71	11	19.64
	Semi medium (5.01-10.00 acres)	4	7.14	1	1.79
	Medium (10.01-25.00 acres)	3	5.36	-	-
	Big (>25.01 acres)	4	7.14	-	-

Optimization of Financial Resources for IT Industry Through Goal Programming

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Introduction

The company recognizes that to achieve its ambitious long and short run objectives effectively and efficiently, it must be both a planning and a learning organization. The Corporate Management Division is responsible for business and fiscal planning, budgetary control and for ensuring the company's corporate information technology. Which are met in a coordinated and cost effective manner. The information management and technology Branch is responsible for the design, planning, development, implementation and maintenance of information management and technology in support of company core business. Information management services include: the provision of strategic advice on application design, planning development of polices and standards, user education and maintenance of company systems.

Corporate planning has taken center-stage across boardrooms around the world. The term applies to all aspects of a business. Given the fact that technology is expected to play a key role in helping organizations to achieve their business objectives, it is imperative to discuss the role of corporate governance over technology. IT strategy includes planning for technology obsolescence. Technology that is inadequate for the enterprise or becomes obsolete too soon is a growing concern. This has an adverse effect on productivity, cost efficiency as well as on security. Technology is changing at a rapid pace and unless organizations constantly upgrade their IT infrastructure, their business will suffer.

To align IT strategy with corporate strategy, you need to possess a corporate strategy in the first place. The existence of powerful IT tools, like customer databases, may influence the choice of strategy. But management still has to formulate overall objectives, to define the ends for which IT will provide the means. And the number of companies with clearly envisaged, robust strategies is astonishingly small, even at the top end of the corporate spectrum.

Risk management is a critical component of corporate planning and it helps organizations recognize the wide spectrum of risks that they are exposed to. It aims to help them prioritize risks based on their potential impact, put mitigation plans in place and monitor them so that they don't become hurdles in achieving corporate objectives. Information technology is a key support function in any business and regulation which requires requires the board and the management to report key risks and their assessment of how these risks are being managed.

The conventional linear programming model becomes less advocate to handle the corporate planning problem because it is developed to handle a single goal in the objective function. Thus the complexity of the problem resulting from the multiple roles of the modern corporate industry can better

be explain through of a multiple objective decision model like Goal Programming. **Aouni et al. [2005]** have discussed decision makers preferences by using stochastic Goal Programming. **Bell et al. [2003]** have used the multi-criteria decision making methods for IA practitioners. **Beuthe et al. [2000]** were worked on accessing risky public investments using multi-criteria decision – making methods. **Gao et al. [2003]** have developed the multi-objective model for bulk-raw materials of large scale integrated steel plant. **Joubert et al. [2004], Kosmidou et al. [2006], Kraft et al. [2006], Yevseyeva et al. [2005]** were developed the multi-objective Goal Programming models in their areas of application adopted. This paper presents optimum solutions to the financial decisions of the INFOSYS, India, given the INFOSYSbasic financial constraints, legal obligations and the long and short-run goals of the management.

Data of the Problem

In order to demonstrate the application of Goal Programming (GP) to top management level, financial planning data were obtained from INFOSYS. Infosys is the No.1 provider of integrated business, technology and process solutions on a global delivery platform. INFOSYS is a global services provider delivering technology-driven business solutions that meet the strategic objectives of our clients. INFOSYS has 40+ 'Centers of Excellence' that create solutions around specific needs of industries. INFOSYS delivers unmatched business value to customers through a combination of process excellence, quality frameworks and service delivery innovation. INFOSYS is the World's first CMMI Level 5 certified software services company from last 28 years. The total number of employees was 65,000 and 584 clients as of March 31,2008.

The Relevant Information Is Given In The Following Table 1.

Table 1: Revenue and Expenditure Variables

Revenue 2008 (in millions)

	Constants or Variables	Assumed Value
Electricity Revenue	A_1X_1	–
Rate per KWH	X_1	–
Estimated Demand	A_1	Rs.42,356,417
Minimum or Maximum Desired Rate	A_{12}	5.02/KWH
Gas Revenue	A_2X_2	–
Rate per MCF	X_2	–
Estimated Demand (MCF)	A_2	6,11,698
Minimum or Maximum Desired Rate	A_{13}	21.32/MCF
Non-Operating Revenue	A_3	Rs.6,215,698
Depreciation	A_4	Rs.8,667,521
Amortization	A_5	6.4
Construction Funds		
Bond Fund	X_3	–
Assumed Upper Limit	A_6	0.0
Improvement & Contingency Fund	X_4	–
Ratio to Earned Revenue	A_7	13.1%
Contribution From Customers	A_8	Rs.2,167
Salvage	A_9	596
Mutual Funds	A_{10}	86.20
Antitrust	A_{11}	88.69
Expenses 2007		
	Constants or Variables	Assumed Value
Bond Retirement	B_1	Rs.54,213
Interest Payment	B_2	9,215
Operating Expenses	B_3	8,516,720
Payroll & Employee Benefits	B_4	2,123,157

Technical Improvement	X_5	–
Desired ratio to earned revenue	B_5	0.007
Payments to the Stockholders – Preliminary	B_6C_1	–
Ratio of Payments to Total Assets	B_6	0.0210
Payments to the Stockholders – Final	X_6	–
Ratio of Payments to Earned Revenue	B_7	0.22
Construction	X_7	–
Desired Construction	B_8	Rs.9,456,672
Bond Reserve Fund	B_9	4,123
Interest Reserve Fund	B_{10}	3,245
Beginning and Ending Balances		
Total Assets at the Beginning of the Year	C_1	Rs.68,964.12
Beginning Balance	C_2	5670.76
Ratio of Surplus to Total Assets to Lower Rates	C_3	0.31

GOAL PROGRAMMING MODEL

Priority Structure for Management Goals

P_1 = The first priority of the firm's top management, to avoid issuing any new bonds in 2007. The issued bonds in 2008, and there is no mood among the stockholders to consider new bonds. Therefore, P_1 is to be assigned to d_7^- and d_7^+

P_2 = The second goal of the management, to meet the current operating and payroll expenses, as well as payments of the bond principal, interest, and reserve fund expenses. However, management feels that the payment of operating and payroll expenses is twice as important as paying other expenses. Hence, $2P_2$ is assigned to d_1^- and P_2 is assigned to d_2^-

P_3 = The third priority of the management, to provide the payments to the city. $2P_3$ is assigned to d_3^- (preliminary payments) and P_3 to d_5^+ (overachievement of the final payment to the city).

P_4 = The fourth priority factor, the avoidance of a shortage in the I & C fund. P_4, therefore, is assigned to d_{11}^-

P_5 = The fifth priority of the management, to secure desired funds for technological improvements of the firm's operation. Hence, P_5 is assigned to d_{10}^-

P_6 = The sixth goal, to secure a desirable amount of funds for continuous construction projects. $2P_6$ is assigned to d_{12}^- to ensure that construction not going under the desired level, which is based on the bond and I & C funds. Then P_6 is assigned to d_{13}^-

P_7 = The last goal of the management, at least to maintain the current electricity and gas service rates. Therefore, P_7 is assigned to d_8^- and d_9^-

The Goal Constraints are Developed as Follows:

G1: Operating Expenses and Payroll

[Electricity revenue + Gas revenue + Bond fund + Beginning balance + Non-operating revenue + Depreciation + Contribution from customers + Salvage + Mutual funds + Antitrust funds] – (Operating expenses + Payroll & Employee benefits] ≥ 0

$[A_1X_1 + A_2X_2 + X_3 + C_2 + A_3 + A_4 + A_5 + A_8 + A_9 + A_{10} + A_{11} - B_3 + B_4] \geq 0$

$[42,356,417X_1 + 507,894X_2 + 0X_3 + 5670.76 + 6,215,698 + 8,667,521 + 6.4 + 2,167 + 596 + 86.20 + 58.0) - 8,516,720 + 2,123,157 \geq 0$ or

$42,356,417X_1 + 507,894X_2 \; d_1^- - d_1^+ = 21,509.0$

G2: Payment of Principal, Interest And Reserve Funds

[Electricity revenue + Gas revenue + Bond fund + Beginning balance + Non-operating revenue + Depreciation + Amortization + Contribution from customers + Salvage + Mutual funds + Antitrust funds] – [Bond retirement + Interest payment + Operating expenses + Payroll and Employee benefits + Bond reserve fund + Interest reserve fund] ≥ 0

$[A_1X_1 + A_2X_2 + X_3 + C_2 + A_3 + A_4 + A_5 + A_8 + A_9 + A_{10} + A_{11}] - [B_1 + B_2 + B_3 + B_4 + B_9 + B_{10}] \geq 0$

$[\$42,356,417X_1 + 507,894X_2 + 0X_3 + 567076 + 5252357 + 7599478 + 6.4 + 1616.26 + 596 + 86.20 + 58.0] - [49169 + 5767 + 7537920 + 1179855 + 4,123 + 3,245 \geq 0$ or

$42,356,417X_1 + 507,894X_2 - d_2^- - d_2^+ = 27,240.2$

G3: Preliminary Payment to I & C Fund

[Electricity revenue + Gas revenue + Bond fund + Beginning balance + Non-operating revenue + Depreciation + Amortization + Contribution from customers + Salvage + Mutual funds + Antitrust funds] – [Bond retirement + Interest payment + Operating expenses + Payroll and Employee benefits + Bond reserve fund + Interest revenue fund + Preliminary payments to the stockholders] ≥ 0

$[A_1X_1 + A_2X_2 + X_3 + C_2 + A_3 + A_4 + A_5 + A_8 + A_9 + A_{10} + A_{11}] - [B_1 + B_2 + B_3 + B_4 + B_9 + B_{10} + B_6C_1] \geq 0,$

$[42,356,417X_1 + 507,894X_2 + 0X_3 + 567076 + 5252357 + 7599478 + 6.4 + 1616.26 + 596 + 86.20 + 58.0] - [49169 + 5767 + 7537920 + 1179855 + 4,123 + 3,245 + 0.0210\,(72075.11] \geq 0$ or

$42,356,417\,X_1 + 507,894\,X_2 + d_3^- - d_3^+ = 34,231.5$

G4: Preliminary Payments to The Stockholders

[Electricity revenue + Gas revenue + Non-operating revenue] – [Bond retirement + Interest payment + Operating expenses + Payroll and Employee benefits + Bond reserve fund + Interest reserve fund + Preliminary payments to the stockholders + Ratio of I & C fund to earned revenue [Electricity revenue + Gas revenue + Non-operating reven ue]] $\geq$ 0

$[A_1X_1 + A_2X_2 + A_3] - [B_1 + B_2 + B_3 + B_4 + B_9 + B_{10} + B_6C_1 + A_7 [[A_1X_1 + A_2X_2 + A_3]] \geq 0,$

$[42,356,417\,X_1 + 507,894\,X_2 + 5252357] - [49169 + 5767 + 7537920 + 1179855 + 4,123 + 3,245 + 0.0210\,[72075.11] + 0.125\,[42,356,417\,X_1 + 507,894\,X_2 + 5252357] \geq 0$ or

$39710872.575\,X_1 + 571380.75\,X_2\, d_4^- - d_4^+ = 51,375.1$

G5: Final Payments to the Stockholders

[Final payments to the stockholders + Preliminary payments to the stockholders] $\geq$ Ratio of stockholders payments to earned revenue]

$X_6 + B_6C_1 \geq [A_1X_1 + A_2X_2 + A_3]$

$X_6 + 0.0210\,[72075.11] \geq 0.22\,[42,356,417\,X_1 + 507,894\,X_2 + 5252357]$, or

$494797.42\,X_1 + 71105.16\,X_2 - X_6 + d_5^- - d_5^+ = 6,672.8$

G6: Breakeven Constraint

[Electricity revenue + Gas revenue + Bond fund + Non-operating revenue + Depreciation + Amortization + Contribution from customers + Salvage + Mutual fund + Antitrust fund] – [Technical improvement + Final payments to stockholders + Construction + Bond retirement + Interest payment + Operating expenses + Payroll and employee benefits + Bond reserve fund + Interest reserve fund + Preliminary payments to the stockholders] = 0

$[A_1X_1 + A_2X_2 + X_3 + A_3 + A_4 + A_5 + A_8 + A_9 + A_{10} + A_{11}] - [X_5 + X_6 + X_7 + B_1 + B_2 + B_3 + B_4 + B_9 + B_{10} + B_6C_1] = 0,$

$[42,356,417\,X_1 + 507,894\,X_2 + X3 + 5252357 + 7599478 + 6.4 + 1616.26 + 596 + 86.20 + 58.0] - [X_5 + X_6 + X_7 + 49169 + 5767 + 7537920 + 1179855 + 4,123 + 3,245 + 0.0210\,[72075.11]] = 0$, or

$42,356,417\,X_1 + 507,894\,X_2 + X_3 + X_4 - X_5 - X_6 - X_7 - X_8 + d_6^- - d_6^+ = 40,052.5$

G7: New Bonds

Bond funds $\leq$ Assumed bond upper limit

$X_3 \leq A_6$

$X_3 \leq 0.0$ or $X3 + d_7^- - d_7^+ = 0.0$

G8: Minimum Electricity Rate

Electricity rate/KWH $\geq$ Desired rate

$X_1 \geq A_{12}$

$X_1 \geq 5.02$/KWH, or $X_1 + d_8^- - d_8^+ = 5.02$

G9: Minimum Gas Rate

Gas rate/MCF $\geq$ Desired rate

$X_2 \geq a_{13}$

$X_2 \geq 1.32$/MCF, or $X_2 + d_9^- - d_9^+ = 21.32$

G10: Technological Improvement

Technological improvement fund $\geq$ Desired ratio of technological improvement to earned revenue [Electricity revenue + Gas revenue + Non-operating revenue]

$X_5 \geq 3_5\,(A_1X_1 + A_2X_2 + A_3)$,

$X_5 \geq .007\,[42,356,417\,X_1 + 507,894\,X_2 + 5252357]$, or

$X_5 - 176492.767\,X_1 - 2539.47X_2\, d_{10}^- - d_{10}^+ = 11.4$

G11: Final Payment to I & C Fund

I & C fund $\geq$ I & C ratio to earned income (electricity revenue + gas revenue + non operating revenue) + (depreciation + amortization + contribution from customers + salvage + mutual funds + antitrust funds)

$X_4 \geq \lambda_7\,[A_1X_1 + A_2X_2 + A_3] + [A_4 + A_5 + A_8 + A_9 + A_{10} + A_{11})$

$X_4 \geq .125[42,356,417\,X_1 + 507,894\,X_2 + 5252357 + [7599478 + 6.4 + 1616.26 + 596 + 86.20 + 58.0]$, or

$X_4 - 4412319.175\,X_1 - 63486.75\,X_2\, d_{11}^- - d_{11}^+ = 11,409.4$

G12: Construction

Construction $\geq$ Desired construction

$X_7 \geq B_8$

$X_7 \geq 5945721$, or $X_7 + d_{12}^- - d_{12}^+ = 5945721$

The construction fund must be derived from the bond fund and I & C fund. However, there should be at least 5 million in the I & C fund for contingencies.

$X_7 = X_3\,[X_4 - 5,000.0]$ or $X_3 + X_4 - X_7 + d_{13}^- = 5,000.0$

G13: Objective Function

$\text{Min } Z = P_1\,[d_7^- + d_7^+] + 2P_2 d_1^- + P\,d_2^+ + 2P_3 d_3^- + P_3 d_5^+ + P_4 d_{11}^- + P_5 d_{10}^- + P_6 d_{13}^- + P_7\,[d_8^- + d_9^-]$

RESULT AND DISCUSSION

The solution will be obtained by using QM for Windows software, the breakeven goal is treated as the lowest priority goal in order to identify the revenue requirements. The electricity rate (X_1) is increased to 0.04 per KWH. This situation occurred because of low priority that was assigned to maintaining the electricity rate. The gas rate (X_2) of 0.89 per MCF was achieved even though it was of a low priority goal. The result is due to the fact that we have not assigned any differential weights to the maintenance of existing rates between electricity and gas. The breakeven objective and construction fund goals were fully achieved. The goals to achieve the required payments to the operating and payroll expense and to principal, interest and reserve account were fully achieved. Therefore, it is important that management recognize the financial consequences of not raising the rates in order to weigh the utility of going to the council for an increase and to present a valid justification for any increase.

Table 2

$X_1 = 0.04$	$d_c^- = 0$
$X_2 = 0.89$	$d_c^+ = 0$
X_3.....X8 = 0	

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TOWARDS A GOAL PROGRAMMING METHODOLOGY FOR CONSTRUCTING EQUITY MUTUAL FUND PORTFOLIOS

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INTRODUCTION

The Mutual Fund [MF] industry has experienced huge growth internationally in recent years, becoming the primary vehicle through which individuals and most institutions invest in capital markets. Within India, at present, there are 26,512 MFs, with total assets rising to **Rs 3503 Cr** [Data as at the end of 2006: Association of Indian Institutional Investors]. In the same way, the industry of collective investments in India is growing rapidly. According to recent date from the Association of Indian Institutional Investors, today there are 27 MF management companies that manage 266 MFs, with assets rising to **Rs 23.86 Cr** [Data as of 29th March, 2007].

This situation highlights the great growth of the MF market worldwide. Thus, it is very difficult for investors to choose funds according to their decision policy, the risk level that they are willing to take, and their profitability goals. Within this context, it is obvious that a successful portfolio selection and construction strategy is a necessity for investment management for both institutional and individual investors.

Within the framework of portfolio management, the objective is to construct a portfolio of securities [e.g. Stock, Bonds, MFs, etc.] which maximizes the investor's utility. Considering the considerable number of available investment alternatives, the portfolio management problem is often addressed through a two-stage procedure. At the first stage, an evaluation of the available securities is performed. This involves the selection of the most proper securities on the

basis of the decision makers' investment policy. At the second stage, on the basis of the selected set of securities, the portfolio composition is performed.

The traditional portfolio theory developed by **Markowitz [1952]** is mainly involved with the second stage of the above procedure. It accommodates the portfolio composition problem on the basis of the existing trade-offs between the maximization of the expected return of the portfolio and the minimization of its risk [mean-variance model]. On the same mean-variance basis or in other similar probabilistic measures of return and risk, several other approaches have been developed including the capital asset pricing model [CAPM], the APT, single and multi-index models, average correlation models, mixed models, utility models and models using different criteria such as the geometric mean return, stochastic dominance, safety first and skewness. **Elton and Gruber [1995]** provide a comprehensive review of these approaches.

In the same way, this study refers to the second stage of the portfolio management problem in the case of the construction of equity MF portfolios. The proposed methodology is based on the continuous multicriteria decision aid [MCDA] method, namely Goal Programming [GP], and is applied on real-world data on Indian MFs with encouraging results.

In this study, the aim of the GP model is to compose an MF portfolio whose performance on a set of predetermined goals is as close as possible to their most preferred values. The proposed GP model is subject to a series of linear and non-linear constraints and the objective function considers multiple goals. This GP model is solved under a set of different investment policy scenarios and supports the investor/portfolio manager in composing efficient MF portfolios which meet his investment preferences.

Data of the Problem

The sample used in this study is provided from the ICICI Mutual Fund Company and consists of daily data [Returns] of all domestic equity MFs operating in the Indian market over the period 2004-2006. At the end of 2007, the sample consisted of 72 domestic equity MFs. Nevertheless, not all MFs have been in operation for the whole three-year time period of the analysis. Actually, there were full data for the whole period for only 33 MFs. Therefore, in order to eliminate the effect that could be caused by the fact that not all MFs were in operation for the same period, it was decided to consider only these 33 MFs for which complete data were available.

For application of the proposed methodology, further information is derived from the Bombay Stock Exchange and the Reserve Bank of India, regarding the return of the market portfolio and the three-month Treasury bill rate, respectively.

Furthermore, in the present study, for the selection of MFs used in portfolio composition, the MFs under consideration are classified in two homogeneous predefined groups. The classification is accomplished with the help of Indian MF managers. It was decided to employ an approach involving the classification of MFs according to their performance in relation to the Bombay Stock Exchange General Index [BSE-GI], which is used as a proxy of the market. This approach leads to the classification of the MFs as opposed to the BSE-GI used as the reference/benchmark point. Two grouping scenarios are considered in this context. In both scenarios, the classification of the MFs is determined on the basis of their return R as opposed to the return of the market $[R_M]$ as follows:

Group 1: High performance funds with $R > R_M[1 + k]$, and
Group 2: Low performance funds with $R < R_M[1 + k]$.

Both the MFs return R as well as the market return R_M [return of BSE-GI] are considered for the first semester in 2007 [1st January 2007 - 30th June 2007]. Bearing in mind that data used in the analysis cover the period 2004-2006, it is clear that this classification of the MFs is based on their future returns over a subsequent time period, thus providing a basis for relating their past performance characteristics to their future prospects as investment opportunities. The parameter k is given different values in the two grouping scenarios. In the first scenario, k is set equal to 10 per cent, whereas in the second scenario, k is set equal to 5 per cent. In that respect, the first scenario corresponds to a more risk-prone portfolio management style, whereas the second scenario corresponds to a less risk-prone approach. Within this context, the MFs of the first group are the ones with the best perspectives and constitute good investment opportunities compared with the other MFs. In contrast, the MFs of the second group are the ones with lower performance than the ones of the first group.

According to the first grouping scenario, 21 MFs in the sample are assigned to the first group, and 12 funds in the second group. Similarly, in the second grouping scenario, 24 MFs belong to the first group, while nine MFs belong to the second group. It should be noted that other grouping scenarios were also tested -with varying values for the parameter k but, given the small sample, there was a significant imbalance between the numbers of MFs in each group, thus leading to poor results.

From the initial set of 33 MFs, the ones that belong in the first group and have the higher performance are selected. In particular, for the first grouping scenario, nine MFs are selected, while for the second grouping scenario 11 MFs are selected, for the composition of appropriate MF portfolios.

Table 1: Performance of the Selected MFs on the Evaluation Criteria

	Criteria								
Mutual funds	Standard deviation σ [%]	% Change In NAV	Geo. mean of excess Return [%]	Sharp index	β coefficient	Jensen α coefficient	HM's α coefficient	HM's γ coefficient	Treynor and Black index
Alpha Trust Infrastructure [Domestic][a,b]	59.112	2262.886	69.896	-0.302	0.913	0.016	0.115	-0,154	0.018
Alpha HDFC Domestic Equity[a]	54.941	1878.566	26.841	-0.893	0.908	0.005	0.031	-0.074	0.009
Alpha Domestic Equity Fund[a]	52.754	855.662	23.470	-0.985	0.871	0.001	0.021	-0.028	0.002
ICICI Value Index Domestic Equity[a,b]	51.092	2840.323	40.730	-0.756	0.810	-0.022	-0.030	0.010	-0.040
HSBC Growth[a,b]	53.340	25.538	36.588	-0.781	0.879	0.025	0.084	-0.079	0.045
Interamerican Small Capitalisation[a]	56.407	1047.875	6.509	-1.173	0.918	-0.009	0.074	-0.089	-0.014
tnteramerican Dynamic MF Equity[a]	51.502	4.770	9.054	-1 .262	0.876	-0.010	0.032	-0.041	-0.030
Sogen Invest Domestic Equity Fund[a,b]	55.164	-22.720	28.473	-0.850	0.881	0.105	0.183	-0.113	0.138
European Reliance Growth Fund[a,b]	54.775	224.262	12.231	-1.133	0.914	-0.013	-0.022	0.035	-0.034
Alpha Trust Growth Domestic Equity[b]	63.298	127.021	30.181	-0.716	1.016	0.027	0.051	-0.070	0.035
Alpha Trust New Enterprises Dom[b]	56.699	220.131	38.405	-0.680	0.872	0.016	0.096	-0.140	0.019
HSBC Dom. Equity Fund FTSE/ASE20[b]	45.232	79.781	-1.157	-1 .641	0.773	-0.021	-0.038	0.021	-0.067
Alpha Growth Domestic Equity Fund[b]	48.198	370.110	21.285	-1.121	0.821	-0.027	-0.032	0.008	-0.081
Laiki Indian Equity Fund[b]	56.397	1925.976	24.621	-0.888	0.878	-0.035	0.031	-0.091	-0.048
Teiesis Equity Domestic Fund[b]	48.763	166.397	23.913	-1.051	0.800	-0.019	0.018	-0.049	-0.037
Most/least preferred value	51 .0927	2840.323/	69.8967	-0.3027	0.8107	0.1057	0.1837	0.035/	0.1387
[1st grouping scenario]	59.112	-22.720	6.509	-1 .262	0.918	-0.022	-0.030	-0.154	-0.040
Most/least preferred value	48.198/	2840.323/	69.8967	-0.302/	0.7737	0.1057	0.1837	0.0357	0.1387\
[2nd grouping scenario]	63.298	-22.720	-1.157	-1.641	1.016	-0.035	-0.038	-0.154	-0.081

[a]MF considered for the 1st grouping scenario.
[b]MF considered for the 2nd grouping scenario.

Goal Programming Model

A GP model has the following general form:

Min $f(d_i^+, d_i^-)$

Subject to:

$g_i(x) + d_i^+ - d_i^- = t_i \quad X \in B \quad d_i^+, d_i^- \geq 0$

where g_i is the goal i defined as a function [linear or non-linear] ot the decision variables x, t_i is the target value for goal g_i as defined by the decision maker, d_i^+, d_i^- are decision variables corresponding to the deviations from the target values [Underachievement and Overachievement of the goals], B is the set of feasible solutions defined by a set of constraints, and /is a function [usually linear] of the deviational variables. In using a GP model in practice, the decision maker must specify all relevant constraints that define the feasible solutions, express his/her goals as functions of the decision variables, define the appropriate target values for the goals and specify the deviations from the target values which are relevant to the analysis [e.g. in some cases only the under achievements of the goals are relevant].

Evaluation criteria

The criterion used in the present study are the following:
[1] the standard deviation of the returns,
[2] the percentage change of the Net Asset Value [NAV],
[3] the geometric mean of excess return over benchmark,
[4] the Sharpe index,
[5] the systematic risk,
[6] Jensen's a,
[7] the Henriksson—Merton a coefficient,
[8] the Henriksson—Merton γ coefficient and
[9] the Treynor—Black ratio.

A brief description of these criteria is given below.

The standard deviation is the most commonly used measure of variability. For an MF, the standard deviation σ is used to measure the variability of its daily returns, thus representing the total risk of the fund. The standard deviation of daily returns [752 observations] is transformed in this analysis to refer to the three-year time period using the simple transformation $\sigma\sqrt{752}$.

The return of MFs and other risky investments is often considered in relation to a risk-free asset. In the case of MFs, the measure used to consider this issue is the geometric mean of their excess returns over the return R_f of a risk-free asset. The excess return of a fund is considered as the difference between the fund's return and the risk-free return. The geo-

metric mean of a fund's excess return over a benchmark [Risk-free asset] shows how well the manager of the fund was able to pick stocks. In this analysis, the three-month Treasury bill rate is used as a proxy for R_f

The beta [β] coefficient is a measure of a fund's risk in relation to the market risk. It is called systematic risk, and the CAPM implies that it is crucial in determining the prices of risky assets. For the calculation of the beta [β] coefficient, the following regression was used: $R = \alpha + \beta R_M + \varepsilon$ where α is a coefficient measuring the return of a fund when the market is constant and ε is an error term that represents the impact of non-systematic factors that are independent from the market fluctuations.

The traditional total performance measure, the Sharpe index, **Sharpe [1966]**, is used to measure the expected return of a fund per unit of risk. This measure is defined as the ratio $[R - R_f]/\sigma$ The evaluation of MFs with this index shows that an MF with higher performance per unit of risk is the best-managed fund, while an MF with lower performance per unit of risk is the worst-managed fund.

Jensen's alpha measure is the intercept in a regression of a fund's excess returns against the excess returns on the benchmark, **Jensen [1968]**. The use of this measure assumes that investors are well diversified and therefore, they are only taking into account systematic risk when evaluating a fund's performance. The Jensen alpha [α] measure is given by the regression model $R - R_f = \alpha + \beta(R_M - R_f) + \varepsilon$ Coefficient α will be positive if the manager has some forecasting ability and zero if he has no forecasting ability.

The **Henriksson-Mertoii Model [1981]** measures both market timing and the security selection abilities of funds' managers and it is expressed in the form of the regression model $R - R_f = \alpha + \beta(R_M - R_f) + \gamma Z_M + \varepsilon$, where $Z_M = \max(0, R_M - R_f)$.In this model, the parameters α and γ provide estimates on the performance of the MF managers. In particular, α shows the stock selection ability of the manager, while the parameter γ shows his market-timing ability. Positive values for α and γ show that the MF manager has forecasting abilities, negative values indicate forecasting inability, and values close to zero show no ability at all.

Finally, another measure regarding the MF managers' forecasting abilities is the **Treynor and Black [1973]** appraisal ratio, defined as the ratio α s where α *the Jensen alpha coefficient and 5 is* is the standard deviation of the error term in the regression used to obtain the α coefficient. Higher [lower] values of this measure show higher [lower] forecasting ability of the manager

On the basis of these criteria, the proposed Goal Programming formulation for the construction of the final portfolio is solved for both grouping scenarios. The data of the problem are noted as c_{ij}, where c_{ij} is the performance of MF *i* on criterion j, i = 1,. . ., 9 [First grouping scenario]; = 1,.,., 11 [Second grouping scenario] and j =1,...,9 [Nine criteria for both grouping scenarios]. Table 1 presents the performance of the selected MFs on the selected criteria. Within a portfolio construction context, it is necessary to express the above criteria in terms of the composition of the portfolio [The proportion w_i of each MF *i* in the portfolio]. This is performed as follows:

* The standard deviation of returns of portfolio *p* is denoted by c_1^p and is calculated in matrix form as follows:

$c_1^p = \sqrt{w^t \Sigma w}\sqrt{N}$, where *w* is a $m \times 1$ vector of the proportion of the available capital invested in each MF [*m*=9 for the first scenario and m = 11 for the second scenario], w^t is the transpose of *w*, and Z is the variance-covariance matrix of the MFs' daily returns.

* The percentage change of net asset value of portfolio *p* is denoted by c_2^p and is expressed as a linear function of the following form $c_2^p = \sum c_{i2} w_i$ where c_{i2} is the percentage change of net asset value for MF *i*.

* The geometric mean of excess return over benchmark of portfolio *p* is expressed as c_3^p and is calculated as follows **Bernstein and Wilkinson [1997]**; $c_3^p = (1 + R_{pg} - \sigma_{pg}^2)^{N-1}$, where R_{pg} the expected excess is return of the portfolio over a benchmark [risk-free interest rate] and σ_{pg}^2 is the corresponding variance. In a matrix form, the calculation of the expected excess return R_{pg} of the portfolio p is calculated as follows: $R_{pg} = r_g^t w$ The expected excess return r_g is referred to as the mean excess return over the risk-free interest rate and is calculated as follows: $r_g = [r - r_f][r_M - r_f]$, where *r* is a [m.1] vector of the expected MF returns and r_M is the expected market return.

* The Sharpe index for portfolio *p*, is denoted by c_4^p and is calculated as follows $c_4^p = R_{ps} / \sigma_{ps}$ where R_{ps} the expected excess return of portfolio p is over the risk-free asset $R_{ps} = (r - r_f)^t w]$ and σ_{ps} is the corresponding standard deviation

* The beta coefficient of portfolio *p*, is denoted by and is expressed as a linear function of the following form:

$c_5^p = \sum w_i c_{i5}$ is the beta coefficient for MF *i*.

* The Jensen alpha [α measure of portfolio *p*, is denoted by c_6^p and is expressed as a linear function of the following form: $c_6^p = \sum w_i c_{i6}$ where c_6^p is the Jensen coefficient α for MF *i*.

* The alpha coefficient [α]of the Henriksson - Merton model of portfolio *p*, is denoted by c_7^p and is expressed as a linear function of the following form: $c_7^p = \sum w_i c_{i7}$ where c_7^p is the Henriksson-Merton coefficient for MF *i*.

* The γ coefficient of the Henriksson-Merton model of portfolio *p*, is denoted by c_8^p and is expressed as a linear function of the following form: $c_8^p = \sum w_i c_{i8}$ where c_8^p

is the Henriksson-Merton γ coefficient for MF *i*.

The Treynor and Black appraisal ratio of portfolio *p*, is denoted by $c_9^{'}$ and is calculated as follows **Miller [1999]**;

$c_9^{'} = \alpha[\sigma_p^2 / N - (\sigma_M^2 / N)\beta^2]^{-1/2}$, where α is the Jensen coefficient of portfolio *p*, σ_p^2 is the variance of portfolio *p* and σ_M^2 is the variance of the market [BSE-GI].

Standardization of the Data

In using a GP model, it is often appropriate to scale the goals so that they are of approximately the same order of magnitude, thus ensuring that the effect of the different scales on the obtained solution is eliminated. In the MF portfolio composition problem considered in this paper, the standard deviation is expressed as a percentage, the β coefficient takes values very close to unity, and the Jensen α coefficient takes values close to zero, etc. To eliminate the effect of these different scales, a standardization of the data is initially performed. The standardization is employed only for the criteria for which the performance of the portfolio is a linear function of the proportion of each MF in the portfolio. These criteria [linear criteria] are the following: percentage change of NAV β coefficient, Jensen's α coefficient, Henriksson and Merton's α and γ coefficients. The standardization is performed through the following simple linear transformation:

$$c_{ij}^{'} = \frac{c_{ij} - c_j^{\min}}{c_j^{\max} - c_j^{\min}} \in [0,1]$$

where $c_{ij}^{'}$ denotes the standardized performance of MF *i* on criterion, C_j, C_{ij}, denotes the unstandardized performance of MF *i* on criterion C_j, $c_j^{\max}$ is the most preferred value of criterion C_j, and $c_j^{\min}$ is its least preferred value. For the linear criteria to -which the above standardization is applied, their most and least preferred values are easily found directly from the unstandardization data of the selected MFs [*cf.* Table 1]. For instance, the most [least] preferred performance on the NAV change criterion is simply its maximum [minimum] value for the selected MFs in each grouping scenario [Higher NAV change indicates a better MF]. The same also applies to Jensen's α coefficient, and Henriksson and Merton's α and γ coefficients. In contrast, for the β coefficient the most [least] preferred performance is determined as the maximum [Minimum] value of β the coefficient for the MFs in each grouping scenario [higher β coefficient indicates higher risk].

Mathematical Formulation of the Goal Programming Problem

The proposed GP formulation for the composition of the final portfolio is expressed as follows:

$$\text{Min f} = p_1 d_1 + p_2 d_2 - p_3 d_3 - p_4 d_4 + p_5 d_5 + p_6 d_6 + p_7 d_7 + p_8 d_8 + p_9 d_9 + \sum_i k_i d_i^- \quad (1)$$

Subject to the constraints:

$c_j^{'} - d_j = 0$, for criteria j = 1,3,4,9 (2)

$c_j^{'} + d_j = 1$, for criteria j = 2,5,6,7,8 (3)

$w_i - d_i^- + d_i^+ = B$, for MFs i = 1,2,.....9 and i = 1,2,....11 in the first and second grouping scenarios (4)

$\sum_i w_i = 1$ (5)

$w_i, d_i^-, d_i^+ \geq 0$, for MFs i = 1,2,.....9 and i = 1,2,....11 in the first and second grouping scenarios (6)

$d_j \geq 0$, for criteria j = 1,2,5,6,7,8 (7)

d_j Unrestricted in sign for criteria j = 3,4,9 (8)

Constraints [2] – [3] describe the performance of portfolio *p* on the selected criteria expressed in terms of the proportion of each MF in the portfolio [the proportions w_i sum up to unity, cf constraint [5]]. In particular, goal constraint [2] applies only to the non-linear criteria which are not standardized [*j* =1 for standard deviation, *j*= 3 for geometric return, *j*=4 for Sharpe's index, and *j*=9 for the Treynor and Black index]. For these criteria, zero [the left-hand side of constraint [2]] is selected as the reference point with which the performance of the constructed portfolio is compared. For the standard deviation criterion, zero corresponds to the ideal case of a zero-risk portfolio and, consequently, deviation d_1 from this ideal case should be minimized. For the other three non-linear criteria [*j*= 3,4,9], constraint [2] implies that the constructed portfolio should have a performance as high as possible compared with the zero-level reference point. For instance, for the geometric return criterion [*j*=3], setting the reference point at zero level implies that the constructed portfolio should have as much positive geometric return as possible. In this case, the deviation d_3 between the portfolio's geometric return and the zero-level geometric return should be as positive as possible [d_3 is unrestricted in sign to consider the possibility that the portfolio's geometric return may be negative]. Constraint [2] is used in the same way for the two other non-linear criteria involving Sharpe's index *[j*=4] and Treynor and Black's index *[j*= 9].

In contrast, goal-constraint [3] applies only to the linear criteria *[j*=2 for the NAV change, *j*=5 for the β coefficient, *j*=6 for Jensen's α *i*=7 for HM's α and *j*=8 for HM's γ The use of constraint [3] implies that the performance of the constructed portfolio on these criteria should be as close as possible to the ideal values of the criteria, which arc equal to unity in the standardized [0, 1] scale.

In addition to goal constraints [2]—[3] which involve the performance of the constructed portfolio on the selected criteria, portfolio diversification is also imposed through goal constraint [4]. This constraint imposes a goal regarding the maximum proportion B of each MF in the portfolio [In this analysis, *B* is set equal to 0.4]. An overachievement

of this goal for an MF i indicates that the proportion w_i of this fund in the constructed portfolio is too high [higher than 40 per cent]. For diversification reasons, such an overachievement is undesirable and should be minimised. The overachievement of this goal for an MF i is measured through the deviational variable d_i^+ which is to be minimized.

The objective of the GP model [1]—[8] minimizes a weighted sum of the deviations from the aforementioned goals. The coefficients p_j and k_i [$p_j, k_i \geq 0$) ;ed in the objective function [1] represent the relative importance of the goals. In particular, the coefficients p_j involve the goals on the selected portfolio construction criteria [$j=1,2,...,$ 9]; while coefficients k_i involve the diversification goals regarding the maximum proportion of each MF's i in the portfolio. These weighting coefficients can be specified according to the investment policy of the MF manager.

Result and Analysis

For each one of the two grouping scenarios, the GP problem [1]—[8] is solved under a set of different investment policy scenarios. Each scenario corresponds to different values of the weighting coefficients p_j used in the objective function which represent the relative importance of the goals on the selected portfolio construction criteria.

In all scenarios, the values assigned to coefficients p_j range in the interval [1, 5], in order to obtain a portfolio that best matches the predetermined goals. The weights assigned to the diversification goal were set equal to 2 [low to medium importance] in all cases. Similarly, the NAV change criterion was assigned low significance [p_2=1] in all scenarios because the performance of the MFs considered on this criterion was [in most cases] remarkably high. The rest of the portfolio construction criteria are grouped into three major categories as follows:

* Return criteria: Geometric Mean, Sharpe's index, Jensen's α
* Risk criteria: Standard Deviation, β coefficient.
* MF managers' evaluation criteria: HM's α coefficient, HM's γ coefficient, Treynor and Black ratio.

On the basis of this categorization, 20 different investment policy scenarios were explored regarding the significance of each category of criteria assuming that within each category all criteria are equally important.

The presented results involve the average proportion of each MF in the 20 constructed portfolios constructed for each weighting scenario of Table 2.

Table 2: Investment policy scenarios and weights of the evaluation criteria

	Weights of the evaluation criteria				
Scenarios	**Return**	**Risk**	**Manager's ability**	**NAV**	**Diversification**
1	1	1	1	1	2
2	2	2	2	1	2
3	2	5	2	1	2
4	2	1	2	1	2
5	5	2	2	1	2
6	1	2	2	1	2
7	2	2	5	1	2
8	5	5	2	1	2
9	5	1	2	1	2
10	1	5	2	1	2
11	5	2	5	1	2
12	5	2	1	1	2
13	1	2	1	1	2
14	2	2	1	1	2
15	1	1	2	1	2
16	1	2	1	1	2
17	2	1	1	1	2
18	2	1	1	1	2
19	2	1	5	1	2
20	2	1	1	1	2

Table 3 summarizes the results of the analysis regarding the composition of the constructed portfolios for the two grouping scenarios.

According to the results obtained, three MFs have the higher proportion in both grouping scenarios. In the first grouping scenario, the Alpha Trust Infrastructure, the BSE-GI and the Reliance Invest Domestic Fund had proportions higher than 32 per cent in 8, 13 and 16 investment policy scenarios, respectively. In the second grouping scenario, the Alpha Trust Infrastructure, the BSE-GI and the Reliance Invest Domestic Fund had proportions higher than 37 per cent in 12, 7 and 16 investment policy scenarios, respectively. These MFs performed fairly well in most of the examined criteria. All the other MFs have a very small proportion [approximately 1 per cent].

Table 3: Average Proportions [%] of the MFs in the Constructed Portfolios

Mutual funds	1st Grouping scenario	2nd Grouping scenario
Alpha Trust infrastructure	20.65	28.26
Alpha HDFC	1.60	
Alpha Domestic Equity Fund	2.17	
ICICI Value Index	32.55	20.57
HSBC Growth	3.19	2.78
Interamerican Small Cap	0.95	
Interamerican Dynamic	1.23	
Reliance Invest Domestic Fund	36.58	37.90
European Reliance Growth	1.09	1.13
Alpha Trust Growth		1.15
Alpha Trust New Enterprises		1.92
HSBC Fund-FTSE/ASE20		1.62
Alpha Growth Domestic		1.65
Laiki Indian Equity Fund		1.15
Telesis Equity Domestic Fund		1.7

Furthermore, Table 4 summarizes the results of the analysis regarding the performance of the constructed portfolios for the two grouping scenarios on the nine evaluation criteria. The presented results involve the rate of closeness of the portfolios' performance to the best values of each criterion. It is important to note that all the constructed portfolios performed fairly well in most of the examined criteria in both grouping scenarios.

Table 4: The Rate of Closeness [%] of the Constructed Portfolios to the Most Preferred Values of the Goals on the Criteria

Criteria	1st Grouping scenario	2nd Grouping scenario
σ	69.06	52.54
NAV	51.25	44.69
R	53.62	51.07
Sharpe	55.47	70.45
β	48.55	59.07
Jensen's α	44.79	53.28
HM's α	53.85	62.41
HM's γ	42.19	33.33
Treynor and Black	50.68	62.84

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SOCIOCULTURAL SCIENCES

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EFFECT OF FAMILIAL FACTORS ON ACADEMIC LEARNING ENVIRONMENT OF HIGH SCHOOL STUDENTS

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Introduction

One of the major aims of the education is the development of wholesome personality. Family is the socio-biological unit that exerts the greatest influence on the development and perpetuation of the individual's behaviour. Next to home, school is the most important experience in the process of development of children. Both the environments, share influential place in child's life and also contribute to the development of children. School is the second home to children. Teachers and parents have greater responsibility to foster mental health status of the students. At times in adverse conditions the school may also substitute the home situations and meets the emotional needs of those neglected in the home. Pupils perception, or attitude towards the school climate or environment has got considerable influence over their mental health. School atmosphere, includes favourable attitude towards school teacher, co-students, curriculum, methods of teaching, facilities available in the classroom and teacher-student interaction.

Children living in poor environment may fail to develop their potentials and skills to the optimum extent, may have a negative affect on their performance in school and achievements in social life, while children growing up in conducive environment may show superior cognitive abilities and academic competence. It is therefore necessary to study the academic learning environment of children in these two different contexts of home and school and trace the causal factor for enhancing the academic accomplishment of children.

Home environment has been conceptualized as the quality of human interactions, from the point of view of the child. It includes those aspects which foster growth and development, such as family trust and confidence, sharing of ideas, parents support, parental approval, parenting, parental encouragement, care, affection and approval and support of siblings.

Children living in rural or urban areas are exposed to different environment. Generally children from low socio-economic status attend government schools while, children of well-to-do families attend private schools or public schools. These two types of schools have another major difference – difference in medium of instruction.

In addition, home learning environment, school learning environment and academic achievement may be influenced by various socio-economic factors like age, gender, family size, parent's education and occupation and also by economic status of the family.

Thus the present study was an attempt to investigate the effect of familial factors like family education, size of the family and socio-economic status of the family on academic learning environment of school students.

Methodology

The population of the study consisted of high school children from 8th, 9th and 10th class students with an age range of 12-16 years studying in aided and unaided co-educational high school of Dharwad city. A preliminary survey was carried out in year 2005 to collect information regarding the total number of private and government schools in Dharwad city. There were 27 aided and 12 unaided high schools in Dharwad. Out of these 8 coeducational schools were selected (4 aided and 4 unaided). From each of the selected high school and from each of the class (8th, 9th, and 10th) only one section of the students were selected randomly. From the selected section a minimum of 5 each boys and girls from all three classes were randomly selected. Thus the total sample for the study consisted 240 children.

Tools used for the study

1. Academic learning environment

1. Academic learning environment
a. School learning environment schedule
b. Home learning environment schedule
2. Academic achievement1.
3. Socio-economic status schedule a combination of items developed by Aaron *et al.* (1969),
Venkataramaiah (1983) and Hauser (1994).

a. School learning environment schedule

A full pledged schedule was developed to study the school learning environment. The schedule consists of 130 items with 10 components, viz., goal orientation, study habits of students, school environment of the students, involvement of students in school activities, physical facilities in the school, teaching materials used by school, teacher-student interaction, equality, and method of teaching by schools and qualification of teacher. Each of the statement with a response as 'yes' or 'no' with score of 2 and 1 respectively. Spilt half method was used to test the reliability of the schedule. The reliability of the tool was = 0.65.

b. Home learning environment schedule

Home learning environment schedule was developed to know the home learning environment of students and its influence on academic achievement of high school students. The developed version has 37 items categorized into five components viz., parental encouragement and care, facilities provided at home, parental guidance and support, parenting and co-curricular activities. All statements are positive and score of 2 and 1 for 'yes' or 'no' responses are given respectively. Spilt half method was used to test the reliability of the schedule. The reliability of the tool was= 0.63.

Data collection was made by using pre-tested questionnaires. Prior permission of the principal or Headmaster's was taken from the aided coeducational high schools to conduct the study. Among each section 5 boys and 5 girls were selected randomly. After establishing a rapport with subjects, school learning environment schedule and home learning environment schedule was self administered on students. All the selected students from classes 8th to 10th were clubbed in one classroom and tool was administered on students. The students were instructed to give the responses. To obtain student's academic achievement, students previous year's final mark's (percentage) as well as the current year's last two semester's grades were considered.

Karl Pearson's product moment correlation coefficient analysis was used to measure the relationship between school learning environment, home learning environment, academic achievement and socio-economic status of the family of high school students. ANOVA (Analysis of variance) technique was used to test the effect of mother's occupation, size of the family and socio-economic status of the family on school learning environment, home learning environment and also academic achievement of high school students

Results and Discussion

The results indicated that (Table.1), parent's education and father's occupation had positive relation with school learning environment. Parent's education had positive and significant influence on home learning environment and academic achievement of high school students. Supporting to this result, Poonam and Balda (2001) reported that parents educational status had positive correlation with the intelligence of children. Similarly, Cherian and Cherian (1995) reported that children of more educated parent were exposed to a more stimulating and richer environment than those of less educated. Grolnick (1997) found that better the education of mother better was the home environment because mother was better equipped with the skills in coaching and better was the capacity in involving in cognitive, social and intellectual activities of children.

Further, father's occupation was positively and significantly related to academic achievement of students. Similarly Gill and Sidhu (1988) reported that occupation of parents influenced the school performance of their children.

Table 2. shows that, the students whose mothers were working had significantly higher mean scores than labourers on school learning environment i.e., mothers who were working in professional jobs, provided significantly better school learning environment. While no such trend was observed in case of home learning environment and academic achievement.

The results also revealed that, there was non-significant difference in home learning environment, school learning environment and academic achievement between students of different family sizes though the low family size had higher mean scores. Size of the family were negatively related to home learning environment and academic achievement high school students. Supporting to this result, Cherian (1990) revealed that, negative relationship between family size of children and their academic achievement and Poonam and Balda (2001) reported that family size was negatively correlated with academic achievement and IQ of the children respectively. Increase in family size lead to decrease in academic achievement, which may be due to greater number of siblings sharing their physical environment, parental attention and reduction in opportunities for learning material at home.

The socio-economic status of the family was positively and significantly related to academic achievement of students. Supporting to this result, Vijaylaxmi and Natesan (1992) reported that socio-economic status influenced academic achievement. Mathur and Hundal (1972) revealed that, positive correlation between academic achievement and economic status of parents.

Results of the study revealed that, familial factors viz., parental education, occupation and socio-economic status of family also influenced the school learning environment, home learning environment and academic achievement of students. This implies that there is an utmost need to counsel and guide under privileged students and their parents and teachers to facilitate better learning process. Teachers and parents should be made aware of the existence of different cognitive styles in children and help the children to achieve better cognitive competence.

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Table 1. Influence of parent's education on school learning environment, home learning environment and academic achievement of students

Sl. No.	Socio-economic characteristics	School learning environment 'r'	Home learning environment 'r'	Academic achievement 'r'
1.	Father's education	0.10	0.12	0.19**
2.	Father's occupation	0.11	0.19**	0.20**
3.	Mother's education	0.12	0.20**	0.14*

* Significant at 0.05 per cent level
** Significant at 0.01 per cent level

Table 2. Comparison of mean scores of school learning environment of high school students by mother's occupation

Category	N	Mean	SD
1. House wife	186	234.02	15.69
2. Labourer	10	228.20	17.53
3. Working women	44	239.36	14.01
4. Total	240	234.76	15.60

ANOVA

Source	d.f.	Sum of square	Mean square	F	Sig	CD
Between groups	2	1464.28	232.14	3.06**	0.049	2.79
Within groups	237	56735.69	239.391			

** Significant at 0.01 per cent level

Home learning environment

Category	N	Mean	SD
1. House wife	186	67.82	3.87
2. Labourer	10	66.30	5.21
3. Working women	44	68.52	3.14
4. Total	240	67.88	3.82

ANOVA

Source	d.f.	Sum of square	Mean square	F	Sig
Between groups	2	43.87	21.93	1.51	0.22^{NS}
Within groups	237	3436.86	14.50		

NS – Non significant.

Academic achievement

Category	N	Mean	SD
1. House wife	186	71.00	11.44
2. Labourer	10	63.80	13.13
3. Working women	44	73.63	12.23
4. Total	240	71.18	11.76

ANOVA

Source	d.f.	Sum of square	Mean square	F	Sig
Between groups	2	815.78	407.89	2.99	0.05^{NS}
Within groups	237	32242.77	136.04		

NS – Non significant.

Table 3. Comparison of mean scores of school learning environment of high school students by size of the family

Category	N	Mean	SD
1-5	200	234.78	15.65
6-8	38	234.00	15.52
>8	2	247.00	14.14
Total	240	234.76	15.60

ANOVA

Source	d.f.	Sum of square	Mean square	F	Sig
Between groups	2	321.66	160.83	0.659	0.519
Within groups	237	57878.32	244.21		

Home learning environment

Category	N	Mean	SD
1-5	200	67.96	3.81
6-8	38	67.45	3.94
>8	2	68.50	2.12
Total	240	67.88	3.82

ANOVA

Source	d.f.	Sum of square	Mean square	F	Sig
Between groups	2	9.159	4.57	0.31	0.73^{NS}
Within groups	237	3471.57	14.64		

NS – Non significant

Academic achievement

Category	N	Mean	SD
1-5	200	71.49	11.90
6-8	38	69.31	10.99
>8	2	76.00	12.72
Total	240	71.18	11.76

ANOVA

Source	d.f.	Sum of square	Mean square	F	Sig
Between groups	2	198.35	99.17	0.71	0.49^{NS}
Within groups	237	32860.20	138.65		

NS – Non significant.

Table 4.7a. Comparison of mean scores of school learning environment of high school students by SES

Category	N	Mean	SD
Low	88	230.33	15.33
Medium	71	237.51	15.90
High	81	237.16	14.71
Total	240	234.76	15.60

ANOVA

Source	d.f.	Sum of square	Mean square	F	Sig	CD
Between groups	2	2729.88	1364.94	5.83**	0.003	2.77
Within groups	237	55470.10	234.05			

** Significant at 0.01 per cent level

Home learning environment

Category	N	Mean	SD
Low	88	66.72	4.03
Medium	71	68.32	3.64
High	81	68.77	3.43
Total	240	67.88	3.82

ANOVA

Source	d.f.	Sum of square	Mean square	F	Sig	CD
Between groups	2	196.74	98.37	7.09**	0.001	0.68
Within groups	237	3283.99	13.85			

** Significant at 0.01 per cent level

Academic achievement

Category	N	Mean	SD
Low	88	69.42	10.81
Medium	71	71.98	12.05
High	81	72.40	12.38
Total	240	71.18	11.76

ANOVA

Source	d.f.	Sum of square	Mean square	F	Sig
Between groups	2	440.57	220.28	1.60	0.20^{NS}
Within groups	237	23617.98	137.62		

NS – Non significant.

REVIEW OF SOCIAL STATUS OF WOMEN IN INDIA

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Introduction :

According to HDI (Human development Index) of UNDP (United Nations Development Programme), there are certain norms to know the level of women empowerment like life expectancy of women, their share in property, health and their participation in politics etc. As per these norms, status of Indian women is secondary. Compare to other nation there is good scope for improvement.

For women empowerment some other things should be considered though women became economically self reliant, that does not mean that they are empowered. Irrespective of it, their social status, dignity and their active participation in socio-economic-cultural life of the nation .It becomes necessary to test the remarkable contribution of women in the field of social engineering.

In welfare Economics, the concept of GDI (Gender Development Index) made revolution, still the concept of "male female equality" should be put forward in a meaningful way because in this 21st century social status of women is not satisfactory. According to world development report 2006 published by UNDP 70% women in the world are living below poverty line including developed countries.

Obviously in the developing country like India women are living miserable life.

This paper is an attempt to review social status of women in India which will focus on the contribution of women to the society in number of fields and will also comment on the current status of women.

Social Status of Women In Vedic Age:

Since ages Indian culture is giving equal status to women .Lord Shiva was the chief deity of Aryans whose incarnation "Ardhanarinateshwar" itself is the symbol of male-female equality. "Ydnya" was the prime duty of an individual; and without wife no "Ydnya" could be completed. Therefore after abandonment of Seeta; Ram made a golden idol of her to complete "Ashwamedh Yadna".

In पूर्वमीमांसा (Poorva Mimansa), Women have equal rights in यज्ञकर्म (Yadnya Karma).As per the opinion of श्रौतसूत्र (Shroutasootra) women used to repeat vedic mantras with their spouse . In यमस्मृती (Yamasmruti) it is mentioned that

पुराकल्पेषु नारीणां मौंजीवन्धनमिष्यते।
अध्यापनंच वेदानां सावित्रीवचनं यथा॥

It means women had right to know Vedas , Gayatrimantra and right of उपनयन (thread ceremony).

There was co-education 'Aatreyee' learned with 'Lav- Kush' . 'Anasuya', 'Priyanvada' ,'Shakuntala'learned with 'Sharangrava' & 'Sharadvata'.

There are four main characters in 'Bruhadaranya Upanishada' out of which two are women. 'Gargi' asked thusands of questions to 'Yadnayavalka' . she was so talented that 'Yadnayavalka' had impressed .

In 'Rugveda' out of 1028 suktas 20 to 25 suktas are written by 'Rishikas'like 'Romasha', 'Lopamudra ' , 'Apala' etc. There are some famous 'Samvadsuktas' like 'Yama-Yami'10.10 'Pururava-Urvashi' 10.95 'Sarama-Panee'(10.108) , 'Mudgal –Indrasena ' etc. which indicate intelligence , confidence and excellent communication skills of women.

The marriage was not compulsory for women. In 'Rugveda' we find examples of unmarried women who lived with their parents unto death. They had right to choose their own husband.

Social Status Of Women In Post Vedic Age :-

In the age of 'Upanishdas' women had great status. Manu honoured in his 'Manusmruti' as—

यत्र नार्यस्तु पूज्यन्ते रमन्ते तत्र देवता।

During his age women used to travel independently through public transport. There are the references of 'Nareeyaan' (Vehicles specially for women) in 'Manusmruti'(3.52).In 'Ramayana' as well as ' Mahabharata' the right to choose husband was in existence but there were restrictions In the 'Swayamvars' 'Seeta' and 'Draupadi' there was a condition to achieve the target , it means there was no liberty but 'Kunti'

'Indumati' and 'Damayanti' used their right of choice .

Even in the age of 'Kautilya', women used to contribute in the process of production . Women had number of qualities eg.'Shabari' was expert in agricultural science , 'Savitri' had deep knowledge of medicines , 'Vishpala' (Rig 1.116.15)fought bravely though her leg was broken when 'Ashwinikumar' fixed up an iron rod in her leg and again she was ready for the war. 'Satyabhama' and 'Kaikayee' assisted their husbands during the war.

Women took lead in politics as well. Devamata 'Aditi' inspired her children to fight against 'Asuras'. 'Kunti' always encourage 'Pandawas' to regain the empire.

Wives of 'Arjun', 'Chitrangada' and 'Ulupi' were great politicians who groomed up their sons 'Babrhuvahana' and 'Irawan' respectively as noble kings . It indicates that women had power in that age.

Dignity Of Women

'Durgasaptashati' indicates the dignity of women .The goddess is described in her enormous forms like 'Annapurana' , 'Kali', 'Durga', 'Lakshmi', 'Saraswati'.

The story of 'Ashtabhuja' is a metaphor of a strong lady leading the society. The main cause behind 'Ram-Ravan' war or 'Kaurav-Pandav' war was the dignity of women.

The opportunity of development was provided but there were restrictions on women. 'Yadnavalka' said , "Abandon the women if she is drinking , shouting without reason and who is spendthrift ." 'Manu' had explained rights and duties of women.

Period Of Transformation

In mediaeval age, social status of women gradually reduced. Society became male dominated.

Because of foreign intruders , restrictions on women were increased. Gradually they remain deprived of education and social contact so there was no scope for their development . They were unaware of their rights which were beneficial for male dominated society. It was continued for centuries but 'Mahatma Phule' established a school for women which channelised the society.

The path towards development

The journey of women towards development was restarted by 'Mahatma Phule' ,and then women never turned back. Today women have proved their talent in various fields but their struggle for the social status has not ended yet. Women belonging to rich class pretend about their equal rights and separate identity but sometimes it is very painful to listen the conversations like this——

Lady 1 : How are you?

Lady 2 : Hi .I am fine .I am very fortunate to have good husband who always gives me permission to do anything. We have a liberal atmosphere in our family.

By birth every individual is free .Women are free from external slavery but they are still under psychological slavery.

Few women have achieved horizons of success but still their millions of sisters are far away from development. Women can change this picture and regain their status only if they are determined.

But they must remember —Miles to go before I sleep, and Miles to go before I sleep!!

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"CAUSES OF GIRL CHILD LABOUR IN INDIA AND SOME RECOMMENDATIONS TO ERRADICATE CHILD LABOUR"

"The child is father of the Man"
Williams Words Worth

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In this paper RECOMMENDATIONS TO ERRADICATE CHILD LABOUR are discussed in detail in a Scientific manner. Child is a bundle of joys – a flower incarnate in person. A flickering smile of the child pleases everyone. The brightness and future welfare of the society is closely interwoven with the brightness of the child and its careful upbringing. Childhood is the most important period of life, as it shapes adulthood. The very initiation of life-making starts at childhood. The early lesson of the child starts from the cradle. Parents adopt different methods to rear up the child the different ages, to make it a happy man or woman later. The mother being closer, has a greater responsibility to train up the child well from the very infancy,

Children are not only the budding and blooming flowers of the garden of society but also the builders of nation. Thus any society, community or nation worth the slat can hardly afford the slightest negligence towards these blooming followers. If it does, it would be digging its grave and cramping the future of the coming generations to a large extent.

Child Labour is usually defined as participation in gainful

activity by children in the age group of 5 to 14. The term child labour is often used as a synonym for "**Employed Child**" or "**Working Child** ". Thus the term means any work performed by a child for a gain. but more commonly the term child labour is used in pejorative sense.

According to **International Labour Organization (ILO)** "Child Labour includes Children prematurely leading adult lives, working long hours low wages ,under conditions damaging to their health and to their physical and mental development , sometimes separated from their families , frequently deprived of meaningful educational and training opportunities that could open up for them a better future.

Causes of Girl Child Labour

Child Labour is a socio-economic phenomenon. It is generally conceded that illiteracy , ignorance, low wages , unemployment poor standard of living, stark poverty, deep social prejudices and appalling backwardness of the country-side are all, severally and collectively , the root causes of child labour.

Thus, though there are many causes of Girl Child Labour ,

1. Poverty
2. Low wages
3. Unemployment
4. Absence of Schemes for Family Allowance
5. Migration of Urban Areas
6. Large Families
7. A Cheap Commodity
8. Non-Existence of provision for Compulsory Education
9. Illiterecy and Ignorance of Parents
10. Traditional Attitudes
11. Son Preference
12. Getting suitable bridegroom is a problem
13. Vicious Circle
14. Other Reasons

Form of Violation of Human rights of girl child

1. Violence
2. Social exclusion
3. Child labour
4. Rape, Sexual exploitation and dowry offences
5. Girl Child and Prostitution

Recommendations

1. Protective Legislation
2. Establishment free legal defense councils
3. Welfare programs

* Healthcare Facilities for girl child labourers.
* Grant of stipends.
* Playing Facilities.

4. Education Facilities.
5. Voluntary Organizations for Girl child labour Welfare
6. Lengthening of the recess breaks
7. Need for seminars and workshops
8. Registration of Units
9. Fixation of minimum hours of work and wages
10. Provision of good working conditions
11. Public awareness.
12. Attack against poverty.
13. Conduct of a detailed survey on Girl child

Conclusion

In India, the birth of a girl is still not welcome, despite a decade devoted to woman and a year to the girl child. The benefits handed down the generations are so deep rooted and so strong that it is fulfill to expect them to be removed in such a short period. The same may be gradually eradicated by providing the proper education to the girl child where it will improve there socio-economic status.

ACTIVITIES PERFORMED BY WOMEN SHG MEMBERS PROMOTED UNDER THE PROJECT EWIA

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Introduction:

Women constitute nearly half of the nation's population and play an important role in household and agricultural activities. But majority of the women living in rural areas are illiterates and are below poverty line having poor economic status. Besides this, in comparison to urban women, rural women have limited access to all kinds of resources such as education facilities, transportation, training facilities, credit, technology etc. Hence there is need to change their capacity to work, increase knowledge, enrich their skills and improve their economic status by providing them the required resources. The new millennium has thrown many challenges subjecting many nations to undergo transformation cutting across their established traditions and culture. New issues have to be addressed to effect social and economical progress of our nation. The most important one is women's empowerment through SHGs which is the pressing need of the day. Empowerment as a concept was introduced at the International Women's Conference in 1985 at Nairobi. Surekha and Rajamanamma (1999) described empowerment as an important process through which women are enabled to realize their full identity and power in all spheres of life. Women development in recent years emphasized on providing equal opportunities to women by removing gender bias, empowering women and creating self-reliance among them. In the recent years empowerment of women has been recognized as a central issue in determining the status of women. The participation of women in SHGs has made a significant impact on their empowerment both in social and economic aspects. Hence the present NATP, mission mode project, entitled "Em-

powerment of women in Agriculture" was envisaged for technological and economic Empowerment of farm women and improve socio economic conditions for improved quality of light.

Mission of the NATP project

Technological and economic empowerment of farmwomen, to reduce their drudgeries, to increase work efficiency in the context of agriculture and animal husbandry and to improve Socio-economic conditions for improved quality of life.

In recent years SHGs are emerging as an alternative credit source to the rural women in the villages. In SHGs, collective actions and solidarity is an important empowering mechanism. The empowerment of women through SHGs would lead to benefits not only to the individual women and women groups but also for the family and community as a whole through collective action for development.

The concept of SHG serves to underline the principle *for the people, by the people, and of the people*, which is exclusively established for the poor, especially rural women. To break the dependency syndrome and provide women with equal opportunities, SHGs were promoted under the National Agricultural Technology Project, EWIA. Hence, the present research was carried to study the impact of the project on farmwomen SHG members.

Material and Methods

The study was conducted in Dharwad and Gadag districts of Karnataka state during 2004-05. NATP adopted villages were purposively selected for the study to know the impact of the project on the farmwomen SHG members. NATP adopted villages and the SHG members required for the study were obtained from the project investigator of the project. Sample size for the study constituted of 120 NATP beneficiaries and required information from the respondents was collected by using pre-tested interview schedule. Appropriate statistical tools were used for analysis of the data.

Results and Discussion

An observation of Table 1 gives us the idea about rankings given to different activities that are performed in the meeting. First rank was given to discussing family problems by 80.8% of the respondents. The reason might be that the rural women members were exposed to the outside urban world with their village women and developed confidence, courage and friendly attitude with NATP staff and group members. Also, they felt that they have some one to listen to their family problems and to suggest proper solutions. The SHG members feel that they have some one to listen to their problems and give solutions. Attendance of the group was also found regular as women found an outlet to their problems. Second rank was given by 47.5 percent of the respondents to discussion on savings because savings played a very important role to give loans to the members. The savings of the SHGs were very important to decide the loan amount to be sanctioned by the banks to take up entrepreneurial activities and hence the saving habit amongst the members can also be improved. Sixth rank was given to singing of bhajans by 86.7 per cent of the respondents. Most of the members reported that they usually start meeting during night time so that all members can attend meeting. Since it was night time and already too late they start directly with discussion of family problem, savings, exchange of loans etc. without wasting time on singing bhajans.

Table 2 highlights that vermicelli making, Rava making and Chilli pounding were group entrepreneurial activities taken up by majority of the SHG members. The reason may be that were was more demand for these products i.e. good market and more profit. For this very reason the women were attracted to this enterprise. The machines were given free of cost to the beneficiaries and training was also provided on the use of these machines. Tailoring was also one of the income generating activities which was taken up by 15.8% of the respondents regularly and the reason may be that most of the women members are interested in tailoring because it is an enterprise which women can take up in their own house and work at their own pace of time. Another reason is that, most of the young girls after their high school or college prefer to get training on tailoring. This is most common in almost all the villages because within a short duration they can learn and can earn more money. Young girls can also stitch their own clothes and money saved can be considered as money earned. Papad making and Roti making are taken by 10% of the respondents regularly because these are individual activities and the respondents may be having the feeling that individual activities are more better than group to perform these activities. And also these activities are not time bound and whenever the women members are free they can take-up these activities. From Table 3, it can be pointed out that majority (96.7) of the SHG members utilized the profit earned on regular household expenditure, followed by children's education (51.7%). Since they are housewives, they have greater responsibility in running the family and looking after daily expenditure. The respondents also reported that there is smooth running of the family without any problem because they were utilizing the profit on regular household expenditure. Before earning any income, SHG member's contribution towards their childrens education was very poor and was taken care by their husband only. But after joining SHGs and taking up economic activity earnings allowed them to contribute on their childrens education. They also know the importance of education in life and they do not want their children to be like themselves i.e., illiterates. Hence, their contribution towards children education was good. Only 5.0% of the respondents reported that the profit earned sometimes was also given to their husbands. The reason is because if they do not give the money they were not allowed to join SHGs and the other reason is that they had faith over their husbands that the money was utilized for right purpose only. With respect to level of income of the SHG members Table 4

depicts that 95.00 per cent of the respondents reported their income level was increased only after joining the project. Thus the study concludes that the project EWIA has become dias for women for their overall empowerment.

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Table 1. Activities performed in the meeting

Sl. No	Activities	Rankings												Mean Ranking
		1		2		3		4		5		6		
		F	%	F	%	F	%	F	%	F	%	F	%	
1	Discussing family problems	97	80.8	22	18.3	1	0.8	-	-	-	-	-	-	1.20
2	Discussions on savings	8	6.7	57	14.5	9	7.5	13	25.0	16	13.3	-	-	2.91
3	Exchange of loans	1	0.8	7	5.8	84	70.0	26	21.7	2	1.7	-	-	3.18
4	Discussing problems on enterprises	-	-	31	26.8	25	20.8	46	38.3	18	15.0	-	-	3.43
5	Discussing problems on Agricultural & allied areas	-	-	1	0.8	1	0.8	18	15.0	84	70.0	16	13.3	4.94
6	Singing Bhajans	16	13.3	-	-	-	-	-	-	-	-	104	86.7	5.33

Table 2. Entrepreneurial Activities performed by SHG members

S.No	Entrepreneurial Activities	Respondents					
		Regularly		Occasionally		Never	
		F	%	F	%	F	%
1	Vermicelli making	48	40.0	3	2.5	69	57.5
2	Rava making	25	20.8	2	1.7	93	77.5
3	Chilli Pounding	20	16.7	-	-	100	83.3
4	Tailoring	19	15.8	1	0.8	100	83.3
5	Papad Making	12	10.0	1	0.8	107	89.2
6	Roti making	11	9.2	2	1.7	107	89.2
7	Bakery Unit	3	2.5	-	-	117	97.5
8	Grocery shop	5	4.2	-	-	115	95.8
9	Kitchen gardening	2	1.7	-	-	118	98.3
10	Bangles Selling	2	1.7	-	-	118	98.3
11	Vegetable vending	2	1.7	-	-	118	98.3
12	Goat rearing	1	0.8	-	-	119	99.2

Table 4. Level of Income of SHG members after joining the project.

Sl.No	Level of Income	Respondents	
		Frequency	Percentage
1	Increased	114	95.0
2	Remained Same	6	5.0
3	Decreased	-	-

Table 3. Utilization of profit earned by SHG members.

Sl.No	Item	Respondents	
		Frequency	Percentage
1	Regular House hold expenditure	116	96.7
2	Education of children	62	51.7
3	Health purpose	29	24.2
4	Celebrating festivals	27	22.5
5	Consumption of nutritious foods	23	19.2
6	Marriage of children	20	16.6
7	Renovation of House	7	5.8
8	Giving it to Husband	6	5.0

MAJOR TRIBULATIONS FACED BY SHG MEMBERS AND THEIR SUGGESTIONS

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Introduction:

Rural women in our country constitute an important work force in agriculture and allied sectors and are vital to the well being of farm households. Nearly half of the available human resource in India is women. Majority of them are living in rural areas and most of them are illiterates and are below poverty line having poor economic status. Besides this in comparison to urban women, rural women have limited access to all kinds of resources but have more hidden talents, which have to be bought in to light. Hence, there is need to change their capacity to work, increase knowledge, enrich their skills and improve their economic status. The new millennium has thrown many challenges subjecting many nations to undergo transformation cutting across their established tradition and culture. New issues have to be addressed to effect social and economical progress of our nation. The most important one is women's empowerment through Self-help groups. SHGs have undoubtedly begun to make a significant contribution in poverty elevation and empowerment of poor, especially women in rural areas of our country.

Hence, the present NATP (National Agriculture Technological Project), mission mode project entitled "Empowerment of Women in Agriculture" was envisaged for technological and economic empowerment of farmwomen, to reduce their drudgeries, increase work efficiency in the context of agriculture and animal husbandry and improve socio-economic conditions for improved quality of life.

Farmwomen SHG members taken for the study have worked in association with NATP project for five years. Hence the study is an attempt to know the constraints faced by farmwomen SHG members while working with the project and to know the suggestions given by SHG members for further improvement of the project.

Methodology:

The present study was conducted in purposively selected villages of Dharwad and Gadag districts of Karnataka state during 2004-2005 with a sample size of 120 farmwomen SHG members who were involved in different entrepreneurial activities promoted under the NATP project.

The research instrument i.e, interview schedule was prepared by relevant literature and experts in the field as well as by making necessary modifications after pre-testing for its applicability and feasibility in a non-sample area. The data was collected through personal interview with the respondents. The statistics employed for data analysis were simple frequency and percentage.

Results and Discussion:

The data projected in Table 1 revealed that majority of the farmwomen SHG members considered lack of formal education (47.5 %) as their personal problem. It is seen that majority of the women living in rural areas are either illiterate or semi-literate. Thus, it becomes essential for the extension personnel's to impart informal education to the rural women so that they can read and write and get knowledge about the day-to-days information. Hence literacy plays an important role in empowering the rural women. Thirty-three percent of the farmwomen SHG members reported shortage of electricity as their technical problem. It is seen that in most of the rural areas electricity is cut off from morning till evening which hinders the success in Income Generating Activities. Hence, good electricity facility should be provided for smooth running of the economic activity. Insufficient loan as their economic problem was reported by 27.5 % of women SHG members may be because of that their repayment of loan is not to the expectation and because of their small savings. So, here SHG members should have more knowledge about the savings and should work hard to gain more profit. Extension functionaries also have role to play i.e., imparting knowledge about savings and in taking up new income generating activities to the farmwomen SHG members. Social problem i.e, lack of social mobility because of the restrictions in the family was reported by 19.2 per cent of the SHG members because thinking that she is woman, the elders in the house do not allow her to move freely in the village and make her to

stay inside the four walls of the house. Manimekalai and Rajendran (1993), in their study reported similar results which indicate that most of the women remained unemployed because of the male dominant families, where they were not allowed to go outside the house to take up new economic activity. Now a day's women have achieved success in almost all the fields were men have achieved, but our rural women are not given opportunities to show their talents. Hence, rural women should be encouraged to go outside four walls of house, attend trainings and take up new economic activity so that women can be empowered and also empower others. With respect to suggestions, among 120 respondents, 78.3 per cent of SHG members suggested that the project should be continued and started in other villages, so that other women can also be benefited in terms of knowledge, savings, current information etc. and even those women can be empowered and recognized in the society. Sixty nine per cent of the respondents suggested increasing the loan amount, which is basic component to start an activity, to improve group productivity, and also women can be financially sound when loan amount is given sufficiently which is very much needed to start an activity. Other suggestions given by the respondents were requirement of information on banking and marketing aspects along with marketing facilities (67.5 %) and requirement of activities that run all the season (65.0 %). The results are on par with Tejaswini and Veerabhadraiah (1996), where the findings in their study reveals lack of proper marketing facilities (75.00%) and problems in getting loan money (66.00%) as their major problems. Hence the extension personnel's should take in the above-mentioned suggestions and problems in to consideration so that the SHGs run successfully and be model for others.

The study concludes by saying that it is necessary to literate rural women, upgrade and improve the skills, provide opportunity for them to express their potential abilities. It is also the responsibility of the extension personnel and other higher authorities to motivate, guide and educate rural women for their empowerment and to solve their problems timely and consider their suggestions if necessary.

References

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Table 1. Problems faced by SHG members

N = 120

Sl. No.	Problems	Respondents	
		Frequency	Percentage
1.	**Personal problems**		
a.	Lack of training/education	34	28.3
b.	Lack of freedom to take decisions	13	10.8
c.	Lack of encouragement	23	19.2
d.	Lack of formal education	57	47.5
2.	**Social problems**		
a.	Lack of social mobility because of		
	restrictions in the family	23	19.2
b.	Conflicts among the group members	6	5.0
3.	**Economic problems**		
a.	Income derived is too little	15	12.5
b.	Loans are not sufficient	33	27.5
c.	Product has no market	10	8.3
4.	**Technical problems**		
a.	Lack of skills to handle the implements	10	8.3
b.	Non-availability of spare parts	40	33.3
c.	Delay in the internalization of skills	14	11.7
d.	Shortage of electricity	39	32.5
e.	Unskilled women group members	35	29.2

Table 2. Suggestions given by SHG members

N = 120

Sl. No.	Suggestions	Respondents	
		Frequency	Percentage
1.	Let project be continued and started in other villages also	94	78.3
2.	Loan amount should be increased	83	69.1
3.	Information on banking and marketing aspects should be		
	given including marketing facilities	81	67.5
4.	Activities which run all seasons should be given	78	65.0
5.	All SHG women members should be given basic knowledge		
	about SHGs and its importance	67	55.8
6.	Problems faced by SHG members should be regularly attended		
	to and given solutions	65	54.1
7.	Follow-up should be increased	56	46.6
8.	Informal education should be given	50	41.6
9.	Unity should be improved	35	29.1
10.	Training on extraction of oil from soybean should be given	11	9.2

ಪ್ರಾಚೀನ ಭಾರತದಲ್ಲಿ ಸಾಮಾಜಿಕ ಹಾಗೂ ಆರ್ಥಿಕ ರಂಗಗಳಲ್ಲಿ ಸ್ತ್ರೀಯ ಸ್ಥಾನಮಾನಗಳು

ಡಾ॥ ಕೆ. ಎಸ್. ರಮಾ
ಪ್ರಾಚಾರ್ಯರು, ಸರ್ಕಾರಿ ಪದವಿ ಪೂರ್ವ ಕಾಲೇಜ, ಬೆಂಗಳೂರು

ಭಾರತೀಯ ನಾರಿಯ ಸ್ಥಾನಮಾನಗಳನ್ನು ವಿವಿಧರಂಗಗಳಲ್ಲಿ ವಿವೇಚನೆಯಿಂದ ಚರ್ಚಿಸುವ, ಅವಳ ಸಮಸ್ಯೆಗಳಿಗೆ ಪರಿಹಾರವನ್ನು ಹುಡುಕುವ, ವಿಜ್ಞಾನ ಮುಂತಾದ ಆಧುನಿಕ ಆಯಾಮಗಳಲ್ಲಿ ಸ್ತ್ರೀಯರ ಪಾತ್ರವನ್ನು, ಕೊಡುಗೆಯನ್ನು ಆಲೋಚಿಸುವ ಪರಿಪೂರ್ಣವಾದ ಚರ್ಚೆ, ಮಂಥನ ಈ ಸಮ್ಮೇಳನದಲ್ಲಿ ನಡೆಯಲಿದೆ, ಈ ಸಮ್ಮೇಳನದಲ್ಲಿ ನಾನು ತೆಗೆದುಕೊಂಡಿರುವ ವಿಷಯ ಪುರಾತನ ಗ್ರಂಥಗಳಲ್ಲಿ ಕಂಡು ಬರುವ, ಸ್ತ್ರೀವಿಷಯಕವಾದ ಸಾಮಾಜಿಕ ಹಾಗೂ ಆರ್ಥಿಕ ಸ್ಥಾನಮಾನಗಳ ಸಂಕ್ಷಿಪ್ತಪರಿಚಯ.

ಭಾರತೀಯರು ಪ್ರಾಚೀನ ಸಂಸ್ಕೃತಿಯಲ್ಲಿ ಸ್ತ್ರೀಗೆ ನೀಡಿರುವ ಸ್ಥಾನ ಎಲ್ಲರೂ ಹೆಮ್ಮೆಪಡುವಂತಹದು, ನಮ್ಮ ಪೂರ್ವಿಕರು ಅರ್ಧನಾರೀಶ್ವರ ಕಲ್ಪನೆಯಲ್ಲಿ ಸ್ತ್ರೀ ಮತ್ತು ಪುರುಷರ ಸಮಾನತೆಯನ್ನು ಎತ್ತಿಹಿಡಿದಿದ್ದಾರೆ.

ಅಂಗಪುರಾಣವು ಹೇಳುವಂತೆ

।ದ್ವಿದಾಕೃತ್ವಾ ಸ್ವಕಂ ದೇಹಮರ್ಧೇನ ಪುರುಷೋ ಭವತ್ ಅರ್ಧೇನ ನಾರೀ ಸಾ ತಸ್ಯ ಶತರೂಪಾ ವ್ಯಜಾಯತ।

॥ ಪರಮೇಶ್ವರನು ತನ್ನ ಶರೀರವನ್ನು ಎರಡು ಭಾಗಗಳಾಗಿ ಮಾಡಿ, ಅರ್ಧಭಾಗವನ್ನು ಪುರುಷನನ್ನಾಗಿಸುಅಲು, ಇನ್ನರ್ಧಭಾಗವು ನಾರಿಯಾಗಿ ಶತರೂಪಗಳನ್ನು ಧರಿಸಿದಳು॥

ನಾನು ಕೊಡುತ್ತಿರುವ ಚಿತ್ರಣ ಒಂದು ಸಾಮಾನ್ಯ ನೋಟ ಂ ಡಿಜಲಿಡಿಜ-ಜಣಿಣಚಿಣುತಜ, ಣಣಜಥಿ ರಡಿ ಚಿ ರಟಜಚಿಣಛಜ ಚಿಣ ಣುಜ, ಣಥಲಿಜಛಣ

ವೇದದ ಕಾಲದಿಂದ ಗ್ರಂಥಗಳಲ್ಲಿ ಲಭ್ಯವಾಗಿರುವ ಕೆಲವು ಉದಾಹರಣೆಗಳಿಂದ ನಾರಿಯ ಒಂದು ಸ್ಥಾನಮಾನಗಳನ್ನು ಅಳೆಯಬೆಕಾಗಿದೆ. ದಾಖಲಾಗಿರುವ ವಿಷಾಯಗಳು ಕಡಿಮೆ. ಕಾಲಗರ್ಭದಲ್ಲಿ ಎಷ್ಟು ದಾಖಲೆಗಳು ನಶಿಸಿಹೋಗಿವೆಯೋ ಅರಿಯುವುದು ಅಸಾಧ್ಯ.

ವೇದಗಳ ಕಾಲದಲ್ಲಿ ಸ್ತ್ರೀಯರನ್ನು ಎರಡು ವಿಧವಾಗಿ ವಿಭಾಗಿಸುತ್ತಿದ್ದರು.

1) ಸದ್ಯೋವಧುಗಳು (2) ಬ್ರಹ್ಮವಾದಿನಿಯರು

ಸದ್ಯೋವಧುಗಳು ವಿವಾಹವಾಗಿ ಪತಿಯೊಡನೆ ಸಂಸಾರದಲ್ಲಿ ತೊಡಗಿಸಿಕೊಳ್ಳುವ ಗೃಹಿಣಿಯರು. ಬ್ರಹ್ಮವಾದಿನಿಯರು ತಮ್ಮ ಜೀವನವನ್ನು ಜ್ಞಾನಾರ್ಜನೆಗೆ ಮೀಸಲಿಟ್ಟಿದ್ದರು. ಇವರು ವಿವಾಹಿತರಾದರೂ ಸಂಸಾರಕ್ಕೆ ತಮ್ಮನ್ನು ಸೀಮಿತಗೊಳಿಸಿಕೊಳ್ಳದೆ ಅಧ್ಯಾತ್ಮಜ್ಞಾನವನ್ನು ಪಡೆದರು. ವೇದಮಂತ್ರಗಳ ದ್ರಷ್ಟಾರರಾಗಿ ಋಷಿಕೆಯರಾ ಹೆಸರುಗಳಿಸಿರುವರು.

ಶೌನಕ ಮಹರ್ಷಿಯ "ಬೃಹದ್ದೇವತಾ" ಗ್ರಂಥವು ಜ್ಞಾನಿಗಳಾದ ಸ್ತ್ರೀಯರನ್ನು ಮೂರು ವಿಭಾಗದಲ್ಲಿ ತಿಳಿಸುತ್ತಾರೆ.

1) ಘೋಷಾ ಗೋಧಾ ವಿಶ್ವವಾರಾ ಅಪಾಲೋಪನಿಷನ್ನಿಷತ್
ಬ್ರಹ್ಮಜಾಯಾ ಜುಹುರ್ನಾಮ ಅಗಸ್ತ್ಯ ಸ್ವಸಾದಿತಿಃ॥
ಇವರೆಲ್ಲರೂ ದೇವತೆಗಳನ್ನು ಪ್ರಾರ್ಥಿಸಿ ತಮ್ಮ ಇಷ್ಟಾರ್ಥಗಳನ್ನು ಈಡೇರಿಸಿಕೊಂಡವರು.

2) ಇಂದ್ರಾಣಿ ಚಾಂದ್ರಮಾತಾ ಚ ಸರಮಾ ರೋಮಶೋರ್ವಶ್ರೀ।
ಲೋಪಾಮುದ್ರಾ ಚ ನದ್ಯಸ್ಚಯಮೀ ನಾರೀಚ ಶಾಶ್ವತೀ॥
ಇವರು ದೇವತೆಗಳೊಂದಿಗೆ ಸಂಭಾಷಣೆ (ಸಂವಾದ) ನಡೆಸಿದವರು.

3) ಶ್ರೀರ್ಲಾಕ್ಷಾ ಸರ್ಪರಾಜ್ಞೀ ವಾಕ್, ಶ್ರಾದ್ಧಾ, ಮೇಧಾ ಚದಕ್ಷಿಣಾ
ರಾತ್ರೀ ಸೂರ್ಯಚ ಸಾವಿತ್ರೀ ಬ್ರಹ್ಮವಾದಿನ್ಯಃ ಈರಿತಃ
ಬ್ರಹ್ಮದೇವತಾ ಜಜ
A.M. Macdowell

ಈ ಋಷಿಕೆಯರು ಬ್ರಹ್ಮವಾದಿನಿಯರು.

ಅಪಾಲಾ ಇಂದ್ರನನ್ನು ಆಹ್ವಾನಿಸಿ, ಅರಾಧಿಸಿ ತನ್ನ ತಂದೆಯ ಖಾಯಿಲೆಯನ್ನು ಗುಣಪಡಿಸುತ್ತಾಳೆ. ತಂದೆಯ ಬರಡಾದ ಭೂಮಿಯನ್ನು ಹಸಿರಾಗಿಸುತ್ತಾಳೆ (ಋಗ್ವೇದ 4 91)

ಕಾಮಯಾನನ ಮಗಳು ಶ್ರದ್ಧಾಕಾಮಯಾನಿ, ಶ್ರದ್ಧೆಯ ಪ್ರತೀಕ ಅವಳು

ದೇವತಾಸ್ಥಾನದಲ್ಲಿದ್ದಾಳೆ (ಋಗ್ವೇದ 1. 129)

ಋಗ್ವೇದದ ಹತ್ತನೆ ಮಂಡಲದ 125 ನೇ ಸೂಕ್ತದ ಋಷಿಕೆ. ಹಾಗೂ ದೇವತೆ ವಾಕ್, ತಾನೇ ಬ್ರಹ್ಮನೆಂದೂ.

ಶಕ್ತಿಶಾಲಿಯೆಂದೂ, ಐಶ್ವರ್ಯ, ಜ್ಞಾನವನ್ನು ಕೊಡುವಳೆಂದೂ ತಿಳಿಸುತ್ತಾಳೆ.

ಪುಲೋಮನ ಮಗಳಾದ ಶಚೀ (ಋಗ್ವೇದ 10 ಮಾ. 129 ಸೂ)
ಮನೆಯ ಆಡಳಿತಕ್ಕೆ ಒಡೆಯಳಾಗಿದ್ದಾಳೆ. ಶಕ್ತಿಶಾಲಿಯಾದ ಮಗ, ಸುಹಾರಾಣೀಯಂಥ ಮಗಳು. ಸುಂದರ ಸಂಸಾರ.

ಲೋಪಾಮುದ್ರೆಯು ಅಗಸ್ತ್ಯನ ಪತ್ನಿ. ಪತಿಯು ಪೂರ್ಣವಾಗಿ ಆಧ್ಯಾತ್ಮದಲ್ಲಿ ಮುಳುಗಿ ಸಂಸಾರದಲ್ಲಿ ವಿರಕ್ತನಾಗಿರಲು, ಸಕಾಲದಲ್ಲಿ ಅವನಿಗೆ ಗೃಹಸ್ಥಾಶ್ರಮದ ಪ್ರಾಮುಖ್ಯತೆಯನ್ನು ಮನವರಿಕೆ ಮಾಡಿಕೊಟ್ಟು ಅವನಿಂದ ಮಕ್ಕಳನ್ನು ಪಡೆಯುತ್ತಾಳೆ (ಋಗ್ವೇದ 1-129)

ಋಗ್ವೇದದ ಸೂರ್ಯಸೂಕ್ತವು ಅಂದಿನ ವಿವಾಹ ಪದ್ಧತಿಯನ್ನು ತಿಳಿಸುತ್ತದೆ. ಈ ಮಂತ್ರದ ದುಷ್ಕಾರಣ್ಣ ಸೂರ್ಯ ಇದೇ ವಿವಾಹ ಪದ್ಧತಿಯನು ಇಂದೂ ಅನುಸರಿಸುತ್ತಿದ್ದೇವೆ.

ಎರಡು ಮಂತ್ರಗಳನ್ನು ಉದಾಹರಣೆಯಾಗಿ ನೋಡಿದರೆ ಅಂದಿನ ಸ್ತ್ರೀಗೆ ವಿವಾಹದಲ್ಲಿ ಮತ್ತು ಆನಂತರ ಎಂಥಹ ಉನ್ನತವಾದ ಸ್ಥಾನವಿತ್ತು ಎಂದು ತಿಳಿಯುತ್ತದೆ.

ಗೃಹ್ಣಾಮಿ ತೆ ಸೌಭಗತ್ವಾಯ ಹಸ್ತಂ ಮಯಾ ಪತ್ಯಾಜರದೋ ಅರ್ಯಮಾ
ಸವಿತಾ – ಜರಧಿಷ್ಟಿರ್ಯಾಥಾಸಃ 4
-ಪುರಂಧಿರ್ದುಹ್ಯಂ ತ್ವಾದುರ್ಗಾರ್ಹಪತ್ಯಾಯ ದೇವಾಃ ॥
ನಿನ್ನ ಹಸ್ತವನ್ನು ಸಮೃದ್ಧಿಗಾಗಿ ಹಿಡಿಯುತ್ತಿದ್ದೇನೆ.

ಈ ವಿವಾಹದಿಂದ ನಾವಿಬ್ಬರೂ ವೃದ್ಧಾಪ್ಯದವರೆಗೆ ಒಂದಾಗಿ ಬಾಳೋಣ ಭಗ, ಅರ್ಯಮಾ, ಸವಿತೃ ಮತ್ತು ಪೂಷಾ ನಿನ್ನನ್ನೌ ಈ ಮನೆಯ ಒಡತಿಯಾಗಿರಲೆಂದು ನನಗೆ ಅನುಗ್ರಹಿಸಿದ್ದಾರೆ.

ಸಾಮಾಜ್ಞಿ ಶ್ವಶುರೇ ಭವ ಸಮಾಜ್ಞೀ ಶ್ವಶ್ರವಾಂ ಭವ।
ನನಾಂದರಿ ಸಮ್ರಾಜ್ಞೀ ಭವ ಸಮ್ರಾಜ್ಞೀ ಅಧಿ ದೇವೃಷು॥

ಪತಿಯ ಮನೆಗೆ ಬರುವ ವಧುವಿಗೆ ಗೌರವದ ಗೃಹಪತ್ನಿಯ ಪಟ್ಟ ದೊರಕುತ್ತದೆ.

ಅತ್ತೆ ಮಾವಂದಿರಿಗೆ ನಾದಿನಿ ಮೈದುನರಿಗೆ ಸಮ್ರಾಜ್ಞಿಯಾಗಿ ಪ್ರೀತಿಯಿಂದ ಎಲ್ಲರನ್ನೂ ಕಾಪಾಡುವ ಹೊಣೆ ಹೊರುತ್ತಾಳೆ ಆದರೆ ಇದು ಅಷ್ಟಾಗಿ ಅಲ್ಲ. ಮನೆಯೊಡತಿಯಾಗಿ.

ಇಂದಿಗೂ ವಿವಾಹದಲ್ಲಿ ನಡೆಯುವ ಮುಖ್ಯಕಾರ್ಯಕ್ರಮವೊಂದಿದೆ. ಅದೇ ಸಪ್ತಪದಿ.

"ಇಷೆ ಏಕಪದೀ ಭವ। ಊರ್ಜೆದ್ವಿಪದೀ ಭವ।
ರಾಯಸ್ಪೋಷಾಯ ತ್ರಿಪದೀಭವ। ಮಯೋಭವ್ಯಾಯ ಚತುಷ್ಪದೀ ಭವ।
ಪ್ರಜಾಭ್ಯಃ ಪಂಚಪದೀ ಭವ। ಋತುಭ್ಯಃ ಷಟ್ಪದೀ ಭವ। ಸಖಾ ಸಪ್ತಪದೀ ಭವ॥

ಜೀವನದಲ್ಲಿ ಪತಿಪತ್ನಿಯರ, ವೈವಾಹಿಕ ಜೀವನದ ಆದರ್ಶಧೇಯಗಳನ್ನು ಈ ಸಪ್ತಪದಿ ತಿಳಿಸುತ್ತದೆ.

ವಿವಾಹದಲ್ಲಿ ವಧುವರರು ಏಳು ಹೆಜ್ಜೆಗಳನ್ನು ಜೊತೆಜೊತೆಯಾಗಿ ಇಡುತ್ತಾರೆ. ಮೊದಲನೆಯ ಹೆಜ್ಜೆ ಜೀವನ ನಿರ್ವಹಣೆಗಾಗಿ. ಎರಡನೆಯ ಹೆಜ್ಜೆ ಅಭಿವೃದ್ಧಿಗಾಗಿ (ಊರ್ಜಾ) ಶಕ್ತಿಮಾನಸಿಕ ಹಾಗೂ ದೈಹಿಕ ಆರೋಗ್ಯಕ್ಕಾಗಿ, ಐಶ್ವರ್ಯಕ್ಕಾಗಿ ಮೂರನೆಯ ಹೆಜ್ಜೆ, ನಾಲ್ಕನೆ ಮತ್ತು ಆರನೆಯ ಹೆಜ್ಜೆಗಳು ದಾಂಪತ್ಯ, ಸುಖ, ಸಂಸಾರ ಸುಖಕ್ಕಾಗಿ, ಐದನೆಯ ಹೆಜ್ಜೆಯು ಸಂತತಿಗಾಗಿ, ಏಳನೆಯ ಹೆಜ್ಜೆಯು ಇಬ್ಬರೂ ಸ್ನೇಹಿತರಾಗಿ ಬಾಳುವುದಕ್ಕಾಗಿ.

ವೇದದ ಕಾಲದ ಹೆಣ್ಣಿನ ಒಂದು ಚಿತ್ರಣ ವೇದ ಮಂತ್ರಗಳಿಂದ ದೊರೆಯುತ್ತದೆ. ಕೆಲವು ಮಂತ್ರಗಳಲ್ಲಿ ಬಹುಪತ್ನಿತ್ವ (ಋ.ಗಿ. ಷಿ 33.2) ಸಶಗಮನ (ಋಗ್ವೇದ 10. 18.8) ರಜೀಗೆ ಸೂಚನೆ ಇದೆ ಎಂದು ಕೆಲವು ವಿದ್ವಾಂಸರ ಅಭಿಪ್ರಾಯ, ಆದರೆ ಈ ಮಂತ್ರಗಳ ಅರ್ಥದ ಬಗ್ಗೆ ಭಿನ್ನಾಭಿಪ್ರಾಯಗಳಿರುವುದರಿಂದ ಈ ಬಗ್ಗೆ ಹೆಚ್ಚು ಒತ್ತುಕೊಟ್ಟಿಲ್ಲ.

ಋಷಿಗಳ ಆತ್ಮಸಂಶೋಧನೆಯ ನಿರಂತರ ಪ್ರಯತ್ನದ ಫಲ ಉಪನಿಷತ್ತುಗಳಲ್ಲದೆ. ಪ್ರಪಂಚವನ್ನು ಯಜ್ಞಶಾಲೆಯಾಗಿ ಕಲ್ಪಿಸಿದೆ ಇಲ್ಲಿ ಹೋಕೃವು (ಪುರೋಹಿತ) ಪುರುಷ, ಸ್ತ್ರೀ ಯಜ್ಞದ ಪವಿತ್ರಾಗ್ನಿ ಹೋತೃವು ಯಜ್ಞದ ಸಾಮಗ್ರಿಗಳನ್ನು ಒಟ್ಟುಗೂಡಿಸಿ ಅಗ್ನಿಗೆ ಆಹುತಿ ಕೊಡುತ್ತಾನೆ. ಅಗ್ನಿ ಆ ಹವಿರ್ಭಾಗವನ್ನು ಎಲ್ಲದೇವತೆಗಳಿಗೂ ಹಂಚುತ್ತನೆ ಹಾಗೆಯೇ ಪುರುಷ ಜೀವನಾವಶ್ಯಕ ವಸ್ತುಗಳನ್ನು ಒಟ್ಟುಗೂಡಿಸುತ್ತಾನೆ (Man is a collection and women is distributior) ಹೆಣ್ಣು ಅದನ್ನು ಸಮರ್ಪಕವಾದ ರೀತಿಯಲ್ಲಿ ಹಂಚುತ್ತಾಳೆ.

ಬೃಹದಾರಣ್ಯಕ ಉಪನಿಷತ್ತು ನಲ್ಲಿ ನಾಲಿಯ ಎರಡು ಮುಖಗಳನ್ನು ನಾವು ಕಾಣಬಹುದು. ಯಾಜ್ಞವಲ್ಕ್ಯ ಮಹರ್ಷಿಗೆ ಇಬ್ಬರು ಪತ್ನಿಯರು. ಕಾತ್ಯಾಯನಿ ಮೈತ್ರೇಯಿ, ಕಾತ್ಯಾಯನಿಯು ಐಹಿಕವಾಗಿ ಕರ್ಮಮಾರ್ಗವನ್ನು ಅನುಸರಿಸಿ ಸಂಸಾರಿಯಾಗಿ ಜೀವನ ಸಾರ್ಥಕಮಾಡಿಕೊಂಡಳು ಮೈತ್ರೇಯಿ ಮೋಕ್ಷಪತ್ನಿಯಾದಳು.

ಬ್ರಹ್ಮವಾದಿನಿ ಗಾರ್ಗಿವಾಚಕ್ನವಿಯ ಹೆಸರು ಪ್ರಸಿದ್ಧ ಜನಕನ ಆಸ್ಥಾನದಲ್ಲಿ ಶ್ರೇಷ್ಟವಾದ ಜ್ಞಾನ, ಬ್ರಹ್ಮಜ್ಞಾನದ ವಿಷಯವು ಚರ್ಚಿಸಿದಾಗ, ಗಾರ್ಗಿಯು ಯಾಜ್ಞವಲ್ಕ್ಯರಿಗೆ ಹಾಕುವ ಪ್ರಶ್ನೆಗಳ ಸರಮಾಲೆ, ಕೊನೆಯಲ್ಲಿ ಗಾರ್ಗಿಯೇ ನಿರ್ಣಾಯಕವಾಗಿ ಯಾಜ್ಞವಲ್ಕ್ಯರನ್ನು ಶ್ರೇಷ್ಠ ಬ್ರಹ್ಮಜ್ಞಾನಿ ಎಂದು ಘೋಷಿಸುವುದು ಅಂದಿನ ಸ್ತ್ರೀಯರಿಗೆ ಇದ್ದ ವಿದ್ಯಾಭ್ಯಾಸದ ಸ್ವಾತಂತ್ರ್ಯ, ವಿದ್ವಾಂಸರ ಸಭೆಯಲ್ಲಿ ಚರ್ಚಿಸುವ ನಿರ್ಣಯವನ್ನು ಕೊಡುವ ಅವಕಾಶಗಳನ್ನು ತೋರಿಸುತ್ತಿದೆ. ಬೃಹದಾ. 3. 8.1

ಪಿ. ವಿ. ಕಾಣಿಯವರು ತಮ್ಮ History of Dharma Sastra ದಲ್ಲಿ (Vol II part-I) ಯಮ ಸ್ಮೃತಿಯ ಮಾತನ್ನು ಉಲ್ಲೇಖಿಸುತ್ತಾ ಹೆಣ್ಣುಮಕ್ಕಳಿಗೆ ವೇದಾಧ್ಯಯನ ಉಪನಯನಗಳ ಅವಕಾಶವಿತ್ತು ಎಂದು ತಿಳಿಸುತ್ತಾರೆ.

ಪುರಾಣಗಳಲ್ಲಿ ಹೆಣ್ಣು ಗಂಡಿಗೆ ಸ್ಥಾನವನ್ನು ಸಮನಾಗಿ ಕೊಟ್ಟಿದೆ.

ನಾರಾಯಣೋಹಂ ಲಕ್ಷ್ಮೀಸ್ತ್ವಂ ಬ್ರಹ್ಮಾಸ್ಮಿತ್ವಂ ಸರಸ್ವತೀ॥
ಜಾಹ್ನವೀ ತ್ವಂ ಸಮುದ್ರೋಹಂ ತ್ವಂ ರತಿಚಿತ್ತ ಭೂರಹಂ॥

ಗಾಂಧರ್ವ ವಿವಾಹದಲ್ಲಿ ಹೆಣ್ಣುಗಂಡುಗಳ ಪರಸ್ಪರ ಒಪ್ಪಿಗೆ ಇರುವುದರಿಂದ ಒಂದು ಕಾಲದಲ್ಲಿ ಆ ವಿವಾಹಕ್ಕೆ ಮನ್ನಣೆಯಿತ್ತು ಕಣ್ವರ ಮಾತು ಮಹಾಭಾರತದಲ್ಲಿ

"ಸಕಾಮಾಯಾಃ ಸಕಾಮೇನ ನಿರ್ಮಂತ್ರಃ ಶ್ರೇಷ್ಠ ಉಚ್ಯತೆ"

ಪುರಾಣಗಳಲ್ಲಿ ಅನೇಕ ಕಡೆ ಪತ್ನಿಯು ಇಚ್ಛೆ ಇಲ್ಲದಿದ್ದಾಗ ಅವಳನ್ನು ಕಾಮಕ್ಕಾಗಿ ಬಲವಂತ ಮಾಡಬಾರದೆಂದು ತಿಳಿಸುತ್ತದೆ. ಅಕಾಲದಲ್ಲಿ ಕಾಮದಿಂದ ಸ್ತ್ರೀಗಮನ ಮಾಡಿದರೆ ಅದರಿಂದ ಹುಟ್ಟುವ ಮಕ್ಕಳ ಮೇಲೆ ಪರಿಣಾಮವಾಗುತ್ತದೆ. ಋತು ಕಾಲದಲ್ಲಿ ಮಾತ್ರ ಒಕ್ಕೆಯ ಮಕ್ಕಳನ್ನು ಪಡೆಯಲು ಸತಿಪತ್ನಿಯರು ಸೇರಬೇಕೆಂದು ಪುರಾಣಗಳು ತಿಳಿಸುತ್ತವೆ.

ಕಾಶೀರಾಜನು ಪತ್ನಿ ಕಲಾವತಿಯನ್ನು ಬಲವಂತವಾಗಿ ಸಂಭೋಗಿಸಲು ಪ್ರಯತ್ನಿಸಿದಾಗ ಕಲಾವತಿಯ ಮೈ ಕಾದಕಬ್ಬಿಣದಂತೆ ಭಾಸವಾಗಿ ತನ್ನ ಪ್ರಯತ್ನವನ್ನು ಬಿಡಬೇಕಾಗುತ್ತದೆ. ಕೈ ಕಸಿ-ವಿಶ್ರವಸಗೆ ಅಕಾಲ ಸಂಭೋದದಿಂದ ಹುಟ್ಟಿದ ಸಂತಾನ ಕ್ರೂರ ಸಂತಾನ ದೋಷಿತ ಸಂತಾನ ರಾವಣ.

ನಿಯೋಗವೆನ್ನುವುದು ಪತಿಯ ಮರಣಾನಂತರ, ಪತ್ನಿಗೆ ಸಂತಾನವಿಲ್ಲದಿದ್ದಾಗ ಆಚರಿಸುತ್ತಿದ್ದ ಪದ್ಧತಿ, ಸಂತತಿಯೇ ಪರಮ ಉದ್ದೇಶವಾಗಿರುವ ಕಾಲದಲ್ಲಿ ಈ ಪದ್ಧತಿಯಿಂದ ಸಂತತಿಯನ್ನು ಪಡೆದು ವಂಶವಾಹಿನಿಯನ್ನು ಮುಂದುವರಿಸುವುದು ರೂಢಿಯಾಗಿತ್ತು. ಮನೆಯ ಹಿರಿಯರ ಅನುಮತಿಯಿಂದ, ಅವರು ಸಮ್ಮತಿಸಿದ ವ್ಯಕ್ತಿಯೊಂದಿಗೆ ಸೇರಿ ಸಂತಾನವನ್ನು ಪಡೆಯುವುದು, ವಂಶಾಭಿವೃದ್ಧಿಯನ್ನು ಮಾಡುವುದು. ಈ ಸಂತಾನಕ್ಕೆ ಕ್ಷೇತ್ರಜನೆಂದು ಹೆಸರು. ಕ್ಷೇತ್ರಜನು ಔರಸ ಪುತ್ರನಂತೆಯೇ ಎಲ್ಲ ಹಕ್ಕುಗಳಿಗೂ ಬಾಧ್ಯನಾಗುವನು. ಪತಿಯು ದೈಹಿಕವಾಗಿ ಸಂತತಿಯನ್ನು ನೀಡಲು ಅಸಮರ್ಥನಾಗಿದ್ದರೆ ಅವನು ಬದುಕಿರುವಾಗಲೇ ಅವನ ಸಮ್ಮತಿಯಿಂದ ಯೋಗ್ಯನಾದ ಪುರುಷನೊಂದಿಗೆ ಸಂಗಮಿಸಿ ಮಕ್ಕಳನ್ನು ಪಡೆಯಬಹುದಾಗಿತ್ತು. ಮಹಾಭಾರತದಲ್ಲಿ ಪಾಂಡವರ ಜನನ ಒಂದು ಉದಾಹರಣೆ ಪುರಾಣಗಳಲ್ಲಿ ಕಲ್ಮಾಷಪಾದನು ತನ್ನ ಪತ್ನಿ ಮದಯಂತಿಯನ್ನು ತಾನೇ ಶೃಂಗರಿಸಿ, ವಸಿಷ್ಠಮಹರ್ಷಿಗಳಿಗೆ ಒಪ್ಪಿಸಿ ತನ್ನ ಕ್ಷೇತ್ರದಲ್ಲಿ ವಂಶೋದ್ಧಾರಕನಾದ ಮಗನನ್ನು ಉತ್ಪತ್ತಿಮಾಡಲು ಕೇಳಿಕೊಳ್ಳುತ್ತಾನೆ. ಆದರೂ ಈ ಪದ್ಧತಿಯು ಕಾಲಕ್ರಮದಲ್ಲಿ ಸಮಾಜಕ್ಕೆ ಇಷ್ಟವಾಗಲಿಲ್ಲವೆಂಬುದು ಪಾಂಡವರು ಕೌರವರ ವೈಮನಸ್ಯದಲ್ಲಿ, ವ್ಯಕ್ತವಾಗುತ್ತದೆ.

ಸ್ತ್ರೀಧನ ಹೆಣ್ಣಿಗೆ ನೀಡಿದ ಆರ್ಥಿಕ ರಕ್ಷಣೆ. ಕೌಟಿಲ್ಯ, ವ್ಯಾಸ ಮುಂತಾದವರು, ತಂದೆ, ತಾಯಿ, ಪತಿ ಅಣ್ಣತಮ್ಮಂದಿರು, ಸಂಬಂಧಿಕರು ಹೆಣ್ಣಿಗೆ ಅವಳ ಸಂತೋಷಕ್ಕಾಗಿ, ಸುಖಕ್ಕಾಗಿ ಸ್ತ್ರೀಧನವನ್ನು ಕೊಡಬೇಕೆಂದು ತಿಳಿಸುತ್ತಾರೆ. ವಿವಾಹ ಸಮಯದಲ್ಲಿ ಕನ್ಯೆಗೆ ಕೊಟ್ಟಂತಹ ಪ್ರೀತಿಯ ಧನ, ಸ್ತ್ರೀಧನ, ಮನ, ಯಾಜ್ಞವಲ್ಕ್ಯ, ನಾರದ, ವಿಷ್ಣು ಮುಂತಾದ ಸ್ಮೃತಿಕಾರರು ಸ್ತ್ರೀಧನದ ವ್ಯಾಖ್ಯೆಯನ್ನು ಮಾಡಿದ್ದಾರೆ. ಕೌಟಿಲ್ಯನ ಪ್ರಕಾರ "ಸರ್ವೇಷಾಂ ಪ್ರತ್ಯಾದೋಪಣ ಮಪ್ರತಿದ್ಧಮಿತಿ". ತಂದೆ ತಾಯಿ, ಅತ್ತೆಮಾವ, ಸೋದರರು, ಸೋದರ ಮಾವಂದಿರು, ಬಂಧುಗಳು ಇವರೆಲ್ಲ ಕೊಟ್ಟ ಹಣ, ಆಭರಣ, ಮುಂತಾದುವು ಸ್ತ್ರೀಗೆ ಸೇರುತ್ತದೆ. ವೃತ್ತಿರಾಬಂಧ್ಯಮ್ ವಾ ಶ್ರೀ ಧನಂ, ವೃತ್ತಿ ಎಂದರೆ ಜೀವನವನ್ನು ಮಾಡಲು ಬೇಕಾಗುವ ಭೂಮಿ, ಹಿರಣ್ಯ ಇವುಗಳು ಆ ಬಂಧ್ಯವೆಂದರೆ ಆಭರಣಗಳು ಕನ್ಯೆಗೆ ಜೀವಿತಕ್ಕಾಗಿ ಕೊಡುವಂತಹ ಹಣದ ಮಿತಿ ಕೌಟಿಲ್ಯನ ಅಭಿಪ್ರಾಯದಲ್ಲಿ ೨೦೦೦ ಕಾರ್ಷಾಪಣಗಳು ಆದರೆ ಆಭರಣಗಳಿಗೆ ಮಿತಿಯಿಲ್ಲ.

ವಿವಾಹ-ಸಮಯಕ್ಕೆ ಅಗ್ನಿ ಸನ್ನಿಧಿಯಲ್ಲಿ ದೊರೆತ ಸ್ತ್ರೀಧನವು ಅಧ್ಯಗ್ನಿ ಕೃತ. ಸ್ತ್ರೀ ಧನ. ಶ್ವಶುರಗೃಹಕ್ಕೆ ಹೋಗುವಾಗ ಪ್ರಿತ್ಯವು ಕೊಟ್ಟ ಧನವು ಅಧ್ಯಾವಹನಿಕ. ಅತ್ತೆಮಾವಂದಿರ ಪಾದವಂದನೆಯ ಕಾಲಕ್ಕೆ ದೊರೆತದ್ದು ಪ್ರೀತಿದತ್ತ. ತಾಯಿ ತಂದೆಯರಿಂದ ದೊರೆತದ್ದು ಸದಾಯಿಕ ಸ್ತ್ರೀ ಧನ.

ಕನ್ಯೆಯನ್ನು ವಿವಾಹಮಾಡಿಕೊಡುವಾಗ ತೆಗೆದುಕೊಂಡ ಶುಲ್ಕಕ್ಕೆ ಅನ್ವಾಧೇಯಕವೆನ್ನುವರು. ವಿವಾಹನಂತರ ಈ ಶುಲ್ಕವನ್ನು ತಂದೆ ತಾಯಿಯರು ವಿವಾಹಿತ ವಧುವಿಗೆ ಕೊಡುವರು. ಸ್ತ್ರೀಧನವನ್ನು ಸ್ತ್ರೀಯು ಪತಿಯು ಬದುಕಿರುವಾಗ ವಿಕ್ರಯ ಮಾಡಬಾರದು. ಕೇವಲ ಭೋಗಿಸುವ ಹಕ್ಕನ್ನು ಅವಳು ಪಡೆದಿರುತ್ತಾಳೆ. ಹೇಗೆ ಇರಲಿ ಸ್ತ್ರೀಧನವನ್ನು ಪತಿಯು ತನ್ನ ಹಕ್ಕೆಂದು ಕಿತ್ತುಕೊಳ್ಳುವಂತಿಲ್ಲ. ಸ್ತ್ರೀಯ ಮರಣಾನಂತರ ಅದು ಅವಳ ಹೆಣ್ಣುಮಕ್ಕಳಿಗೆ ದೊರೆಯುತ್ತದೆ.

ಸಮಾಜದಲ್ಲಿ ಸ್ತ್ರೀಯ ಸ್ಥಾನ, ಭಾರತದಲ್ಲಿ ವೇದ, ಉಪನಿಷತ್ತು, ಪುರಾಣಗಳ ಕಾಲದಲ್ಲಿ ಉನ್ನತವಾದ ಗೌರವ ಸ್ಥಾನವನ್ನು ಹೊಂದಿತ್ತು. ಯಾವುದೇ ಕಾರಣಕ್ಕಾಗಿಯೋ ಪರಿತ್ಯಕ್ತ, ಸ್ತ್ರೀ ಆಗಿದ್ದರೆ, ಅವಳು ಎಷ್ಟು ಕೆಟ್ಟವಳಾಗಿದ್ದರೂ ಪತಿಯು ಅವಳಿಗೆ ಊಟ, ಬಟ್ಟೆ ವಸತಿಗಳನ್ನು ಒದಗಿಸಬೇಕಾಗಿತ್ತು. ಗೌರವದಿಂದ ಕಾಣಬೇಕಿತ್ತು.

ಇಂದಿನ ಭಾರತೀಯ ನಾರಿಯರು ಇನ್ನೂ ಹೆಚ್ಚಿನ ಆರ್ಥಿಕ ಸ್ವಾತಂತ್ರ್ಯವನ್ನು ಹೊಂದಿದ್ದಾರೆ. ಆದರೆ ಸಮಾಜದಲ್ಲಿ ಒಂದು ಕಡೆ ಪುರೋಗಾಮಿಯಾಗಿ. ಮಹಿಳೆಯರು ದಾಖಲೆಗಳನ್ನು ನಿರ್ಮಿಸುತ್ತಾ ವಿವಿಧರಂಗಗಳಲ್ಲಿ ಮುನ್ನಡೆ ಸಾಧಿಸುತ್ತಿರಲು, ಇನ್ನೊಂದು ಕಡೆ, ಸಮಾಜದ ದುಷ್ಪಕೂಟಗಳಿಗೆ, ದುಶ್ಚಟಗಳಿಗೆ ಬಲಿಯಾಗಿ, ಸುಂದರವಾದ ಕೌಟುಂಬಿಕ ಜೀವನದ ನೆಮ್ಮದಿಯನ್ನು ಕಳೆದಿಕೊಳ್ಳುತ್ತಿದ್ದಾರೆ. ಇಂತಹ ಪರ್ವಕಾಲದಲ್ಲಿ ಭಾರತೀಯ ನಾರಿ ಭಾರತೀಯ ಸಂಸ್ಕೃತಿಯ ಪ್ರತೀಕವಾಗಿ ಪ್ರಪಂಚದಲ್ಲಿ ಒಂದು ವಿಶಿಷ್ಟಿಅ ಹೆಗ್ಗಳಿಕೆಯನ್ನು ಪಡೆಯಬೇಕಾಗಿದೆ.

PSYCHOSPIRITUAL AND PHILOSOPHICAL SCIENCES

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"A CRITICAL STUDY ON BENEFITS OF YOGA ON APPARENTLY HEALTHY FEMALE SUBJECTS"

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Department of Physiology, BLDE University's Shri. B.M.Patil medical college. Bijapur.

INTRODUCTION

The word "yoga" is derived from its Sanskrit origin "YUJ" which means "to bind"or "to join". It can be defined as 'the art and science of holistic way of life'. As in Bhagavad-Gita "Evenness of mind in dualities is called yoga". Yoga has been mentioned in the Vedas, Upanishad, Bhagavad Gita, Buddhism and Jainism. Yoga is probably the lifestyle ever devised in the history of mankind.(1) All over the world scientists have extensively studied yoga and claimed that it increase longevity, it has therapeutic and rehabilitative effects.(2) In the ancient system of education, various yogic practices like Surynamaskar, pranayama, meditation as well as good value system were introduced with the formal education to enable the development of good physique, strong ethical values and good stress tolerance. A state of mental tranquility is achieved by the practice of yoga as revealed by an increase in alpha index of EEG after short term yoga. Yoga can protect the individual by bringing harmony between mind and body, modulating stress responses and one's attitude to stress. It also improves mental faculties such as attention, memory, learning efficiency and positive attitude to life.(3)

Practice of yoga has become increasingly popular in India as well as in Western countries as a method for coping with stress and improving quality of life(4)

The methods of classical yoga include ethical discipline, physical postures, breathing control and meditation. Traditionally it is an Eastern practice, which is now becoming popular in the West also. In fact, many companies, especially in Britain, are seeing the benefits of yoga, recognizing that relaxed workers are more healthier and more creative than others. Hence, they are sponsoring yoga fitness programs.(5) Although there are several schools of thought on yoga, the ultimate aim remains the same.(1)

NEED FOR THE STUDY

Stress may be defined as an individual's perception about less than pleasant functioning of body organs, which in turn helps the individual to assess the environment.(6)

People live in variety of situations and they do not feel the same way about life and the world around them. From practical viewpoint, it is important to know how different persons feel with regard to their day to day concerns like their health or family. Such a knowledge is necessary if an improvement in quality of people is to be brought about. Yoga is one of the method by which a goal of positive mental health can be achieved. (4)

Various conventional as well as non-pharmacological methods including progressive muscle relaxation are becoming popular for reduction of stress.(6)

The present study was undertaken to demonstrate the beneficial effects of yoga on stress levels of apparently healthy female individuals, who attended yoga camp of one month duration.

MATERIALS AND METHODS

A yoga camp of one month duration was organized by Mahila Mandal, Jalangar, Bijapur. Out of 50, 33 apparently healthy female individuals aged between 20-50years who had volunteered in participating in the study were included. All were house- wives and not suffering from any major physical or mental problems and not having undergone any yogic training earlier.Yogasana, pranayama and meditation techniques were taught to them daily for one hour between 6pm to 7pm for a period of one month.

Starting with chanting, the asanas practiced were-suryanamaskar, vajrasana, shalabasana, matsyasana, ardkatichakrasana, pavanmuktasana, parvatasana, makarasana, padhastasana, shasankasana, pacchimothasana, bhujangasana, savasana including meditation and pranayama.

The camp was conducted under the supervision of an expert instructor. Along with yoga the practices, philosophy of yoga were also delivered.

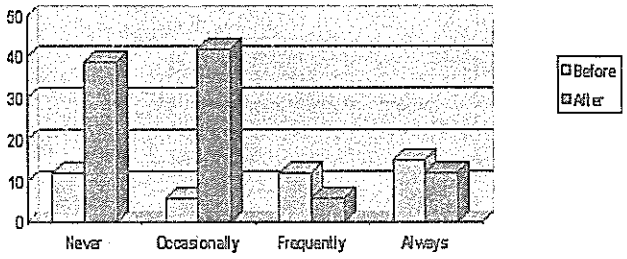
For evaluation of effect of these yogic practices, all the participants were asked to fill the "HAMILTON ANXIETY SCALE (HAMA) (7) in the beginning as well as at the end of yoga camp. HAMH consists of 28 questions related to one's feelings and attitude about various areas of life, such as happiness, achievement, interpersonal relationship etc. Each subject is expected to tick the most suitable choice from four options like(1)Never (2)Occasionally (3)Frequently (4) Always. The score before and after the yoga practice were compared using paired t-test.

HAMA scale consists of following questions-

1. I blame myself when things go wrong.
2. I concentrate on my work to forget about personal problems.
3. I take out anger and frustration on those nearest to me.
4. I notice negative changes in my behaviour pattern when I am under stress.
5. I focus on negative rather than positive aspects of life.
6. I feel uncomfortable while experiencing new situation.
7. I feel that the role I play within my organization/home is worthless.
8. I arrive late for my work/meetings.
9. I respond negatively to personal criticism.

10. I feel guilty if I sit down and do nothing for an hour or so.
11. I feel rushed even if I am not under pressure.
12. I demand attention/service immediately.
13. I avoid expressing true emotions at work and home.
14. I undertake more tasks than I can handle at one.
15. I resist taking advice from colleagues and friends.
16. I ignore my own professional/physical limitations.
17. I miss on my hobbies because my work takes all the time.
18. I take situations before thinking them through thoroughly.
19. I am too busy to have lunch with colleagues/family members.
20. I put off confronting difficult situations when they arise.
21. I am embrassed to say when I am overloaded with work.
22. I avoid delegating tasks to other people.
23. I find it difficult to say no to request and demands.
24. I feel I have to finish all outstanding work each day.
25. I think I will not be able to cope with my work load.
26. Fear of failure stops me from taking action.
27. My work life tends to take more priority over my family.
I become impatient if something does not happen at once.

1 I BLAME MYSELF WHEN THINGS GO WRONG



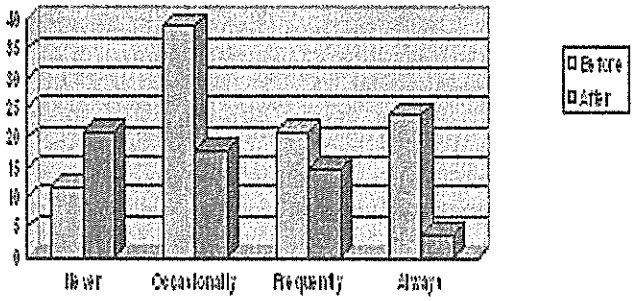
1] Before involving in yoga practices, for the item "I BLAME MYSELF WHEN THINGS GO WRONG", 12%of people were in opinion of 'Never',6% of people were in the opinion of 'Occasionally',12% of people were in opinion of 'Frequently',15 % of people were in opinion of 'Always'.
After involving in yoga practices, for the same item ,39%of people were in opinion of 'Never',42% of people were in the opinion of 'Occasionally',6% of people were in opinion of 'Frequently',12% of people were in opinion of 'Always'

RESULTS

Table showing percent of participants with type of opinion for each of 28 items of HAMA Scale before and after yoga camp.

Sl.	NEVER%		OCCASIONALLY%		FREQUENTLY%		ALWAYS%	
No	BEFORE	AFTER	BEFORE	AFTER	BEFORE	AFTER	BEFORE	AFTER
01	12	39	6	42	12	6	15	12
02	12	21	39	18	21	15	24	45
03	12	55	45	21	24	15	15	9
04	6	18	48	30	33	12	12	39
05	33	39	33	42	12	6	21	12
06	18	36	42	42	21	6	18	15
07	27	61	48	9	18	9	6	21
08	42	64	39	24	12	3	6	9
09	21	45	48	33	12	3	18	18
10	24	21	33	48	3	3	39	27
11	36	42	12	27	3	3	48	27
12	9	18	36	24	3	0	52	58
13	52	55	24	18	6	3	18	24
14	27	27	36	45	12	6	24	21
15	36	48	36	30	12	3	15	18
16	45	64	33	24	6	0	15	12
17	30	55	36	33	18	6	15	6
18	27	42	42	42	9	3	21	12
19	45	45	39	42	9	12	6	6
20	30	48	42	30	15	3	18	18
21	27	30	30	39	12	6	30	24
22	39	48	27	24	3	0	30	27
23	36	45	15	18	3	3	45	33
24	15	12	21	33	18	0	48	55
25	42	52	24	24	12	12	21	12
26	30	58	58	39	3	0	24	3
27	36	52	36	27	6	0	21	21
28	12	30	39	39	9	3	39	27

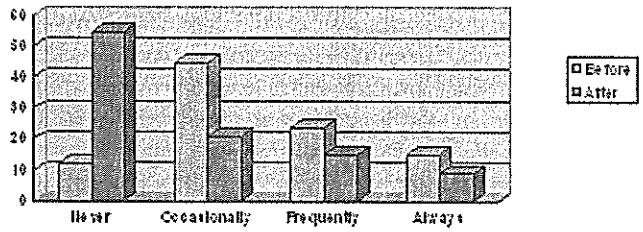
2. I CONCENTRATE ON MY WORK TO FORGET ABOUT PERSONAL PROBLE



2] Before involving in yoga practices, for the item "I CONCENTRATE ON MY WORK TO FORGET ABOUT PERSONAL PROBLEBS" ,12%of people were in opinion of 'Never',39% of people were in the opinion of 'Occasionally',21% of people were in opinion of 'Frequently',24% of people were in opinion of 'Always'.

After involving in yoga practices, for the same item ,21%of people were in opinion of 'Never',18% of people were in the opinion of ' Occasionally',15% of people were in opinion of 'Frequently',45 % of people were in opinion of 'Always'

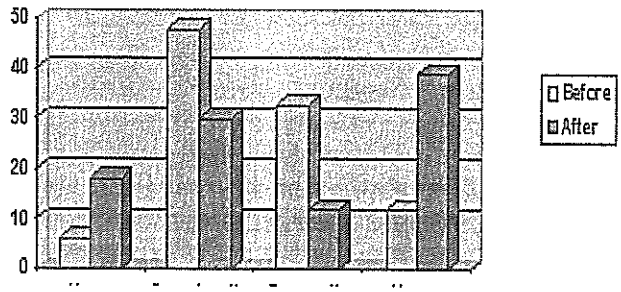
3. I TAKE OUT ANGER AND FRUSTRATION ON THOSE NEAREST TO ME.



3] Before involving in yoga practices, for the item "I TAKE OUT ANGER AND FRUSTRATION ON THOSE NEAREST TO ME",12 %of people were in opinion of 'Never',45% of people were in the opinion of 'Occasionally',24 % of people were in opinion of 'Frequently',15 % of people were in opinion of 'Always'

After involving in yoga practices, for the same item ,55%of people were in opinion of 'Never',21 % of people were in the opinion of 'Occasionally',15% of people were in opinion of 'Frequently',9 % of people were in opinion of 'Always'

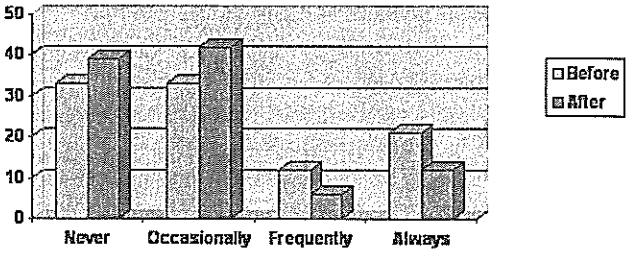
4. I NOTICE NEGATIVE CHANGES IN MY BEHAVIOUR PATTERN WHEN I AM UNDER STRESS.



4] Before involving in yoga practices, for the item "I NOTICE NEGATIVE CHANGES IN MY BEHAVIOUR PATTERN WHEN I AM UNDER STRESS",6%of people were in opinion of 'Never',48% of people were in the opinion of 'Occasionally',33% of people were in opinion of 'Frequently',12%of people were in opinion of 'Always'.

After involving in yoga practices, for the same item ,18%of people were in opinion of 'Never',30% of people were in the opinion of 'Occasionally',12% of people were in opinion of 'Frequently',39% of people were in opinion of 'Always'

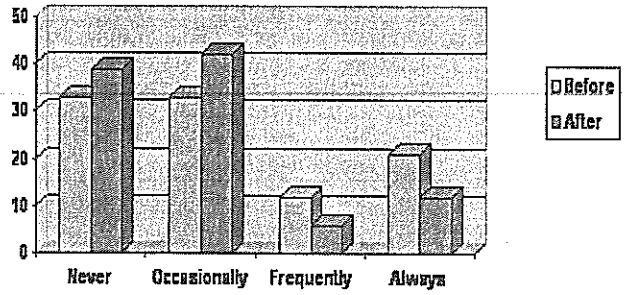
5. I FOCUS ON NEGATIVE RATHER THAN POSITIVE ASPECT OF MY LIFE.



5] Before involving in yoga practices, for the item "I FOCUS ON NEGATIVE RATHER THAN POSITIVE ASPECT OF LIFE",33%of people were in opinion of 'Never',33% of people were in the opinion of 'Occasionally',12% of people were in opinion of 'Frequently',21% of people were in opinion of 'Always'.

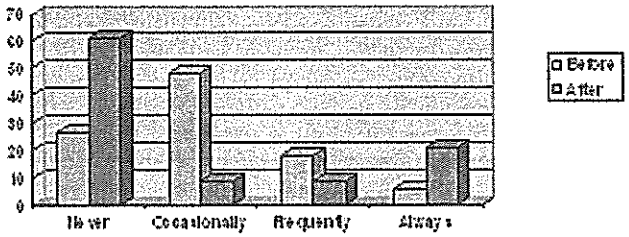
After involving in yoga practices, for the same item ,39%of people were in opinion of 'Never',42% of people were in the opinion of 'Occasionally',6% of people were in opinion of 'Frequently',12% of people were in opinion of 'Always'

6. I FEEL UNCOMFORTABLE WHILE EXPERIENCING NEW SITUATION.



6] Before involving in yoga practices, for the item "I FEEL UNCOMFORTABLE WHILE EXPERIENCING NEW SITUATION",18%of people were in opinion of 'Never',42% of people were in the opinion of 'Occasionally',21% of people were in opinion of 'Frequently',18% of people were in opinion of 'Always'.After involving in yoga practices, for the same item ,36%of people were in opinion of 'Never',42% of people were in the opinion of 'Occasionally',6% of people were in opinion of 'Frequently',15% of people were in opinion of 'Always'

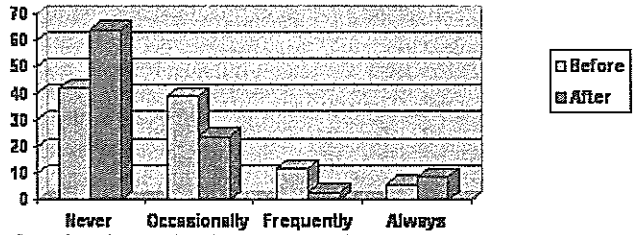
7. I FEEL THAT THE ROLE I PLAY WITHIN MY ORGANIZATION/HOME IS WORTHLESS.



7] Before involving in yoga practices, for the item "I FEEL THAT THE ROLE I PLAY WITHIN MY ORGANIZATION/ HOME IS WORTHLESS",27%of people were in opinion of 'Never',48% of people were in the opinion of 'Occasionally',18% of people were in opinion of 'Frequently',18% of people were in opinion of 'Always'.

After involving in yoga practices, for the same item ,61%of people were in opinion of 'Never',9% of people were in the opinion of 'Occasionally',9% of people were in opinion of 'Frequently',21% of people were in opinion of 'Always'

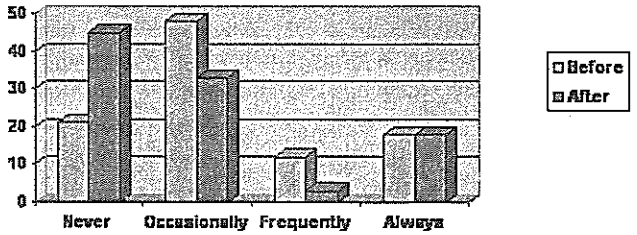
8.I ARRIVE LATE FOR WORK/MEETING



8] Before involving in yoga practices, for the item "I ARRIVE LATE FOR WORK/MEETINGS",42%of people were in opinion of 'Never',39% of people were in the opinion of 'Occasionally',12% of people were in opinion of 'Frequently',6% of people were in opinion of 'Always'.

After involving in yoga practices, for the same item ,64%of people were in opinion of 'Never',24% of people were in the opinion of 'Occasionally',3% of people were in opinion of 'Frequently',9% of people were in opinion of 'Always'

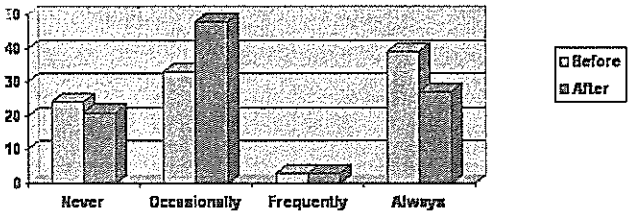
9. I RESPOND NEGATIVELY TO PERSONAL CRITICISM.



9] Before involving in yoga practices, for the item "I RESPOND NEGATIVELY TO PERSONAL CRITICISM",21%of people were in opinion of 'Never',48% of people were in the opinion of 'Occasionally',12% of people were in opinion of 'Frequently',18% of people were in opinion of 'Always'.

After involving in yoga practices, for the same item ,45%of people were in opinion of 'Never',33% of people were in the opinion of 'Occasionally',3% of people were in opinion of 'Frequently',18% of people were in opinion of 'Always'

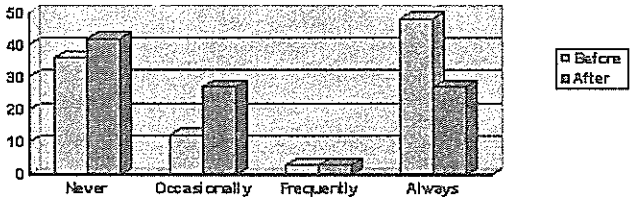
10. I FEEL GUILTY IF I SIT DOWN AND DO NOTHING FOR AN HOUR OR SO.



10] Before involving in yoga practices, for the item "I FEEL GUILTY IF SITDOWN AND DO NOTHING FOR AN HOUR OR SO",24%of people were in opinion of 'Never',33% of people were in the opinion of 'Occasionally',3% of people were in opinion of 'Frequently',39% of people were in opinion of 'Always'.

After involving in yoga practices, for the same item ,21%of people were in opinion of 'Never',48% of people were in the opinion of 'Occasionally',3% of people were in opinion of 'Frequently',27% of people were in opinion of 'Always'

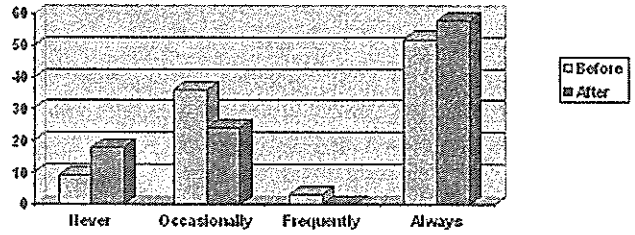
11. I FEEL RUSHESED EVEN IF I AM NOT UNDER PRESSURE.



11] Before involving in yoga practices, for the item "I FEEL RUSHED EVEN IF I AM NOT UNDER PRESSURE",42%of people were in opinion of 'Never',12% of people were in the opinion of 'Occasionally',3% of people were in opinion of 'Frequently',48% of people were in opinion of 'Always'.

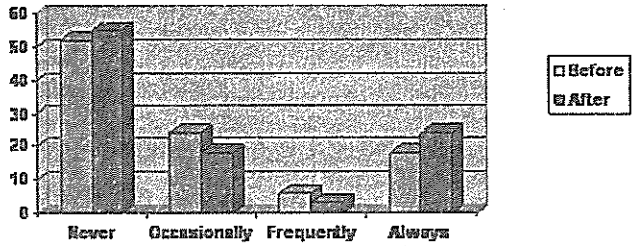
After involving in yoga practices, for the same item ,36%of people were in opinion of 'Never',27% of people were in the opinion of 'Occasionally',3% of people were in opinion of 'Frequently',27% of people were in opinion of 'Always'

12. I DEMAND ATTENTION/SERVICE IMMEDIATELY



12] Before involving in yoga practices, for the item "I DEMAND ATTENTION/SERICE IMMEDIATELY",9%of people were in opinion of 'Never',36% of people were in the opinion of 'Occasionally',3% of people were in opinion of 'Frequently',52% of people were in opinion of 'Always'.After involving in yoga practices, for the same item ,18%of people were in opinion of 'Never',24% of people were in the opinion of 'Occasionally',0% of people were in opinion of 'Frequently',58% of people were in opinion of 'Always'

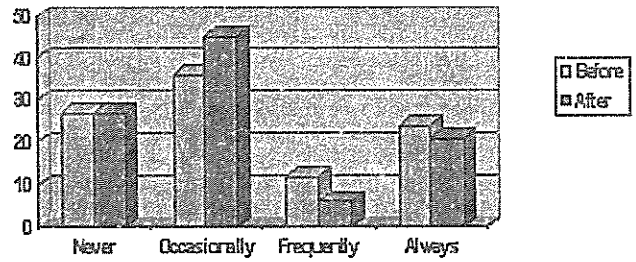
13. I AVOID EXPRESSING TRUE EMOTIONS AT WORK AND HOME.



13] Before involving in yoga practices, for the item "I AVOID EXPRESSING TRUE EMOTIONS AT WORK AND HOME",52%of people were in opinion of 'Never',24% of people were in the opinion of 'Occasionally',6% of people were in opinion of 'Frequently',18% of people were in opinion of 'Always'.

After involving in yoga practices, for the same item ,55%of people were in opinion of 'Never',18% of people were in the opinion of 'Occasionally',3% of people were in opinion of 'Frequently',24% of people were in opinion of 'Always'

14. I UNDERTAKE MORE TASKS THAN I CAN HANDLE AT ONE.

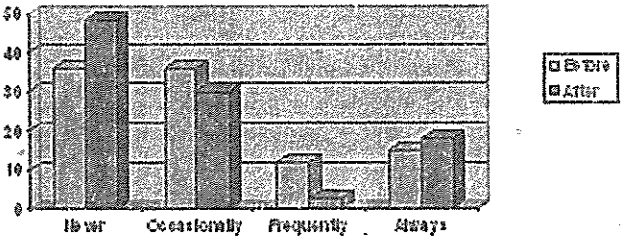


14] Before involving in yoga practices, for the item "I UNDERTAKE MORE TASKS THAN I CAN HANDLE AT ONCE",27%of people were in opinion of 'Never',36% of people were in the opinion of 'Occasionally',12% of people were in opinion of 'Frequently',24% of people were in opinion of 'Always'.

After involving in yoga practices, for the same item ,27%of people were in opinion of 'Never',45% of people were in the opinion of

'Occasionally',6% of people were in opinion of 'Frequently',21% of people were in opinion of 'Always'

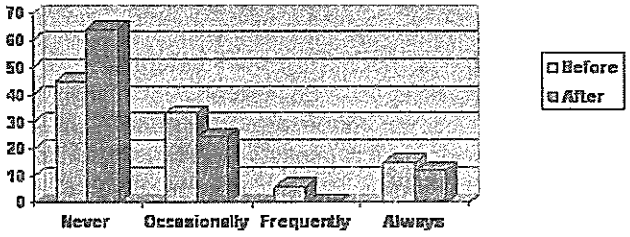
15. I RESIST TAKING ADVICE FROM COLLEAGUE AND FRIENDS.



15] Before involving in yoga practices, for the item "I RESIST TAKING ADVICE FROM COLLEAGUES AND FRIENDS",36%of people were in opinion of 'Never',36% of people were in the opinion of 'Occasionally',12% of people were in opinion of 'Frequently',15% of people were in opinion of 'Always'.

After involving in yoga practices, for the same item ,48%of people were in opinion of 'Never',30% of people were in the opinion of 'Occasionally',3% of people were in opinion of 'Frequently',18% of people were in opinion of 'Always'

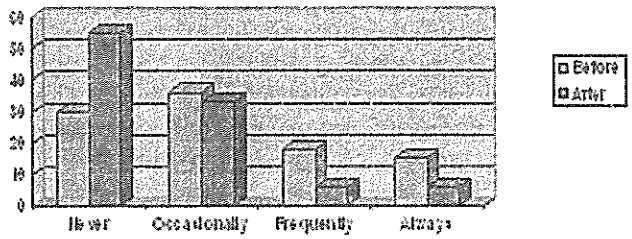
16. I IGNORE MY OWN PROFESSIONAL/PHYSICAL LIIMITATIONS.



16] Before involving in yoga practices, for the item "I IGNORE MY OWN PROFESSIONAL/PHYSICAL LIMITATIONS",45%of people were in opinion of 'Never',33% of people were in the opinion of 'Occasionally',6% of people were in opinion of 'Frequently',15% of people were in opinion of 'Always'

After involving in yoga practices, for the same item ,64%of people were in opinion of 'Never',24% of people were in the opinion of 'Occasionally',0% of people were in opinion of 'Frequently',12% of people were in opinion of 'Always'

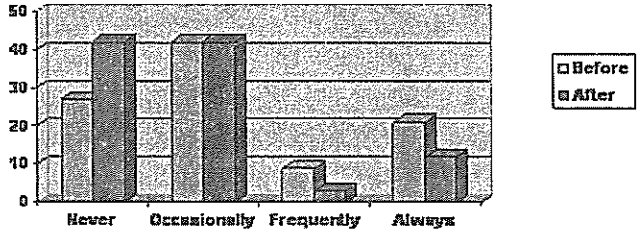
17. I MISS ON MY HOBBIES BECAUSE MY WORK TAKES ALL THE TIME.



17] Before involving in yoga practices, for the item "I MISS ON MY HOBBIES BECAUSE MY WORK TAKE ALL THE TIME",30%of people were in opinion of 'Never',36% of people were in the opinion of 'Occasionally',18% of people were in opinion of 'Frequently',15% of people were in opinion of 'Always'.

After involving in yoga practices, for the same item ,55%of people were in opinion of 'Never',33% of people were in the opinion of 'Occasionally',6% of people were in opinion of 'Frequently',6% of people were in opinion of 'Always'

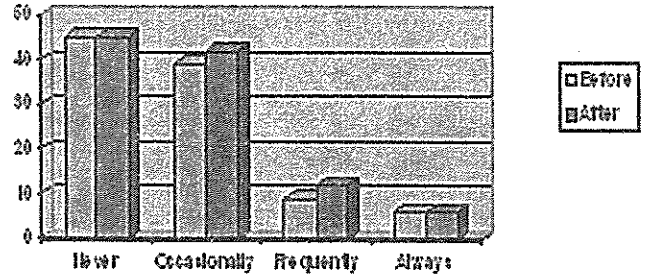
18. I TAKE SITUATIONS BEFORE THINKING THEM THROUGH THOROUGHLY



18] Before involving in yoga practices, for the item "I TAKE SITUSTIONS BEFORE THINKING THEM THROUGH THOROUGHLY",27%of people were in opinion of 'Never',42% of people were in the opinion of 'Occasionally',9% of people were in opinion of 'Frequently',21% of people were in opinion of 'Always'.

After involving in yoga practices, for the same item ,42%of people were in opinion of 'Never',42% of people were in the opinion of 'Occasionally',3% of people were in opinion of 'Frequently',12% of people were in opinion of 'Always'

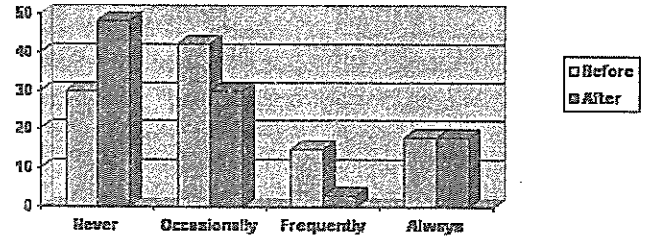
19. I AM TOO BUSY TO HAVE LUNCH WITH COLLEGUES/FAMILY MEMBERS.



19] Before involving in yoga practices, for the item "I AM TOO BUSY TO HAVE LUNCH WITH COLLEAGUES OR FAMILY MEMBERS", 45%of people were in opinion of 'Never',39% of people were in the opinion of 'Occasionally',9% of people were in opinion of 'Frequently',6% of people were in opinion of 'Always'.

After involving in yoga practices, for the same item ,45%of people were in opinion of 'Never',42% of people were in the opinion of 'Occasionally',12% of people were in opinion of 'Frequently',6% of people were in opinion of 'Always'

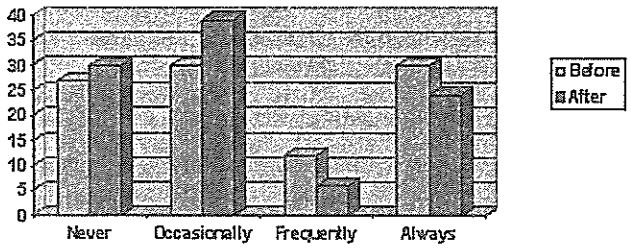
20. I PUT OFF CONFRONTING DIFFICULT SITUATIONS WHEN THEY ARISE



20] Before involving in yoga practices, for the item "I PUT CONFRONTING DIFFICULT SITUATIONS WHEN THEY ARISE",30%of people were in opinion of 'Never',42% of people were in the opinion of 'Occasionally',15% of people were in opinion of 'Frequently',18% of people were in opinion of 'Always'.

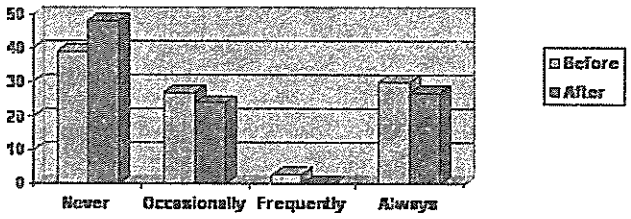
After involving in yoga practices, for the same item ,48%of people were in opinion of 'Never',30% of people were in the opinion of 'Occasionally',3% of people were in opinion of 'Frequently',18% of people were in opinion of 'Always'

21. I AM EMBRASSED TO SAY WHEN I AM OVER-LOADED WITH WORK.



21] Before involving in yoga practices, for the item "I AM EMBRASSED TO SAY WHEN I AM OVERLOADED WITH WORK",27%of people were in opinion of 'Never',30% of people were in the opinion of 'Occasionally',12% of people were in opinion of 'Frequently',30% of people were in opinion of 'Always'.After involving in yoga practices, for the same item ,30%of people were in opinion of 'Never',39% of people were in the opinion of 'Occasionally',6% of people were in opinion of 'Frequently',24% of people were in opinion of 'Always'

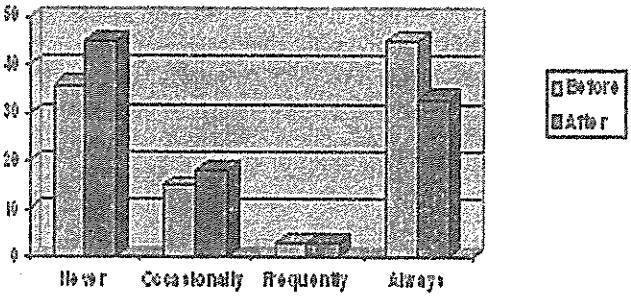
22. I AVOID DELEGATING TASKS TO OTHER PEOPLE.



22] Before involving in yoga practices, for the item "I AVOID DELEGATING TASKS TO OTHER PEOPLE ",39%of people were in opinion of 'Never',27% of people were in the opinion of 'Occasionally',3% of people were in opinion of 'Frequently',30% of people were in opinion of 'Always'.

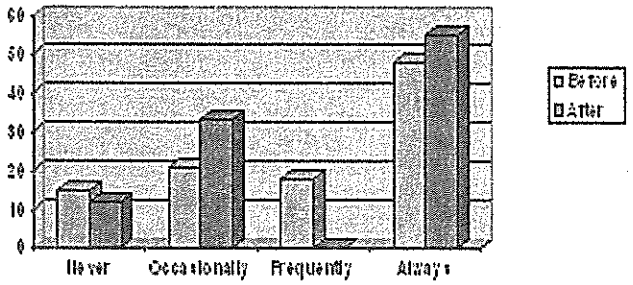
After involving in yoga practices, for the same item ,48%of people were in opinion of 'Never',24% of people were in the opinion of 'Occasionally',0% of people were in opinion of 'Frequently',27% of people were in opinion of 'Always'

23. I FIND IT DIFFICULT TO SAY NO TO REQUEST AND DEMANDS



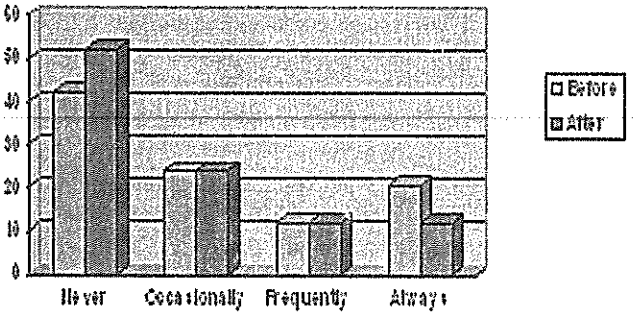
23] Before involving in yoga practices, for the item "I FIND DIFFICULT TO SAY NO TO REQUEST AND DEMANDS", 36%of people were in opinion of 'Never',15% of people were in the opinion of 'Occasionally',3% of people were in opinion of 'Frequently', 45% of people were in opinion of 'Always'. After involving in yoga practices, for the same item, 45%of people were in opinion of 'Never', 18% of people were in the opinion of 'Occasionally', 3% of people were in opinion of 'Frequently', 33% of people were in opinion of 'Always'

24. I FEEL I HAVE TO FINISH ALL OUTSTANDING WORK EACH DAY.



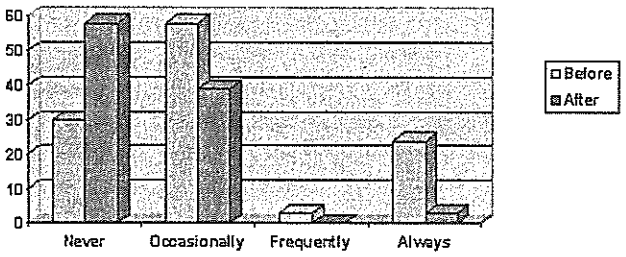
24] Before involving in yoga practices, for the item "I HAVE TO FINISH ALL OUTSTANDING WORK EACH DAY",15%of people were in opinion of 'Never',21% of people were in the opinion of 'Occasionally',18% of people were in opinion of 'Frequently',48% of people were in opinion of 'Always'. After involving in yoga practices, for the same item ,12%of people were in opinion of 'Never',33% of people were in the opinion of 'Occasionally',0% of people were in opinion of 'Frequently',55% of people were in opinion of 'Always

25. I THINK I WILL NOT BE ABLE TO COPE WITH MY WORKLOAD



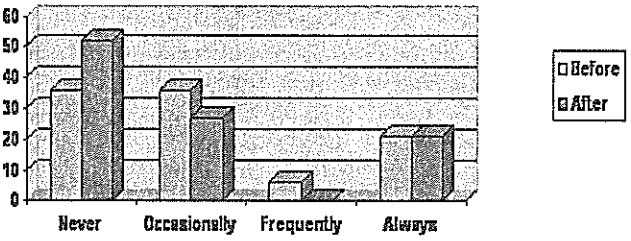
25] Before involving in yoga practices, for the item "I THINK I WILL NOT BE ABLE TO COPE WITH MY WORK LOAD",42%of people were in opinion of 'Never',24% of people were in the opinion of 'Occasionally',12% of people were in opinion of 'Frequently',21% of people were in opinion of 'Always'. After involving in yoga practices, for the same item,52%of people were in opinion of 'Never',24% of people were in the opinion of 'Occasionally',12% of people were in opinion of 'Frequently',12% of people were in opinion of 'Always'

26. FEAR OF FAILURE STOPS ME FROM TAKING ACTION



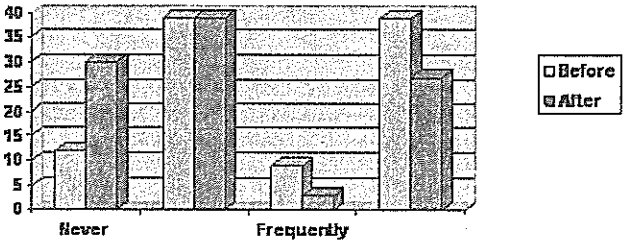
26] Before involving in yoga practices, for the item "FEAR OF FAILURE STOP ME FROM TAKING ACTION",30%of people were in opinion of 'Never',58% of people were in the opinion of 'Occasionally',3% of people were in opinion of 'Frequently',24% of people were in opinion of 'Always'.After involving in yoga practices, for the same item ,58%of people were in opinion of 'Never',39% of people were in the opinion of 'Occasionally',0% of people were in opinion of 'Frequently',3% of people were in opinion of 'Always'

27. MY WORK LIFE TENDS TO TAKE MORE PRIORITY OVER MY FAMILY LIFE.



27] Before involving in yoga practices, for the item "MY WORK LIFE TAKE MORE PRIORITY OVER MY FAMILY LIFE",36%of people were in opinion of 'Never',36% of people were in the opinion of 'Occasionally',6% of people were in opinion of 'Frequently',21% of people were in opinion of 'Always'. After involving in yoga practices, for the same item ,52%of people were in opinion of 'Never',27% of people were in the opinion of 'Occasionally',0% of people were in opinion of 'Frequently',21% of people were in opinion of 'Always'

28. I BECOME IMPATIENT IF SOMETHING DOES NOT HAPPEN AT ONCE



28] Before involving in yoga practices, for the item "I BECOME IMPATIENT IF SOMETHING DOES NOT HAPPEN AT ONCE",12%of people were in opinion of 'Never',39% of people were in the opinion of 'Occasionally',9% of people

were in opinion of 'Frequently',39% of people were in opinion of 'Always'.

After involving in yoga practices, for the same item ,30%of people were in opinion of 'Never',39% of people were in the opinion of 'Occasionally',3% of people were in opinion of 'Frequently',27% of people were in opinion of 'Always'.

DISCUSSION AND CONCLUSION

Stress is known to modulate the activity of autonomic nervous system and central nervous system in a way so as to cope up with the stress to set adapted to it. Stress may be external (environmental), internal (emotions) or sometimes may be the combination of both, interacting with each other(8,9). In stressful states, there will be preponderance of sympathetic activity. Practice of yogasana and pranayama can lead to a reduction in sympathetic activity with shifting of autonomic balance towards relative parasympathetic dominance(10,11,12)

It is evident from the result of our present study that the practice of yoga and adapting the philosophy of yoga leads to significant improvement in feelings of subjective well being. A high positive feed back score was noticed in parameters such as sense of well being, feeling of relaxation, improved concentration, self confidence, improved efficiency, good interpersonal relationship, attentiveness, lowered irritability level and an optimistic outlook in life.

Such results have also been shown by Schell et al (13,14,15) have reported the beneficial effects of Hath yoga on various physiological and psychological parameters. In their study, yoga group showed markedly higher scores in life satisfaction and lower scores in excitability, aggressiveness, openness, emotionality and somatic complaints

Similarly in his twenty years of experience with yoga in psychiatry, Nespor have emphasized the usefulness of yoga in prevention of stress and burn out in health care professionals.

Basing on the results of this study, one may conclude that regular yogic practices and adapting and implementing the principles of yoga in day to day life improves the subjective feelings of well being.

SUGGESTIONS FOR FURTHER RESEARCH:

1. A comparative study of Benefits of yoga between sedentary and non-sedentary women.
2. Benefits of yoga in obese female subjects.
3. A comparative study of benefits of yoga between male and female individuals.

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NEUROPHYSIOLOGICAL AND BIOPHYSICAL BASIS OF YOGA PRACTICE LEADING TO TRANSCENDENTAL STATE OF CONCIOUSNESS

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'Yoga Shastra' is the supreme science of Atma Vidya. It is the scientific approach to the inner world of human existence and exploration of higher states of consciousness. In order to understand the process of yoga practice through science, it is essential first to understand the aim and meaning of yoga according to Indian philosophy.

The basic meaning of the word yoga is 'union'. This word has been used to explain the method of spiritual union by which an individual may become united with supreme God head 'Brahman' - the 'Turiya' state of Upanishats. Brahman is the basic reality behind the whole universe and described as 'SAT' (eternal pure existence), 'CHIT' (eternal pure consciousness) and 'ANANDA' (eternal pure bliss). This state of knowing Brahman is called 'Samadhi'.

Vedanta has postulated the existence of 'tanmatra' – primordial element that has manifested from Brahman called 'AKASHA' (Space). The power of 'akasha' is called 'PRANA'. Swami Vivekananda [1] has given clear picture of akasha and prana concepts. According to his detail proposals, when vibration of prana starts, the creation of universe becomes possible and when vibration of prana of ceases, all the forces existing in nature transform to original prana (i.e., prana, becomes static) also all the material manifestation of nature transform to akasha.

The entire material manifestation of universe works due to the combination of akasha and prana. Human body is existing due to functioning of five types of pranas (prana, apana, vyana, udana and samana) and five tanmatras (akasha, vayu, agni, apas, pruthvi). The 'nirguna Brahman', the pure consciousness, when gets associated with its own power called 'maya', becomes 'saguna Brahman' called 'GOD' or 'ISHVARA'. This consciousness, of creator of universe is the very cause of the universe and the eternal 'I' consciousness of the universe which is reflecting behind our ego based 'I' consciousness creating the very feeling that "I AM", " I have intelligence and consciousness". The yoga shastra emphasises that it is mere reflection of intelligence of the 'Atman'. Atman is the intelligence itself. The word 'Atman' is used to indicate the individual self, the essential and real nature of human beings.

With this knowledge, let us try to understand 'samadhi' process because the practice of yoga gives experimental verification for the concepts of Upanishats. Majority of people practice yoga to get better mental and physical health, which obviously increases the rate of process of 'general evolution'. There are other set of human beings who practice yoga to increase the rate of 'spiritual evolution' to get freedom from suffering and tension caused by body and senses. This spiritual evolution is essentially the process of involution, the inward journey of human existence back to it's source. This process of spiritual evolution, we have to achieve by purifying individual consciousness to get perfect concentration to experience 'Brahman'.

Patanjali, the great Indian sage, in his yogic text 'Patanjala Yogasutras' has explained the methodical way of the yoga practice and defined yoga as

"yogas chitta-vritti- nirodhah"
(Yoga is inhibition of chitta vrittis)

Here, 'vritti' (modification)[2] is a way of existence of chitta, the mind stuff. When we consider the ways in which 'chitta' the mind stuff exists, we have to consider its states of activities as waves in mind stuff (chitta-vrittis). It is well known that the nature of mind is to constantly change and rise to form of vrittis or thought waves, they are obstacle to yoga samadhi. Therefore, yoga is inhibition of thought waves.

The great sage Vyasa has explained this definition of yoga of Patanjali by giving picture of two types of yoga samadhis. i) Savikalpa samadhi and (ii) Nirvikalpa samadhi

(i) Savikalpa samadhi (samadhi with distinctions) : This is proof of ' atman' of vedanta and similar to 'purusha' of 'sankhya' in many ways, where we experience the unchanging principle of consciousness the 'atman', as distinct from all changing phenomena of mind and body. During savikalpa samadhi[2] state along with the perception of ' brahman', there is also awareness of oneself and the awareness of process of contemplation.

(ii) Nirvikalpa samadhi (samadhi without distinctions) : During this samadhi, a yogi will experience the Brahman only (the pure consciousness) and the other aspects of awareness do not exist. By **'knowing' Brahman,** a person will **'become' Brahman.** He / She becomes one with all pervading consciousness. He/she will attain a perfect state of mind without any sort of doubts. This is called 'enlightenment'. It is ultimate reality of inner world of human existence. This is the ultimate aim of all traditional practices like meditation, yoga and prayer of all types of religions of the universe.

NEUROPHYSIOLOGICAL BASIS OF YOGA

To attain the samadhi state through practice of yoga, one has to build control over material state of our existence i.e., either we have to control the body through mind or control the mind through body. This relaxed state of mind and body can be achieved through practice of meditation.

Neurophysiological and neuropsychological experimental data reported from various researchers [3,19-27] show that due to meditation, one should get coherent low frequency cerebral activity i.e., low frequency of electrical activity of brain, decrease of oxygen consumption, decrease of heart

rate, decrease of respiration rate, decrease of body temperature, decrease of cortisol (a major stress hormone), decrease of muscle tension, normalisation of blood pressure, increase of galvanic skin resistance etc. David Orme Johnson[3] points out that _ " the autonomic nervous system which regulates vital internal processes becomes more stable integrated and adaptable , as indicated by its increased ability to recover rapidly from effects of stress. Brain functions more orderly as indicated by growth of physiological correlates of creativity and intelligence such as shorter latencies of cognitive evoked potentials, faster paired H-reflexes, increased EEG coherence, shorter inspection time and faster choice reaction time".

Neurophysiologists have identified following four types of electrical brain waves which can be measured by electro encephalogram (EEG) or magneto encephalogram (MEG).

a - wave	:	8 – 13 Hz
b - wave	:	14 – 25 Hz
q - wave	:	4 – 7 Hz
d - wave	:	0.5 – 3.5 Hz

From these experimental observations, and experiences of yogis documented in spiritual books, I have proposed [28] hypothesis (1999) that - "During savikalpa samadhi, one should get coherent low frequency electrical brain waves and during nirvikalpa samadhi, the frequency of the electro-encephalographic rhythm is expected to fall to zero, which is d-wave pattern of brain wave". A normal human being will get d-wave pattern during deep sleep. But a yogi gets d-wave pattern of brain wave **"with wakeful awareness"**. This is because, the average frequency of electro-encephalograp hic rhythm decreases with decrease of cerebral activity. During meditation the daily rhythms of physiological processes are expected to reduce significantly to zero. This condition of the body allows cosmic rhythms to penetrate the body.

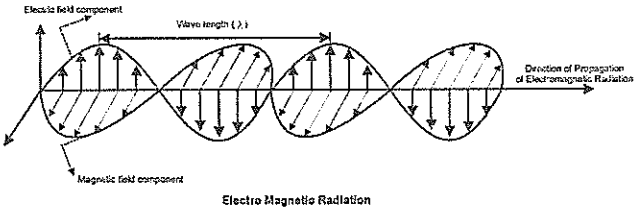
Neurophysiologists have extensively studied and differentiated the remaining altered states of consciousness which can be obtained **"without wakeful awareness"** such as sleep, hypnotic states, states of consciousness induced by drugs and anaesthetics, brain injury cases such as confusion, stupor, coma and cerebral death.

BIOPHYSICAL BASIS OF YOGA

We know that the universe along with the existing matter, galaxies etc also contains electromagnetic radiation from low frequency radio waves to high frequency g- rays and it also contains 'matter radiations'. All matter including human beings are constantly surrounded and interacted by electromagnetic radiations.

What is Electromagnetic radiation?

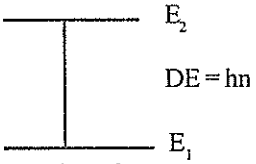
Whenever a charged particle, such as an electron, changes it's velocity, electromagnetic radiation is generated. The charged particle provides the energy for electromagnetic radiation. This energy can be regarded as waves propagated through space involving oscillating electric and magnetic fields at right angles to each other and to the direction of propagation of radiation.



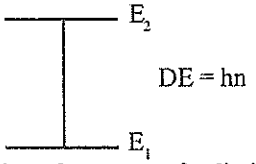
Electro Magnetic Radiation

Interaction of electromagnetic radiation with matter:

To understand the well known phenomenon of ''Interaction of electromagnetic radiation with matter'', we have to consider the 'sources' and 'absorbers' of electromagnetic radiation in matter. Every atom or molecule can have certain discrete internal energies, which are called quantum states. Absorption of quantum of radiation hn (where, h is Planck's constant and n is frequency of radiation) takes the atom (or molecule) from lower energy state(E_1) to higher energy state(E_2), if the energy hn matches the energy difference between two states. By coming from a higher to a lower state, a quantum hn of electromagnetic radiation is emitted, which is same as magnitude of difference between the higher and lower states.



Absorption of quantum of radiation



Emission of quantum of radiation

Where, E_1 is lower energy state
E_2 is higher energy state.

Scattering property of electromagnetic radiation :

Process of **scattering**[29] is fundamental concept for understanding interaction of electromagnetic radiation with matter that contains very large number of charge oscillators. When a charged particle (or an oscillating charge) interacts with electromagnetic wave of particular frequency, the oscillating charge experiences a force proportional to the strength of the electric wave, and it changes it's motion in proportion to the frequency of the electric wave. In this interaction process, the charged particle becomes a source

Cosmic rays	ν - rays	x- rays	UV rays	visible	IR rays	Micro Waves	radio waves

← Frequency

The electromagnetic spectrum

of electromagnetic radiation of same frequency. The primary incident electromagnetic wave provides the energy for work done in order to accelerate the charged particle and to emit secondary radiation. This is the familiar process of "scattering". Since, oscillating charges produce electromagnetic wave, each oscillator with a particular frequency behaves like a small "antenna", that receives and emits the electromagnetic radiation of same particular frequency and obey the principle of "resonance absorption of electromagnetic radiation" given by Robert Kirchoff in the year 1800.

When electromagnetic radiation falls an system containing a large number of small charge oscillators, all oscillators perform oscillations coherently and the total secondary radiation which the system emits contains sum of all phase coherent secondary electromagnetic waves. (Coherent electromagnetic radiation contains two or more waves with constant phase relationship, with their crests and troughs similarly spaced without phase difference). It is well established fact that energy density of the electromagnetic radiation is directly proportional to the square of electric field strength[29]. Electric field strength is produced due to acceleration of charge oscillators. Hence the energy radiated by a charge oscillator increases with square of it's acceleration.

Everyday, these type of interactions of human body with environmental electromagnetic fields will be taking place. Majority of higher frequency radiations produce only thermal effects to the human body[4] and bring molecular vibration, rotation and rearrangement of electrons in outermost orbits depending on the frequency range of interacting electromagnetic radiation. This includes electromagnetic radiation of energy $h\nu > kT$ (Where, T is the temperature characteristic of the organism and k is the Boltzmann Constant) such as visible, IR, higher frequency radio waves. These radiations bring thermal effects such as heating of tissues or biological substances of the body. This excludes UV rays since it has been almost filtered by the ozone layer present in atmosphere and not reaching the biosphere and it also excludes X-rays and g-rays since their availability in biosphere is very less and they produce harmful effects to living organisms.

On the other hand, electromagnetic radiation of energy $h\nu<kT$, which includes lower frequency microwaves, radio waves right down to zero frequency (i.e., constant electric and magnetic fields) will produce non-thermal effects on organisms[4], and hence play significant role in the process of evolution.

The scientific literature available since 1950's by various workers [4,6] including experimental and theoretical evidences show that electromagnetic radiations of the biosphere have played significant roles in the evolution of living organisms.

Electromagnetic fields in living organisms :

In variety of organisms at various of levels of organization certain "electromagnetic regulation systems" have been found. The functioning of these systems depends on their electromagnetic oscillations. Scientists have discovered frequency components of these electromagnetic oscillations. "complex system of electromagnetic regulation of heart rate" and "electromagnetic oscillatory systems of the brain" which can control rhythmicity of both psychological and physiological processes are the example of electromagnetic regulation systems found in human beings.

A.S. Presman[4] in his classical book "electromagnetic fields and life" (1970) points out that - "There are three fundamentally possible types of electromagnetic interconnections in the living organisms.[i] The known scheme of interaction of central control system with peripheral effector and receptor elements as occurs for instance in the nervous regulation of body functions. [ii] The interconnections between elements such as cells and macromolecules (which are apparently under control systems) and [iii] Signals from control system simultaneously to different elements in the organisms".

The oscillators present in human body[4] responsible for electromagnetic interconnection are moving "free" electric charges like electrons, ions and other charged particles. Electromagnetic interconnection also exists due to "displacement of bound charges such as electrons in atoms", "atoms in molecules which have undergone polarization" and "molecules with a constant dipole moment such as protein and water molecules" etc., Electromagnetic field mediated interconnection exists between macromolecules, present in organisms. Two electrons belonging to two macromolecules which have under gone similar excitation behave like "coupled oscillators". The electromagnetic filed can couple these oscillators even though there is no material connection between them, provided they are not far apart. Another type of electromagnetic interconnection between macromolecules can be "dipole-dipole interaction between indentical macromolecules due to changes in the charge distribution of electron and proton charge in molecules."

American scientists Becker[5] et.al. (1962) have found another slow electromagnetic control system in the human body. They have shown that spinal cord generates a direct current which flows through emergent nerves. Hall effect measurements have shown that direct current is due to flow of electrons, where as we know that the bio-currents in nerves are due to motion of ions.

Experimental evidences supporting endogenous electromagnetic fields in living organisms:

The existence of endogenous electromagnetic interconnections in biological systems have been verified by the following experimental data available in science literature [4, 45] indicating the generation and reception of electromagnetic fields of various frequencies in biological systems.

(i) Based on resonance absorption of various frequency ranges of electromagnetic radiation, shnol [7] (1967) has shown that, organs, cells and macromolecules in biological media are sensitive to electromagnetic fields of different frequency ranges.
(ii) Electromagnetic fields have been generated using concept of piezoelectric resonance in biopolymers by Tulkshi et.al.[8] (1965)
(iii) Experimental reports by Wolf .R [17] et.al. (1984) have shown DNA as source of biophoton emission.
(iv) It is well known that, the permanent and important facet of the environment is the periodic processes taking place in the entire ranges of frequencies of electromagnetic radiations. Experimental reports[4] since 1960s on effect on periodic changes in the earth's magnetic field on the corresponding periodic process in organisms have also proved the presence of electromagnetic oscillatory fields in living organisms.

Intensity of endogenous electromagnetic fields of living organisms:

The electromagnetic communication present between different systems in living organisms involves not only electromagnetic fields of radio frequency range but also electromagnetic fields of low and infra low frequencies[4]. This special electromagnetic communication is completely different from the familiar methods of transmitting information along nerves by bioelectric impulses.

Based on experimental observations, A.S. Presman[4] (1970) has pointed out that - "Living organisms have systems which are particularly sensitive to electromagnetic fields of the environment. Such systems could have been formed in the course of evolution of life by constant interaction with electromagnetic fields".

"Effects of endogenous electromagnetic field of biological systems on coherency of life supporting process in individuals cells, cell populations, and living organisms reported by G.Lednyiczkey and Zalko-Tytarenko [9] (1996) have proved that natural processes are supported by interactions between environmental and endogenous electromagnetic fields of extremely low intensity".

From these discussions, it is clear that the endogenous electromagnetic field of the human body has oscillators whose frequencies are characteristic property of the individual human being acquired in the process of evolution and they are sensitive to electromagnetic fields of particular frequency called 'resonant frequency'. Theoretical studies by Topping .S et.al.[15] (1997) on "application of chaos and quantum field theories in consciousness studies: deliberate alteration of genetic expression" support this view.

This implies that the oscillations of endogenous electromagnetic fields of human body depend on the frequency of their oscillators which will be same as the frequency of electromagnetic fields they are going to absorb and emit by interacting with natural electromagnetic fields. The frequencies of these oscillators are controlled by physiological and psychological processes of the human body. The period of variation of natural electromagnetic fields is a important factor when they synchronise the rhythms of biological processes.

Evidences for resonance process in human body:

To explain various types of general molecular processes, the concept of resonance absorption of electromagnetic radiation in the whole human body and in certain parts of the body have been discussed in scientific literature.

Resonance[73] occurs when a system of oscillators perform oscillations at its natural frequency of vibration as determined by set of physical parameters of the system. This property of resonance is a feature of organised system as a whole and it has characteristic that, from low power driving of the system, ultimately large amplitude vibrations occur.

i. G.Lednyiczky[16,18] (1997) has reported the experimental work on biological resonance and the state of the organism from functional electro dynamical testing.

ii. Dorfman[14] (1966) has also used the concept of resonance to explain magnetic chemical effects in organisms. By giving the theoretical proof he has shown that -"the resonance effects can occur when the frequency of induced mechanical vibrations in the particular region of organisms coincides with the natural frequency of its free vibrations".

iii. In abroad, recently the concept of resonance balancing has been used in science and philosophy interdisciplinary literature to explain some types of meditation techniques, in which 'I' consciousness of the individuals continue to remain through out the mediation process.

BIOPHYSICAL ANALYSIS OF SAMADHI STATE

Now, we shall try to understand the process of yoga samadhi by considering the concept of resonance absorption of electromagnetic radiations and frequencies of oscillations of endogenous electromagnetic fields of human body.

Our elementary neurobiological and electrophysiological understandings of altered states of consciousness induced through yoga give us the direct indication, that due to practice of yoga as the electrophysiological activities of human body decrease, the oscillations of electromagnetic oscillators of human body also decrease.

Hypothesis to explain savikalpa samadhi state on the basis of bio electromagnetic fields of the body:

Based on available experimental results and our knowledge of yogic samadhi from scriptures I have proposed the hypothesis[28] (1999) that - " Samadhi state can be attained due to process of **'resonance'** which occurs when the rhythms of physiological and psychological processes of body and mind together become equal to natural rhythms of cosmos. This happens when oscillators of electromagnetic field of the body system vibrate at their lowest natural frequency of vibration of electromagnetic field of cosmos ".

Prior to practice of meditation, the electromagnetic radiations emitted by the body are expected to have random fluctuations of frequencies. Due to practice of meditation, these random frequencies of photons are expected to reduce due to control of autonomic nerves activities, metabolic slowdown, reduced thermal agitation and other neurophysiological factors leading to phase coherency of electromagnetic waves.

At each stage of meditation, the inward journey of mind towards samadhi state our body processes and mental activities are going to tune the oscillators of the endogenous electromagnetic fields of human body to become 'sensitive' to resonance absorption of electromagnetic radiation of particular frequency, from the environmental electromagnetic field.

Experimental evidences for bio-photon emission from human body:

Now, experiments are available in science literature to show the emission of bio-photons from endogenous electromagnetic fields of human body. Cohen .S and Popp. F.A[10] (1992 and 1997) have reported bio-photon emission of human body using highly sophisticated measurement techniques which show that emission of biophotons is distinct from other bioluminescence and biphosphorescence. Theoretical principles of biophoton emission have been formulated by F.A.Popp[11] et.al. (1988). By comparing the theoretically expected results of biophoton emission for a chaotic field (thermal) and those of fully coherent (ordered) field with the actual experimental data, it has been shown (F.A. Popp et. al., 1988) that bio-photons are emitted from a coherent delocalised electromagnetic field occurring within the matter. Kobayashi[12] et. al., (1996) have shown that biophoton phenomenon is linked with coherent transmission of signals in living systems and quantum neurodynamics predicts[50,51] that the subtle signals of biophotons may play a role in the physical correlate behind the coherent perception.

The other sources of evidence for my proposal are recent developments and flood of research publications coming in the research area of biophoton emission. Biophoton emission has been extensively used for studying bioinformational / biocommunication aspects[36,39,40], application of bioenergy field detection data of individuals in alternative system of medicine,[37] for analysing coherent nature of living systems [38], microwave resonance therapy [41], mechanism of interaction between electromagnetic fields and living organism [42] etc.

Hypothesis to explain nirvikalpa samadhi on the basis of bio electromagnetic fields of human body:

Now to understand the ultimate state of meditation, the nirvikalpa samadhi, I have proposed the hypothesis[28] (1999) that - "When a person attains nirvikalpa samadhi state, electromagnetic oscillators of human body system may acquire zero frequency or very near to zero frequency of vibration showing no changes in oscillations of electric and magnetic components of waves." This samadhi does not mean the death of the yogi though all his body and mental processes have become static without any change and yogi can come out of this state radiating entirely new personality due to various transformations of mind and body.

Experimental verification of samadhi state:

However, it is important to measure the bio-photon emission from the endogenous electromagnetic field of a yogi during both savikalpa samadhi and nirvikalpa samadhi states using highly sophisticated and highly sensitive experimental techniques in the absence of environmental external field perturbations. In case, during nirvikalpa samadhi, we observe the expected zero frequency oscillation of electromagnetic field oscillator of human body, it seems to deny the basic quantum physics concepts of "zero point energy" and "Heisenberg's uncertainty principle" showing the static state of the charge oscillator without vibration. Creath .K and Schevargtz. G.E[44] (2003) have proposed recent sophisticated experimental strategy like high performance imaging system for measurement of biophotons emission. However, it is difficult to predict the electric and magnetic properties of human body at its ultimate state of experience of super-consciousness.

Russian physicist Konstantin Koratkov[13] (1998) has developed a new generation Kirlian camera which can take photograph of the entire energy body of the human being using a technique known as 'gas discharge visualisation of Aura'.

Role of electromagnetic oscillators in general and spiritual evolution:

As a meditator, with my experience, I have learnt that, due to meditation as mind goes to subtler states of consciousness, mind becomes sensitive to feel the variation of these bioenergy fields and the emitted radiations of the body spread to longer distance. This is because as a frequency of oscillations of oscillators of human body decrease, the wave length of emitted radiation increase and they spread to longer distance. This is the case of spiritual evolution. In case of general evolution, as we practice any yogic energisation techniques like certain type of pranic breathing exercises and chanting of manthras etc., the frequency of the oscillators increase and we feel more energetic and also mind evolves faster. Yoga practice in the primary step facilitates human beings to undergo general evolution and spiritual evolution (involution) is the secondary step of yoga practice.

Yogic samadhi from the point of view of field theories of physics & Indian philosophic thoughts:

Indian philosophy clearly points out that the human mind (developed due to individual ego based 'I' consciousness) uses the brain as a tool to monitor it's behaviour and there must be another center in the body, which is the real source of pure consciousness.

Bhagavan Ramana maharshi [34] has pointed out the concept of philosophic heart centre in Ramana gita as follows:
"Hrudaya kuhara madye kevalum Brahma matram
hyaha maha mithi sakshat datma rupena bhati"
(In the centre of the heart cave Brahman shines alone.
It is the form of "self" experienced directly as ATMAN - 'I')

Ramana maharshi locates this philosophic heart centre to two digits right of center of the chest of human body. To the question as to how to feel this centre in the human body, Ramana maharshi has answered [34] that "the whole body becomes a mere power, a force current, life becomes a needle drawn to a huge mass of magnet and as you go deeper and deeper you become a mere centre and then not even that for you become mere consciousness".

These discussions clearly point out that "philosophic heart" is the "centre for consciousness field pattern of human body", which is not only the source of electromagnetic fields (sukshma sharira in Sanskrit) but also the source of certain undefined subtle energy field patterns. (Karana sharira & Mahakarana sharira in Sanskrit).
Advaita vedanta has declared that,

'KNOWING BRAHMAN IS BECOMING BRAHMAN'.

It is postulated by Maharshi Mahesh yogi[48] (1966, 1985,) and supported by scientific theory of John.S. Hageline[49], (1987) that "objective unified field of modern theoretical physics" and the "subjective unified field of consciousness" are identical. In order to attain samadhi state, leading to enlightenment, the unification of all forces of nature is required to be established inside the philosophic heart centre of the human body with out causing any damage to the human body.

According to scientific analysis of Mandukya upanishat done by G.M. Gupta [53] the five types of pranas of Indian philosophy and their equivalent terms of modern science have been recognised as follows :

1 Udana (Gravitation)		- Centripetal force
2. Prana (Electricity)		– Centrifugal force
3. Vyana (Magnetism)		– Centrifugal force
4. Samana	(The weak force)	– Centrifugal force
5. Apana(The strong force)		– Centrifugal force

According to quantum theory the four fundamental interactions existing in nature are as follows :
i. "Electromagnetic interaction" (mediated by photons exchanged between charged particles).
ii. "Weak nuclear interaction" (mediated by particles known as intermediate vector bosons, exchanged between leptons and in some cases between a lepton and a hadron).
iii. "Strong nuclear interaction" (mediated by gluons and operates directly between quarks, and binds them together to make hadrons inside the nucleus)
iv. "Gravitation interaction" (mediated by gravitons the force acts between all bodies that have mass)

In the scientific domain, Marco Bischof[52] has proposed the importance of electromagnetic vacuum of zero point fluctuations and fundamental unified vacuum all the four interactions. According to him "The vacuum feature of living organisms and finally the understanding of vacuum may provide the crucial insight on the role of consciousness in physical reality". Marco Bischof also points out that "electromagnetic fields" of the human body are
"bio energetic fields" where as the domain of "vacuum" correspondence to following concepts
· "Bio information fields and subtle energies"
· "Unified field and consciousness".
Russian mathematician V. V. Nalimov[52] has proposed a theory, of **sematic vacuum** which is analogous to the concept of physical vacuum and according to the theory, from sematic vacuum ordinary reflexive consciousness emerges.

Hypothesis to explain to savikalpa samadhi on the basis of grand unified theory:

I propose the following hypothesis in order to explain in savikalpa samadhi by using above mentioned concepts of Indian philosophy and modern science.

"When a person experiences savikalpa samadhi the electromagnetic field oscillators of the human body acquire nearly zero frequency of oscillation and gravitational field and it's associated consciousness continue to function and the other three forces (electromagnetic, strong nuclear and weak nuclear forces) get unified at the philosophic heart centre of the human body (ATMAN) which is now 'zero point energy state of vacuum'. This pure state of vacuum is capable of generating extremely large amount of energy because it has very rapid and violent quantum fluctuations".

In science literature we have theoretical proof for GUT (grand unified theory) which has been proposed to bring all the forces with the exception of the gravitational force in to one set of fundamental equations & unified field theory [54,55] (UFT) or theory of everything (TOE) is a theory that has been proposed to bring all four interactions in to one set of fundamental equations. Savikalpa samadhi and nirvikalpa samadhi states provide the experimental proofs required for these theoretical propositions.

Hypothesis for nirvikalpa samadhi on the basis unified field theory:

Physicists are familiar with the concept of blackhole formation in connection with astrophysical phenomenon like death of massive stars as neutron stars or as blackholes.
I propose a analogous phenomenon in order to carryout scientific analysis of yogic samadhi state and propose the following hypothesis.

"When a yogi attains nirvikalpa samadhi, all types of consciousness fields with different modes of vibration form a single type of oscillation & finally they become static & at this stage the unification of all four types of interactions takes place at the philosophic heart centre of the body

(Atman). Collapse of any object as a result of gravitational pull of all it's parts to the state of extreme density should lead to the formation of a 'black hole' at the philosophic consciousness centre of the body which has **'singularity'** at centre of the hole. This gravitation collapse must release gravitational energy".

Hypothesis to understand nature of atman:

I propose the hypothesis that "the human body centre, which has been described as physical vacuum should be Atman of Indian philosophy and for a evolved yogi with the experience of nirvikalpa samadhi, atman contains point of singularity. It is the place where all the laws of physics including general theory of relativity break down. In this domain we have to deal with microscopic objects smaller than Planck length scale (equal to 10^{-33} cm) & at singularity classical concepts of space, time and gravity are no more valid and quantum effects gain significance"

Scientific basis for formation of blackhole and singularity:

1. Roger Penrose(1965) has proved that "Anything falls into a non-rotating black hole, must be crushed into singularity at the centre of the black hole". With Stephen Hawking, Penrose has also shown[57] that "collapse of matter into such a black hole singularity exactly implies the expansion of universe out of the Big bang". Penrose has also devised a method of representing events taking place inside and around black holes using space time maps known as "Penrose diagrams".

2. A non rotating, spherical black hole, with no over all electric charge has been described mathematically from Schwarzchild's solution to Albert Einstein's equations of general theory of relativity. According to John Gribbin's[57] explanation, "though the equations take no account of quantum theory ..... it is legitimate to suggest that matter collapsing towards a singularity will be affected by quantum processes on that scale, perhaps being 'bounced' in to an expansion out ward into another set of dimensions..... singularities especially those associated with rotating black holes and naked singularities allow the possibility of the time travel".

3. According to John gribbin's[57] description of blackhole – "for any mass there should be critical radius now called as Schwarzchild's radius. ..... if this mass were to be squeezed in side the critical radius, space would close around the object and pinch it off from the rest of universe. It would, in effect, become a self contained universe of it's own right, from which nothing (not even light) can escape".

4. Kip Throne[56] has described the quantum singularity as "a place where gravity 'unglues' space and time from each other and destroys time as a concept & destroys the definiteness of space leaving 'quantum foam' from which anything may emerge".

Scientific basis for zero point energy of vacuum:

a) According to Timothy H. Boyer[72] "when all matter has been excluded, however, space is not empty, it remains filled with electromagnetic radiation. A part of the radiation is thermal, and it can be removed by cooling, but another component of the radiation has a subtler origin. Even if the temperature of vacuum could be reduced to absolute zero, a pattern of fluctuating electromagnetic waves would persist. This residual radiation, which has been analysed only in recent years, is an inherent feature of the vacuum, and it cannot be suppressed".

b) The zero point energy has been described as "the ultimate quantum free lunch" (science, vol.275, 1997)

c) Puthoff [58] has given cosmological feed back principle according to which "zero point energy of vacuum constitutes a continual exchange of energy between any charge particle and rest of the charged particles in the universe".

d) According to Moray King[59] "zero point energy provides the possibility of obtaining energy directly from fabric of space time. There is a evidence that zero point energy is not a passive system but actually is a manifestation of an energy flux passing through our space orthogonally from higher dimensions. As this flux vibrates, it generates an electric field component in our space creating 'mini white holes' (flux entrances) and "mini black holes' (flux exits). The random action of this higher dimensional process gives rise to the observed zero point fluctuations in three dimensional space".

Proposition of experimental verification for black hole formation during samadhi state:

Hawking radiation has to be emitted in the form of energy from a non rotating black hole Therefore yogi at the time of experience of nirvikalpa samadhi has to emit Hawking radiation. One can extract energy from a rotating black hole(a Kerr black hole) as described by Penrose at the end of 1960s. The blackhole starts rotating after yogi comes out of nirvikalpa samadhi state.

It is essential to carry out the scientific investigation of nature of radiation emitted by a yogi at the time of experience of yoga samadhi and after experience in the normal mode using sophisticated instruments.

Theories for scientific study of consciousness:

In recent decades in order to understand consciousness, two types of theories have been proposed in following important domains of science

I. Electromagnetic field theories of consciousness

II. Quantum theories of consciousness

Electromagnetic field theories of consciousness:

The proposed electromagnetic theories of consciousness claim that the electromagnetic field generated by the brain should be the carrier of conscious experience and these fields can be measured by EEG.

1. Pockett. S [46] (2000) has given the concept that consciousness is identical with brain's electromagnetic field.

However this theory of Pockett does not explain definite nature of conscious electromagnetic fields.

2. The neurophysiologist E. Roy John [31] (2002) as proposed a theory of consciousness involving electromagnetic fields. Roy John has proposed that – "consciousness emerges from resonating organised fields in the brain, established due to recruitment of neurons in the thalamo-cortical oscillations by electromagnetic fields of brain. Roy John's theory does not explain the mechanism of transformation of information from conscious electromagnetic field to neurons.

3. Johnjoe Mc Fadden [30] (2002) has proposed the conscious electromagnetic information (cemi field) theory, claiming that – "Digital information with in the neurons is pooled and integrated to form an electromagnetic information field. Consciousness is that component of the brain's electromagnetic field that is down loaded to motor neurons and there by capable of communicating it's informational content to the outside world".

According to the main objection for Mc Fadden's theory by Pockett .S[32, 43] "there is actually no one-to-one correspondence between electromagnetic patterns measurable at the scalp or the surface of the brain and the conscious sensation experienced by the 'owner' of the brain". This implies that majority of the information present in electromagnetic field of brain will not be received by neurons and only small portion of the information content in EEG or MEG signal can be correlated with conscious experience.

4. Andrew A. Fingel kurts and Alexander A. Fingel kurts[63] (2004) have discussed the relationship between operational process of brain and consciousness.

Quantum theories of consciousness:

These theories argue that consciousness can not be explained form classical mechanics concepts hence in order to understand brain and mind, quantum mechanics is essential. Quantum mind hypothesis points out the importance of quantum processes like quantum entanglement, superposition, quantum coherence and wave function collapse etc, in order to explain brain's function and origin of consciousness.

From the year 1990-2000 various quantum theories and concepts have been developed by scientists like Bohm David [64], Pribram, [65], Chalmers .D [66] Goswami .A[67] etc. They have proposed relation between consciousness and quantum mechanics in variety of ways. Some of the major recent theories are

1. Henry stapp[68] (2001) has developed quantum theory and discussed the role of mind in nature.

2. Bornoider .G [69] (2003) and others have developed quantum brain dynamics.

3. Penrose .R and Stuart Hameroff[70,71] (1996,2007) have developed a theory of consciousness based on quantum computation in the micro tubules with in the neurons. According to them brain acts as a quantum computer and quantum coherence is related to consciousness in a fundamental way. They have proposed that, if the collapse of wave function can not take place due to decoherence in the environment then an alternative form of wave function collapse takes place which they have called "objective reduction" in which quantum superpositions have their own specific form of quantum computation and when these quantum superpositions are separated by more than Planck length scale and due to effect of gravity they have to become unstable and collapse.

Quantum theories of consciousness are facing the same problem as electromagnetic field theories of consciousness. Both theories are not able to explain the question of what makes these processes to give rises to conscious experience. Another argument against quantum theories of consciousness says that brain structures are not small enough to consider quantum effects. Quantum coherent states can not exist at the order of size of the neurons and it is not possible for these states to remain in the brain for a long time.

Clues for scientific study of consciousness from yoga philosophy:

Three important clues can be provided for understanding consciousness

I. Need for knowing the importance of different types of consciousness fields of the body.

II. Need to consider transcendental nature of consciousness

III. Need to understand MUKHYA PRANA (Primeval force)

I. Need for knowing the importance of different types of consciousness fields of the body:

I propose that it is necessary to incorporate other three types of fundamental interactions viz gravitational, weak nuclear and strong nuclear interaction present in the human body and their associated energy fields along with bio-electromagnetic fields to explain the real nature of conscious experience.

Research paper written by Karimov.A.R. et.al[35] (2001) "on the role of consciousness in the formation of microscopic structures in physical and bio-physical system" may help us to analyse this proposal. J. Ratte [47] (1996) as a vascular surgeon, based on experimental observations, from his clinical practice, has proposed hypothesis which completely supports this view. According to J. Ratte "The neuro-ectoderm and its derived sensory organs detect mainly variation of electromagnetic field. The mesodermic vascular network detects variations of the gravitational field..... The gravitational interaction is more primitive than electromagnetic interaction in the cosmogenesis. Neuro-ectoderm could be the transducer of centrifugal electro-weak interactions. Mesoderm with the vascular system could be the tranducer of gravito – strong interactions. The primacy of the vascular mesodermic network could explain facts not understood on a neural basis. The presence of tubulin

network in every cell, like the presence of receptors and neuro–transmitters in all organs favours the hypothesis that 'thought stuff is not caged in the brain'. (Bargland, Fabric of mind). The sensitivity of tubulin synthysis to a gravity gradient (James Tabony, Science, April 1994) is another argument in favour of role of tubulin as transducer of gravitational consciousness".

II. Need to consider transcendental nature of consciousness:
Any theoretical and experimental studies in the area of consciousness should always consider the fact that after certain stages of spiritual evolution, mental processes can transcend body processes. Though, this discussion comes to the area of parapsychology, it is the experience of yogis that consciousness can lose its contact with the human body, yogi by his will can leave his physical body and can come back to the body. At this stage, consciousness will be with 'subtle body field' called in sanskrit as 'sukshma sharira' and it is explained as 'ativahaka sharira' means 'superconducting body' in yogic text 'Yogavasishtha'. 'Phantom phenomenon' explained in medical surgery books shows a type of relation exists between body and mind. In many cases, it has been observed that 'If any part of the human body is removed from the body and it is nearby, the severed part obeys the mind'.

Review paper by Romijn .H partially supports this out of body experience of yogis. Based on quantum mechanical definition of virtual photons and concepts of electromagnetic field, Romijn. H [33] has argued that "Consciousness did not emerge during evolution only after neural network had been formed able to generate electric and / or magnetic fields of sufficient complexity, but subjectivity (consciousness experience) has already existed in a very elementary form as a fundamental property of omnipresent virtual photons of matter".

III. Need to understand MUKHYA PRANA (Primeval force):
I propose the following hypothesis which establishes the importance of mukhya prana. "The mukhya prana (Primeval force) is required for the existence of life on earth and it is the primary source of consciousness. When a yogi experiences nirvikalpa samadhi all the forces the human body cease to function and get unified at the centre of the body, this primeval force continue to function and it establishes contact with the zero point energy of the three dimensional space and creates a mini **black hole** (outlet for cosmic free energy from the body) at the centre of the human body and the other end of which is a mini **white hole** (inlet for cosmic free energy to body) and both are connected through worm hole".

Scientific basis for the hypothesis on mukhya prana:
In science literature possibility of existence of fifth force have been proposed when dealing with fundamental interactions and their unification.

i). Nymbuya and Golden Goadzirayi [55] proposed a unified field theory of four interactions. The theory proposes a new force from which predictions of the theory can be tested.

ii). Fran de aquino [54] has proposed gravitational electromagnetic field theory in which fifth interaction known as psychic interaction has been identified.

The existence of worm hole has been proposed in following scientific papers

i) Morris et.al.have proposed the possibility of existence of wormhole which can connect different times and can be used as a time machine.[62] The existence worm holes are also supported by Einstein's equations.

ii) Wheeler .J.A [60, 61] has explained about hyperspace channels (worm holes) in his research work on geometrodynamics

The importance of mukhya prana, the fifth force can be realised when we analyse the death case of human beings. At the death, according to Indian philosophic thought, the Atman along with it's consciousness fields leaves the physical body. It is very much essential to note that dead body also has all the four interactions with it's brain and it's structure, but the source of consciousness (mukhya prana) which was monitoring all the activities of the body and which was giving the experience of "I" consciousness has left the body. Therefore it is clear that "I" consciousness uses a brain as a tool for its functioning.

Hypothesis to understand nature of Mukya prana :
In cosmology hypothetical material called Cosmic string (not the string discussed in theories of particle physics under string theory) left as a result of bigbang has been proposed. According to J. Gribbin's[57] explanation of cosmic string "the best way to think of it is as a piece of big bang 'frozen' and trapped inside a tube with a diameter of just 10^{-14} that of an atomic nucleus. Cosmic string cannot have ends (if it did the energy inside would leakout) so it can only exist in form of closed loop. . . . . A Closed loop of string one light year across vibrates roughly once a year. This will produce gravitational radiation, draining energy out of string until the loop shrinks away to nothing". It is well known fact that "Cosmic censorship hypothesis" developed by Roger Penrose proposes the impossibility of time travel by saying that every singularity must be surrounded and hidden behind event horizon and hence it cannot interact with the universe in general.

John Gribbin's explanation[57] regarding cosmic censorship says that "In 1990s computer simulations of the way non-spherical objects (such as spindles) collapse suggested that they may in deed form singularities that are not concealed behind event horizons. And even singularities that are hidden in this way may lose there cloak of respectability eventually if the black hole in which they reside 'evoparates' through the emission of Hawking radiation".

Based on this explanation, I propose the hypothesis that "philosophic heart centre of the human body contains mukhya prana in the form of cosmic strings. After black hole is formed due to practice of meditation and as black hole

evaporates through emission of Hawking radiation, the cosmic string which has been converted to quantum foam singularity at the centre of the hole acquires speed and vibrates at the speed close to the velocity of light and generates super luminal particles called tachyons. These tachyons radiate energy in form of gravitational or electromagnetic radiation and they gain velocity faster than the velocity of light until they go to zero energy state. The particles created in these events are expected to lose energy and acquire the speed and these particles can travel backwards in time. These cosmic strings due to generation of tachyons acquire the capacity to hold the worm hole open inspite of inward attraction of the gravity. These cosmic strings gain capacity to stabilise **worm hole time machine** due to practice of meditation".

This hypothesis proposes the way of building of '**natural wormhole time machine**' which can meet the time travel need of advanced and evolved human beings. Indian philosophy has clearly pointed out the following advantages of practice of yoga samadhi and time travel.

1) Yoga practice can increase the life span of yogi.
2) Yoga practice can maintain the perfect body and mental health and prevent the aging of a person. (yogi can remain in his younger state of body and mind)
3) Yoga practice can provide mental state with proper intuition and insight in to events of universe.
4) Yoga practice opens the channel for unlimited free energy source of the cosmos.

This entire process of attainment of yoga samadhi has long range impact on body and mind which is to be investigated through science.

Conclusions

We have seen that one of the aims of spiritual evolution and hence the practice of yogic samadhi is to tune the de-localised electromagnetic oscillators of the human body to lowest frequencies which absorb those resonance frequencies of environmental electromagnetic fields. **These low frequency oscillators of human body in turn facilitate the condition for drawing cosmic free energy and open the channel for spiritual evolution.** The role played by endogenous electromagnetic field of the human body for attaining the transcendent state of consciousness has given a direct clue for important role of these fields in 'consciousness field formation', neural correlate of conscious experience, role of subtle signals of biophotons behind coherent perception and biophoton cellular communication etc. It is well known fact that electromagnetic fields have capacity to store and carry informations efficiently.

Though here, I have discussed only the role of electromagnetic radiation in the process of evolution, it is also important to explore the role of 'matter radiation' such as a-rays, b-rays, and neutron fluxes of both cosmic and terrestrial origin. It is also important from particle physics point of view to investigate unification of all forces of nature to be established in human body also the interaction of matter radiation with human body and its changes due to practice of meditation.

Now, the challenge is to carry out scientific investigation of nature of the ATMAN. "Does it correspond to relativistic quantum field theory concept of vacuum, the region where space time is in the state of possible lowest energy containing all the energy fields and everything that can exist is already potentially present?" Or "Is it anything more fundamental than vaccum?" or "Does it correspond to cosmic strings?" or "Does it correspond to quantum singularity from which anything may emerge?" are the questions to be answered. Experimental study of bioelectromagnetic fields and their variation due to practice of meditation and other types of altered states of consciousness may help us provide experimental and theoretical basis for the hard problem of establishing the relationship between electromagnetic field generated from brain and conscious experience.

This scientific analysis of yoga samadhi state using combination of yogic science and modern science can provide significant information for an approach to elucidation of still unexplained nature of "CONSCIOUSNESS"

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LEARNING – PEDAGOGY VERSES ANDRAGOGY

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"If you want one year's prosperity, grow grain; but if you want ten year's prosperity, grow men & women"
——Anonymous

☐ **Learning -**

☐ ***Defn.-*** an expected change in behavior which is relatively permanent, occurs as a result of experience or practice & is reinforced by repetition.

☐ It is not due to maturation process

☐ But due to our experiences.

Theories of learning -TWO

1] Stimulus response theories of Thorndike, Pavlov, Skinner & Hull Based on animal experimentation

2] Cognitive theories of Tolman & the 'Gestalt' psychologists Deals with acquisition of knowledge

Types of learning -

1] Cognitive – Learning of knowledge, problem solving & making decisions

2] Psychomotor – Learning of practical skills

3] Affective – Learning of appropriate attitudes.

" If I hear it, I forget it;
If I see it, I remember it;
If I do it, I understand it;
If I discover it, I use it"

What is pedagogy?

1] **Greek** word; ***paid*** –child; ***agogos*** – leading.
[The slave who took children to & from school]
Greek word ***paideia*** – cultural heritage continued through generation.

2] **Latin** word – means "education"

3] Mortimore [1999] defn. " any conscious action by one person designed to enhance learning in another."

4] Mehanna [2004] defn.- "as effective behaviour or activity designed to impart knowledge"

What is Andragogy ?

Greek word – ***anir [andr]*** – man.
i.e. it is art & science of adult learning.
Who is adult?
Who is adolescence? [Teenage]

Pedagogy – the art & science of child [youth] learning

Andragogy -the art & science of adult learning
Used first by Malcolm S. Knowles in early 1960's

In his work of developing a unified system of adult learning, it is essentially a process model & is based around the premise that as an individual matures, his needs & capacity to be self directing to utilize his experience in learning, to identify his own readiness to learn & to organize his learning around life problems increases steadily from infancy to pre adolescence & then increases more rapidly during adolescence

What happens if denial is there?

☐ If the culture of institution or social system [e.g. school, family] denies the need & ability to be self directing, then the result is tension, resistance, resentment & even rebellion in the individual.

☐ This leads to many of problems that exist today in our schools & colleges

Pedagogy versus Andragogy

☐ It is based on 4 assumptions

1] Concept of learner.
2] Role of learner's experience
3] Readiness to learn
4] Orientation to learning

Pedagogy versus Andragogy
1] Concept of learner

Pedagogy	Andragogy
1] Role of learner is dependent	1] Role of learner is essentially self directing
2] Teacher takes full respons ibility for the whole learning process.	2] Role of teacher is to encourage & nurture this self directed need

Pedagogy versus Andragogy
2] Role of learner's Experience

Pedagogy	Andragogy
1] Learner's bring little experie nce to the learning situation	1] Learner's experi ence accumulate over a life time; & is a great resource for learning for self & others
2]Learner is dependent on " expert" input	2] Learners attach greater significance to what they experi ence rather than what they are told.
3] Main technique is transmittal technique	3] Main techniques are experimental techniques

Pedagogy versus Andragogy
3] Readiness to learn

Pedagogy	Andragogy
Learners learn what they are conditioned to learn to obtain parental approval	Learners learn when they feel a need to learn
Fear of failure is great motivator	Learning should meet their needs to help

	them cope with the demands of their world i.e. their home, work place etc.
Learning is standardized & progressive because it is aimed at same age group & every age group is similar in it's learning needs & it's readiness to learn	Learning should be organized to meet learner's needs & sequenced accord ing to individual's ability & readiness to learn

Pedagogy versus Androgogy

4] Orientation to learning

Pedagogy	Andragogy
Learning is subject oriented with emphasis on contents most of which they may forget	Learner seeks to acquire competency to cope up with demands of their world; ☐seek personal development & achievement of potential; ☐ they also seek immediate gratifica tion. ☐ Learning must be relevant & immedi ately applicable.

Source; Malcolm S. Knowles. The Modern Practice of adult education from Pedagogy to Androgogy. 1980 P.43, 44 Prentice Hall Inc. Englewood cliffs, New Jersey

The learning Cycle –

The traditional model [Lois B. Hart 1991]

3 stages of learning cycle.

1] Learning activity

2] Participant's response eliciting methods.

3] Application of learning

The learning Cycle –

1] Learning activity

- **i] Objectives**
- **ii] activity to introduce concepts/ skills etc**

2] Participant's response eliciting methods.

- **i] polling**
- **ii] Rating**
- **iii] Small group discussions**
- **iv] List of responses on newsprint**
- **v] Interviewing partners**
- **vi] Questioning**
- **vii] Sentence completion**

3] Application of learning

- **i] Goal setting. Action plan development**
- **ii] Review of concepts.**
- **iii] Learning from abstracts.**

The seven principles of adult learning

1] Adult must want to learn.

2] Adults learn only what they feel they need to learn.

3] Adults learn by doing.

4] Adults learn by solving practical problems

5] Adults learn through application of past experinces.

6] Adults learn best in an informal environment

7] Adults learn best through a variety of training methods

The five stages of experiential learning cycle [The Andragogical method]

1] Experience [Activity, doing]

2] Publishing [Sharing reactions & observations generated by experience]

3] Processing [discussing patterns & dynamics]

4] Generalizing [Inferring principles about the "real world"]

5] Applying [Planning more effective behavior]

Who is facilitator?

☐ Traditional childhood learning is oriented towards the teacher imparting the knowledge to students.

☐ Adult learning is a process of one person [the facilitator] providing the opportunity for another person [the participant]

Role of facilitator

[As discussed by Tony Pont]

Role of facilitator

[As discussed by Tony Pont]

1] To create informal environment which harnesses in trinsic motivational drive. [formality create tension which impedes learning]

2] Experience of each member must be tapped. To deny it is like denying that person.

Different experiences & different backgrounds enable them to learn from each other which is fundamental of action learning.

3] Must use participatory methods

Summary of Knowles Andragogical model

☐ It is a process model not the traditional content model.

☐ The Andragogical tutor is a facilitator, a consult ant, a change agent, who prepares in advance a set of procedures for involving the learners in a process of

1] Establishing a climate conducive to learning

2] Creating a mechanism for mutual planning.

3] Diagnosing the need for learning

4] Formulating the objectives & contents which will satisfy those needs.

5] Designing a pattern of learning experiences.

6] Conducting those learning experiences with suitable techniques & materials

7] Evaluating the learning outcomes & redesigning the learning

☐ The process model does not ignore the contents but the emphasis is on providing procedures & re sources for facilitating the learners acquisition of knowledge & skills. Their intrinsic motivation is a powerful way of influencing attitudinal changes Expected outcomes of adult learning
☐ Acquiring proficiency & become
☐ self directed, self learning, motivated individuals,
☐ who take the responsibility for their own education &
☐ would be practicing their profession consciously with social accountability, integrity, compassion & empathy towards their patients & community at large realizing
☐ "The man is here for sake of other men"
--Albert Einstein
☐ The mediocre teacher tells.
☐ The good teacher explains.
☐ The superior teacher demonstrates.
☐ The great teacher inspires.

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ಯೋಗ ಚಿಕಿತ್ಸೆ

ಜಯಶ್ರೀ ಎಸ್. ಹಸಬಿ,
ಸಂಶೋಧನಾ ವಿದ್ಯಾರ್ಥಿನಿ, ತತ್ವಶಾಸ್ತ್ರ ವಿಭಾಗ, ಕರ್ನಾಟಕ ವಿಶ್ವವಿದ್ಯಾಲಯ, ಧಾರವಾಡ–3

ಪ್ರಸ್ತಾವನೆ

'ಯೋಗಾಭ್ಯಾಸ' ಇತ್ತೀಚೆಗೆ ಬಹಳ ಜನಪ್ರಿಯ ವಿಷಯವಾಗಿದೆ. ಯೋಗ ಚಿರ ಪುರಾತನ, ನಿತ್ಯ ನೂತನ, ಇಂದಿನ ನಮ್ಮೆಲ್ಲ ದೈಹಿಕ, ಮಾನಸಿಕ ಸಮಸ್ಯೆಗಳಿಗೆ ಯೋಗಾಭ್ಯಾಸ ಸಿದ್ಧೌಷಧ. ಇಂದಿನ ನಾಗರಿಕತೆಯ ನಿರಂತರ ಬದಲಾವಣೆಯ ವೇಗ, ವೈವಿಧ್ಯಗಳು, ಸುಖವನ್ನು ಹುಡುಕಲು ಹೊರಟ ಮನುಷ್ಯ ಅನೇಕ ರೀತಿಯ ಆತಂಕ, ಚಿಂತೆ, ಒತ್ತಡಗಳಿಗೆ ಒಳಗಾಗಿದ್ದಾನೆ. ಇದರಿಂದ ಹೊರಬರಲು ಅವನು ನಾನಾ ದುಷ್ಚಟಗಳಿಗೆ ಸೆರೆಯಾಗಿದ್ದಾನೆ. ಈ ಎಲ್ಲ ದುಷ್ಪರಿಣಾಮಗಳಿಂದ ಬಿಡುಗಡೆ ಹೊಂದಲು ಯೋಗಾಭ್ಯಾಸ ಆಶಾದೀಪವಾಗಿದೆ ಎಂದೇ ಹೇಳಬಹುದು. ಯೋಗಾಭ್ಯಾಸ ಒಂದು ಪೂರ್ಣ ವ್ಯಾಯಾಮ ಇದರ ಸತತ ಅಭ್ಯಾಸದಿಂದ ದೇಹದಾರ್ಢ್ಯ, ಆರೋಗ್ಯ, ಬುದ್ಧಿವಿಕಾಸ, ಸಂಯಮ, ಏಕಾಗ್ರತೆ, ಪೂರ್ಣ ಆಯಸ್ಸು, ಉತ್ಸಾಹ ಮತ್ತು ಬ್ರಹ್ಮಚರ್ಯ ನಿಷ್ಪೆ ಸಿದ್ಧಿಸುತ್ತವೆ.

ರಭಸದಿಂದ ಕೂಡಿದ ಆಧುನಿಕ ಜೀವನಶೈಲಿ ಮನೋ ದೈಹಿಕ ಕಾಯಿಲೆಗಳಿಗೆ ಮುಖ್ಯ ಕಾರಣವಾಗಿದೆ. ಅವುಗಳಲ್ಲಿ ಅಸ್ತಮಾ, ಸಕ್ಕರೆ ಕಾಯಿಲೆ, ರಕ್ತದೊತ್ತಡ, ಹೃದಯ ರೋಗಗಳು, ಕತ್ತು ಬೆನ್ನು ನೋವು, ಕರುಳಿನ ತೊಂದರೆಗಳು ಇತ್ಯಾದಿ. ನಮ್ಮ ಮನಸ್ಸಿನಲ್ಲಿ ಏಳುವ ಪ್ರತಿಯೊಂದು ಆಲೋಚನೆ ದೇಹದ ಮೇಲೆ ಪರಿಣಾಮವನ್ನು ಬೀರುತ್ತದೆ. ಇದರಿಂದ ಮನಃಶಾಂತಿ ಕದಡಿ ಹೋಗುತ್ತದೆ. ಆದ್ದರಿಂದ ಮನಸ್ಸನ್ನು ಸದ್ವಿಚಾರಗಳಲ್ಲಿ, ಸನ್ಮಾರ್ಗದಲ್ಲಿ ಹರಿಯಲು ಬಿಡಬೇಕು. *"ಮನಸ್ಸನ್ನು ನಿಗ್ರಹಿಸುವುದೇ ಯೋಗ – ಮಹರ್ಷಿ ಪತಂಜಲಿ"*. ದೈಹಿಕ ಮತ್ತು ಮಾನಸಿಕ ಸಮತೋಲನವನ್ನು ಯೋಗ ಚಿಕಿತ್ಸೆಯಿಂದ ಪಡೆಯಬಹುದು. ಯೋಗ ಚಿಕಿತ್ಸೆಗೆ ಮೂರು ಆಯಾಮಗಳಿವೆ ಅವುಗಳೆಂದರೆ ಆರೋಗ್ಯವರ್ಧಕ, ರೋಗನಿವಾರಕ ಹಾಗೂ ರೋಗನಿರೋಧಕ.

ಆರೋಗ್ಯ ಎಂದರೇನು?

ಸಮದಾತುಃ ಸಮಾಗ್ನಿಃ ಸಮ ದೋಷಃ ಮಲಕ್ರಿಯಾಃ ।
ಪ್ರಸನ್ನ ಆತ್ಮೇಂದ್ರಿಯ ಮನಃ ಆರೋಗ್ಯಃ ಇತ್ಯ ಭಿಧೀಯತೇ ॥

ಅಂದರೆ ಶರೀರದಲ್ಲಿ ಉತ್ಪನ್ನವಾಗುವ ಸಪ್ತ ಧಾತುಗಳು ಪ್ರಮಾಣಬದ್ಧವಾಗಿರುವಾಗ, ಜಠರಾಗ್ನಿ ಪದೀಪ್ತವಾಗಿರುವಾಗ, ವಾತಪಿತ್ತಕಫಗಳ ಸಮತೋಲನ ಇದ್ದಾಗ, ಮಲಮೂತ್ರ ಸ್ವೇದಗಳ ಉತ್ಪತ್ತಿ ಮತ್ತು ವಿಸರ್ಜನೆ ಸುಸ್ಥಿತಿಯಲ್ಲಿರುವಾಗ, ಆತ್ಮ ಇಂದ್ರೀಯ ಮತ್ತು ಮನಸ್ಸು ಪ್ರಸನ್ನವಾಗಿದ್ದಾಗ ಆರೋಗ್ಯವೆಂದು ಕರೆಯುತ್ತಾರೆ.

ನಮ್ಮ ಶರೀರ ಪಂಚಕೋಶಗಳಾದ ಅನ್ನಮಯ, ಪ್ರಾಣಮಯ, ಮನೋಮಯ, ವಿಜ್ಞಾನಮಯ, ಆನಂದಮಯ ಕೋಶಗಳಿಂದ ರಚಿತವಾಗಿದೆ. ಯೋಗಶಾಸ್ತ್ರದ ಪ್ರಕಾರ ಎಲ್ಲಾ ಕಾಯಿಲೆಗಳು ಮನೋಮಯ ಕೋಶದಲ್ಲಿಯೇ ಉಗಮವಾಗುತ್ತವೆ. ಆದ್ದರಿಂದಲೇ ಅವುಗಳಿಗೆ 'Psychosomatic Diseases' ಎನ್ನಲಾಗಿದೆ.

ಅಸ್ತಮಾ

ನಮ್ಮ ದೇಶದಲ್ಲಿ ಬಹಳ ಸಾಮಾನ್ಯವಾಗಿ ಕಂಡು ಬರುವ ಕಾಯಿಲೆ ಇದಾಗಿದೆ. ಮೈಗೆ ಆಗದಿರುವ ಕೆಲವೊಂದು ವಸ್ತುಗಳನ್ನು ವ್ಯಕ್ತಿ ವಾಘ್ರಾಣಿಸಿದಾಗ (ಕುದುರೆ, ನಾಯಿ, ಬೆಕ್ಕುಗಳ ಕೂದಲು, ಧೂಳು, ತೌಡು, ಹಲವು ಹೂವುಗಳ ಮಕರಂದ, ಚಳಿಗಾಲ) ಪ್ರತಿಸ್ಪಂದನದಿಂದಾಗಿ, ಶ್ವಾಸನಾಳಗಳ ಒಳಗಿನ ಪದರ ಊದಿಕೊಳ್ಳುತ್ತದೆ. ಹಾಗಾಗಿ ಒಳಗೆ ಹೋಗುವ ಅಥವಾ ಹೊರಗೆ ಬರುವ ಗಾಳಿಯ

ಪ್ರಮಾಣ ತುಂಬಾ ಕಡಿಮೆಯಾಗುತ್ತದೆ. ಪರಿಸರ ಮಾಲಿನ್ಯವು ಅಸ್ತಮಾ ರೋಗಕ್ಕೆ ಒಂದು ಕಾರಣವಾಗಿದೆ.

ಅಸ್ತಮಾ ರೋಗದ ನಿವಾರಣೆಗೆ ಉಜ್ಜಾಯೀ ಪ್ರಾಣಾಯಾಮ, ಉತ್ತಿತ ಏಕೈಕ ಪಾದಾಸನ, ಧನುರಾಸನ, ಉಷ್ಟ್ರಾಸನ, ಸರಳ ಮತ್ಸ್ಯಾಸನ, ಸಿಂಹಾಸನ.

ಉಜ್ಜಾಯೀ ಪ್ರಾಣಾಯಾಮ

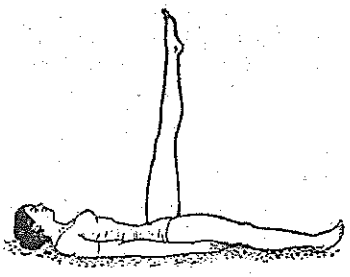
ಪ್ರಯೋಜನಗಳು:

1. ಶ್ವಾಸಕೋಶ ಮತ್ತು ಶ್ವಾಸನಾಳಗಳು ಶುದ್ಧಿಯಾಗಿ ಸದೃಢಗೊಳ್ಳುತ್ತವೆ.
2. ಸುಲಭ ಉಸಿರಾಟ.

ಉತ್ತಿತ ಏಕೈಕ ಪಾದಾಸನ

ಪ್ರಯೋಜನಗಳು:

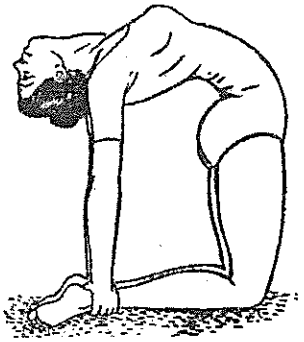
1. ಸರಳ ಉಸಿರಾಟ ಸಾಧ್ಯ.
2. ಶ್ವಾಸನಾಳದ ಊತ ಕಡಿಮೆಯಾಗುತ್ತದೆ.
3. ಜೀರ್ಣಶಕ್ತಿ ಸುಗಮವಾಗುತ್ತದೆ.
4. ಅಜೀರ್ಣದಿಂದ ಬರುವ ಉಬ್ಬಸ



ಉಷ್ಟ್ರಾಸನ

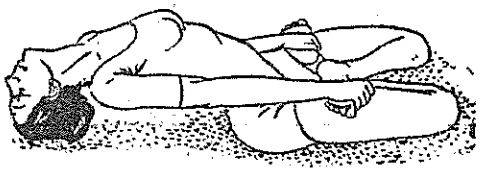
ಪ್ರಯೋಜನಗಳು:

1. ಈ ಆಸನದಲ್ಲಿ ಎದೆಯ ಗೂಡು ಹಿಗ್ಗುವುದರಿಂದ ಸರಾಗ ಉಸಿರಾಟ ಸಾಧ್ಯ.
2. ಗಂಟಲ ನೋವು, ನೆಗಡಿ, ತಲೆನೋವು ಇಲ್ಲವಾಗುತ್ತದೆ.
3. ಪಂಚೇಂದ್ರಿಯಗಳು ಚುರುಕಾಗುತ್ತವೆ.



ಮತ್ಸ್ಯಾಸನ

ಪ್ರಯೋಜನಗಳು:



1. ಕುತ್ತಿಗೆ, ಬೆನ್ನು, ಸೊಂಟ, ತೊಡೆಗಳಲ್ಲಿದ್ದ ದೋಷ ನಾಶವಾಗುತ್ತದೆ.
2. ಪಿಟ್ಯುಟರಿ, ಪೀನಿಯಲ್, ಥೈರಾಯ್ಡ್, ಎಡ್ರಿನಲ್‌ಗ್ರಂಥಿಗಳು ಚುರುಕುಗೊಂಡು ವ್ಯಕ್ತಿಯ ಆರೋಗ್ಯ ವೃದ್ಧಿಯಾಗುತ್ತದೆ.
3. ಯೋಗಾಭ್ಯಾಸದೊಂದಿಗೆ ಅಸ್ತಮಾ ರೋಗಿಗಳು ಕೆಲವೊಂದು ಆಹಾರ ಪತ್ಯವನ್ನು ಅನುಸರಿಸಬೇಕು.

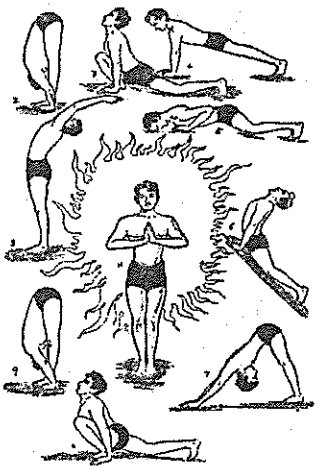
ಸಿಹಿಮೂತ್ರ ರೋಗ

ಇಂದಿನ ಒತ್ತಡದ ಯಾಂತ್ರಿಕ ಜೀವನಶೈಲಿಯು ಇದಕ್ಕೆ ಮುಖ್ಯ ಕಾರಣವಾಗಿದೆ. ಇದು ಗಂಡಸರಿಗಿಂತ ಹೆಂಗಸರಲ್ಲಿ ಹೆಚ್ಚಾಗಿ ಕಂಡುಬರುತ್ತದೆ ಎಂಬುದು ಆಶ್ಚರ್ಯಕರ ಮತ್ತು ವಂಶ ಪಾರಂಪರ್ಯವಾಗಿಯೂ ಬರುತ್ತದೆ. ಆಹಾರ ಪಥ್ಯದೊಂದಿಗೆ ಯೋಗಾಸನ, ಪ್ರಾಣಾಯಾಮ, ಧ್ಯಾನ ಮಾಡಿದಾಗ ಸಿಹಿಮೂತ್ರ ರೋಗ ನಿಯಂತ್ರಿಸಲು ಸಾಧ್ಯ. ಸಿಹಿಮೂತ್ರ ರೋಗ ನಿವಾರಣೆಗೆ ಅಭ್ಯಾಸ ಮಾಡಬಹುದಾದ ಆಸನಗಳು: ಸೂರ್ಯ ನಮಸ್ಕಾರ, ಭುಜಂಗಾಸನ, ಶಲಭಾಸನ, ವಕ್ರಾಸನ, ಮತ್ಸ್ಯೇಂದ್ರಾಸನ, ಹಲಾಸನ, ಧನುರಾಸನ, ಶವಾಸನ.

ಸೂರ್ಯ ನಮಸ್ಕಾರ

ಪ್ರಯೋಜನಗಳು:

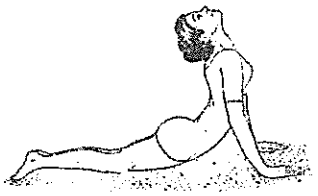
1. ಹೊಟ್ಟೆ, ಸೊಂಟ ತೆಳ್ಳಗಾಗಲು ಸಹಕಾರಿ.
2. ಅಜೀರ್ಣ, ಮಲಬದ್ಧತೆ, ವಾಯು ನಿವಾರಿಸುತ್ತದೆ.
3. ಕಾಲಿನ ಮತ್ತು ತೊಡೆಯ ಸ್ನಾಯುಗಳ ಸದೃಢತೆಯಿಂದಾಗಿ ಸಯಾಟಿಕಾ ನೋವಿಗೆ ಶಮನಕಾರಿ.
4. ಮುಖದ ಕಾಂತಿ ಹೆಚ್ಚುತ್ತದೆ



ಭುಜಂಗಾಸನ

ಪ್ರಯೋಜನಗಳು:

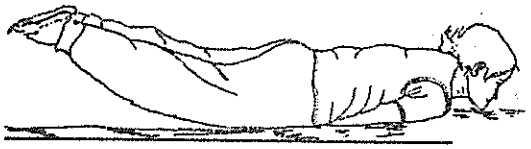
1. ಬೆನ್ನು ನೋವು ತೀವ್ರವಾಗಿ ಶಮನವಾಗುತ್ತದೆ.
2. ಪಚನ ಶಕ್ತಿ ಹೆಚ್ಚಿಸುತ್ತದೆ.
3. ಲವಲವಿಕೆ ಮೂಡುತ್ತದೆ.
4. ಗೂನು ಬೆನ್ನು ಸರಿಯಾಗುತ್ತದೆ.



ಶಲಭಾಸನ

ಪ್ರಯೋಜನಗಳು:

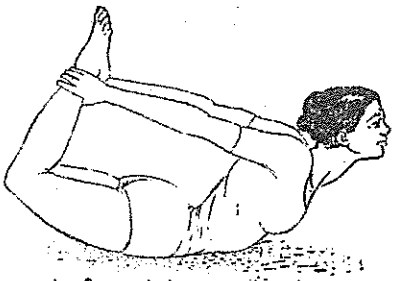
1. ಮಲಬದ್ಧತೆ ನಿವಾರಣೆ
2. ತೊಡೆ ಮತ್ತು ಕಟಿ ಪ್ರದೇಶ ಶಕ್ತಿಯುತವಾಗುವದು



ಧನುರಾಸನ

ಪ್ರಯೋಜನಗಳು:

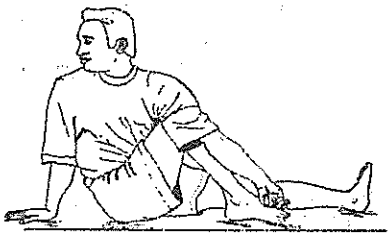
1. ಜೀರ್ಣಶಕ್ತಿ ಹೆಚ್ಚುವುದು
2. ಹೊಟ್ಟೆಯ ಮತ್ತು ತೊಡೆಯ ಬೊಜ್ಜು ಕರಗುವದು
3. ಬೆನ್ನು ಮತ್ತು ಕೈ-ಕಾಲುಗಳಿಗೆ ಉತ್ತಮ ವ್ಯಾಯಾಮ



ವಕ್ರಾಸನ

ಪ್ರಯೋಜನಗಳು:

1. ಈ ಆಸನ ಪ್ಯಾನ್‌ಕ್ರಿಯಾಸ್, ಅಡ್ರಿನಲ್‌ಗ್ರಂಥಿಗಳನ್ನು ಪ್ರಚೋದಿಸುತ್ತದೆ.

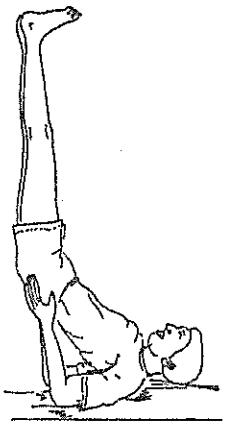


2. ರಕ್ತದಲ್ಲಿರುವ ಗ್ಲುಕೋಸ್ ಅಂಶವನ್ನು ಹಿಡಿತದಲ್ಲಿಡುತ್ತದೆ. ಸೊಂಟ, ಹೊಟ್ಟೆಯ ಕೊಬ್ಬನಾಂಶವನ್ನು ಕರಗಿಸುತ್ತದೆ.

ಅರ್ಧಮತ್ಸ್ಯೇಂದ್ರಾಸನ
ಪ್ರಯೋಜನಗಳು:



1. ಬೆನ್ನು ಹುರಿಯ ಸ್ಥಿತಿಸ್ಥಾಪಕ ಶಕ್ತಿ ಹೆಚ್ಚುವುದು
2. ಮಲಬದ್ಧತೆ ನಿವಾರಣೆ
3. ಹೊಟ್ಟೆಯ ಬೊಜ್ಜು ಕರಗುವದು – ಮದುಮೇಹಿಗಳಿಗೆ ಅತ್ಯುತ್ತಮವಾದ ಆಸನ

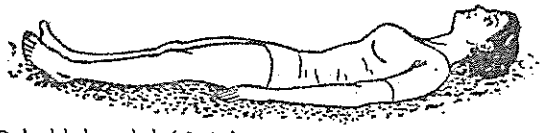


ವಿಪರೀತಕರಣಿ
ಪ್ರಯೋಜನಗಳು:

1. ನಿರ್ನಾಳಗ್ರಂಥಿಗಳನ್ನು ಚುರುಕುಗೊಳಿಸುತ್ತದೆ.
2. ಚರ್ಮದ ಕಾಂತಿ ಹೆಚ್ಚುತ್ತದೆ.
3. ಲವಲವಿಕೆ ಮತ್ತು ಚೈತನ್ಯವನ್ನು ಹೆಚ್ಚಿಸುತ್ತದೆ.

ಶವಾಸನ
ಪ್ರಯೋಜನಗಳು:

1. ದೇಹ ಮತ್ತು ಮನಸ್ಸು ಎರಡಕ್ಕೂ ಸಂಪೂರ್ಣ ವಿಶ್ರಾಂತಿ ಲಭಿಸುತ್ತದೆ.
2. ಹೃದಯ ರೋಗ ಮತ್ತು ಹೆಚ್ಚು ರಕ್ತದೊತ್ತಡ ಇರುವವರಿಗೆ ತುಂಬಾ ಉಪಯುಕ್ತ.
3. ನಿದ್ದೆಬಾರದಿರುವರು ಮಲಗುವ ಮುನ್ನ ಶವಾಸನವನ್ನು ಅಭ್ಯಸಿಸಿದರೆ ಸುಖಕರವಾದ ನಿದ್ದೆ ಬರುತ್ತದೆ.
4. ಮನದ ಆತಂಕ, ಭೀತಿ, ಉದ್ವೇಗ, ಚಿಂತೆ, ದೂರವಾಗುತ್ತದೆ.



ಅಧಿಕ ರಕ್ತದ ಒತ್ತಡ (ಬಿ.ಪಿ.)

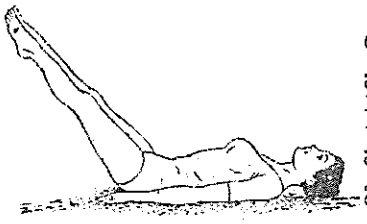
ನಮ್ಮ ಆಧುನಿಕ ಜೀವನದ ಅವಸರ ನರಗಳ ಮೇಲೆ ಉಗ್ರ ಪರಿಣಾಮ ಬೀರುತ್ತದೆ, ಕೆಲಸದಲ್ಲಿ ಪೈಪೋಟಿ, ಕಾತುರ, ಚಿಂತೆ, ಬೇಸರ, ಕೋಪ, ಅಸೂಯೆ, ಹೆದರಿಕೆ ಮುಂತಾದ ಮಾನಸಿಕ ಉದ್ವೇಗದ ಕಾರಣದಿಂದ ಹೆಚ್ಚು ರಕ್ತದ ಒತ್ತಡ ಪ್ರಾರಂಭವಾಗುತ್ತದೆ. ಯೋಗ ಚಿಕಿತ್ಸೆಯ ಮೂಲಕ ಇದನ್ನು ನಿಯಂತ್ರಿಸಬಹುದು.

ಮೊದಲ ಹಂತದಲ್ಲಿ ಅಧಿಕ ರಕ್ತದ ಒತ್ತಡ ಇರುವವರು ದಿನಕ್ಕೆ ಎರಡು ಬಾರಿ ಶವಾಸನವನ್ನು 35–40 ನಿಮಿಷದವರೆಗೆ ಮಾಡಬೇಕು. ಶವಾಸನದಿಂದ ದೈಹಿಕ ಮತ್ತು ಮಾನಸಿಕ ವಿಶ್ರಾಂತಿ ದೊರೆಯುತ್ತದೆ. ಕ್ರಮೇಣ ರಕ್ತದ ಒತ್ತಡ, ನರಗಳ ಉದ್ರೇಕ ಇಳಿಮುಖವಾಗುತ್ತದೆ. ಒಂದು ತಿಂಗಳ ನಂತರ ಎರಡನೇ ಹಂತದಲ್ಲಿ ಸೂರ್ಯಬೇಧ ಪ್ರಾಣಾಯಾಮ, ಚಂದ್ರಬೇಧ ಪ್ರಾಣಾಯಾಮ, ಅನುಲೋಮವಿಲೋಮ ಅಥವಾ ನಾಡಿಶುದ್ಧಿ, ಭ್ರಮರಿ ಪ್ರಾಣಾಯಾಮಗಳನ್ನು (ಕುಂಬಕರಹಿತ) ಅಭ್ಯಸಿಸಬೇಕು. ಎರಡು ತಿಂಗಳ ನಂತರ ಮೂರನೇ ಹಂತದಲ್ಲಿ ರಕ್ತದ ಒತ್ತಡವು ಕಡಿಮೆಯಾದಾಗ ಸರಳ ಆಸನಗಳಾದ ಪದ್ಮಾಸನ, ಉತ್ಥಿತಪಾದಾಸನ, ಪವನಮುಕ್ತಾಸನ, ಶವಾಸನವನ್ನು ಅಭ್ಯಸಿಸಬೇಕು. ರೋಗವನ್ನು ನಿಯಂತ್ರಿಸಲು ಜಿಡ್ಡಿನಾಂಶ ಮತ್ತು ಉಪ್ಪನ್ನು ಕಡಿಮೆ ಮಾಡಬೇಕು.

ಪದ್ಮಾಸನ
ಪ್ರಯೋಜನಗಳು:



1. ಧ್ಯಾನಕ್ಕೆ ಉಪಯುಕ್ತವಾದ ಆಸನ
2. ತೊಡೆಯ ಕೊಬ್ಬು ಕರಗಿಸಲು ಸಹಕಾರಿ



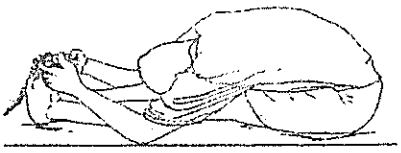
ಉತ್ಥಿತಪಾದಾಸನ
ಪ್ರಯೋಜನಗಳು:

1. ಮಲಬದ್ಧತೆ, ಮೂಲವ್ಯಾದಿ ದೋಷಗಳ ನಿವಾರಣೆ.
2. ಹೆರಿಗೆಯಾದ ಮೇಲೆ ಸಡಿಲಗೊಂಡ ಹೊಟ್ಟೆ ಮೊದಲಿನ ಸ್ಥಿತಿಗೆ ಬರಲು ಈ ಆಸನ ಸಹಕಾರಿ.
3. ಸಿಹಿಮೂತ್ರ ರೋಗಿಗಳಿಗೆ ಉಪಯುಕ್ತವಾದ ಆಸನ.

ಮುಟ್ಟಿನ ದೋಷಗಳು

ಮುಟ್ಟು ನಿಲ್ಲುವಿಕೆ ಮಹಿಳೆಯ ಬದುಕಿನಲ್ಲಿ ಒಂದು ಪರ್ವಕಾಲ. ದೇಹದ ಹಾರ್ಮೋನ್‌ಗಳ ಇಳಿಮುಖದಿಂದಾಗಿ ಆಕೆ ದೈಹಿಕ ಮತ್ತು ಮಾನಸಿಕವಾಗಿ ಒತ್ತಡಕ್ಕೆ ಒಳಗಾಗುತ್ತಾಳೆ. ದೇಹದಲ್ಲಿ ಈಸ್ಟ್ರೋಜನ್ ಕಡಿಮೆಯಾದರೂ ಸೂಕ್ತ ಆಸನಾಭ್ಯಾಸದಿಂದ ಮಹಿಳೆಯಲ್ಲಿ ಲವಲವಿಕೆ ಮೂಡುತ್ತದೆ. ಸೂಚಿಸಿರುವ ಆಸನಗಳನ್ನು ಮಾಡಬಹುದು: ಪದ್ಮಾಸನ, ವೀರಾಸನ, ಪಶ್ಚಿಮೋತ್ತಾನಾಸನ, ಪವನಮುಕ್ತಾಸನ, ಸರಳ ಮತ್ಸ್ಯಾಸನ, ಭದ್ರಾಸನ, ಅರ್ಧ ಮತ್ಸ್ಯೇಂದ್ರಾಸನ, ಸರ್ವಾಂಗಾಸನ, ಶವಾಸನ.

ಪಶ್ಚಿಮೋತ್ತಾನಾಸನ
ಪ್ರಯೋಜನಗಳು:

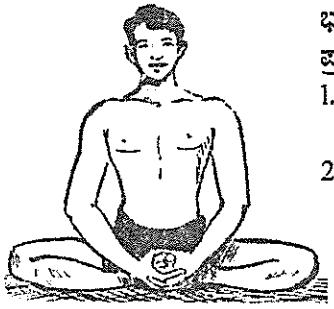


1. ಬೆನ್ನು ನೋವು, ಸೊಂಟ ನೋವಿಗೆ ಶಮನಕಾರಿ.
2. ನರಗಳ ಉದ್ರೇಕ ಕಡಿಮೆಯಾಗುತ್ತದೆ.
3. ಸೊಂಟ, ಹೊಟ್ಟೆಯ ಕೊಬ್ಬು ಕರಗಿ ಮಾಟವಾದ ದೇಹ ಪಡೆಯಲು ಸಹಕಾರಿ.
4. ಹೆಂಗಸರ ಮುಟ್ಟಿನ ದೋಷದ ನಿವಾರಣೆ.

ಸರಳ ಮತ್ಸ್ಯಾಸನ
ಪ್ರಯೋಜನಗಳು:



1. ಥೈರಾಯ್ಡ್‌ಗ್ರಂಥಿಗಳ ಕಾರ್ಯ ಕ್ರಮಬದ್ಧವಾಗುವದು
2. ಸಂಪೂರ್ಣ ಹೊಟ್ಟೆಯ ಸ್ನಾಯುಗಳು ಸದೃಢಗೊಳ್ಳುವವು

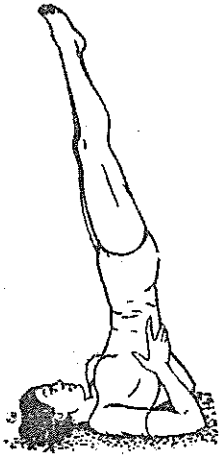


ಭದ್ರಾಸನ
ಪ್ರಯೋಜನಗಳು:

1. ಸ್ತ್ರೀಯರಿಗೆ ಉಪಯುಕ್ತವಾದ ಆಸನ
2. ಗರ್ಭಿಣಿಯರಿಗೆ ಉತ್ತಮ ಫಲಕಾರಿ, ಸುಖ ಪ್ರಸವಕ್ಕೆ ಸಹಕಾರಿ



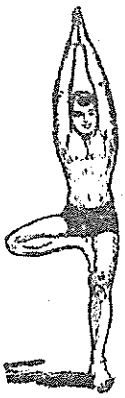
ಸರ್ವಾಂಗಾಸನ
ಪ್ರಯೋಜನಗಳು:



1. ಅನಗತ್ಯ ಕೊಬ್ಬು ಕರಗುತ್ತದೆ.
2. ಮುಖದ ಕಾಂತಿ ಇಮ್ಮಡಿಯಾಗುತ್ತದೆ.
3. ಕೂದಲು ಉದುರುವುದು ನಿಲ್ಲುತ್ತದೆ.
4. ಥೈರಾಕ್ಸಿನ್ ಹಾರ್ಮೋನ್‌ನ ಸೂಕ್ತ ಪ್ರಮಾಣದ ಸ್ರವಿಕೆ.

ಮಾನಸಿಕ ಒತ್ತಡ (ಸ್ಟ್ರೆಸ್ ಮತ್ತು ಡಿಪ್ರೆಷನ್)
ಆಧುನಿಕ ಜಗತ್ತಿನ ಜಂಜಡಗಳಿಂದಾಗಿ "ಏನು ಮಾಡಿದರೂ ರಾತ್ರಿ ನಿದ್ದೆ ಬರುವುದಿಲ್ಲ" ಎಂದು ಹೇಳುವವರ ಸಂಖ್ಯೆ ಹೆಚ್ಚಾಗುತ್ತಲಿದೆ. ನಮ್ಮ ಮನಸ್ಸು ಒತ್ತಡಗಳಿಗೆ ಮಣಿದಾಗ ಉದ್ವೇಗ, ಅನಾಸಕ್ತಿ, ಗಾಬರಿ, ನಿದ್ರಾಹೀನತೆ, ಇತ್ಯಾದಿ ತಲೆದೋರುತ್ತದೆ. ಇವುಗಳಿಗೆ ಚಿಕಿತ್ಸೆ ನೀಡದೆ ಹಾಗೇ ಬಿಟ್ಟರೆ ಆ ವ್ಯಕ್ತಿ ತೀವ್ರ ಮಾನಸಿಕ ರೋಗಗಳಿಂದ ಬಳಲುವನು. ಮನದ ಉದ್ವೇಗ ಅತಿಯಾದರೆ ಹೃದಯಾಘಾತ, ಅಧಿಕ ರಕ್ತದ ಒತ್ತಡ, ಅಸ್ತಮಾ, ಮೈಗ್ರೇನ್ ತಲೆನೋವು, ರುಮಾಟಾಯ್ಡ್ ಅರ್ತ್ರೈಟಿಸ್, ಬೊಜ್ಜು ಖಿನ್ನತೆ ಆತಂಕ, ಅಲ್ಸರ್ಸ್ ಮತ್ತು ಸಿಹಿಮೂತ್ರ ರೋಗ ಮುಂತಾದ ದೈಹಿಕ ತೊಂದರೆಗಳಿಗೆ ಕಾರಣವಾಗುತ್ತದೆ. ಈ ಎಲ್ಲಾ ಮಾನಸಿಕ ಖಿನ್ನತೆಯಿಂದ ಹೊರಬರಲು ಯೋಗ ಅಭ್ಯಾಸದಿಂದ ಸಾಧ್ಯ. ಅವುಗಳೆಂದರೆ ಯೋಗಾಸನ, ವೃಕ್ಷಾಸನ, ಅರ್ಧಕಟಿ ಚಕ್ರಾಸನ, ತ್ರಿಕೋನಾಸನ, ಉತ್ಕಟಾಸನ, ಪದ್ಮಾಸನ, ಸಿಂಹಾಸನ, ಪರ್ವತಾಸನ, ಸಿದ್ಧಾಸನ, ಹಲಾಸನ, ಮಕರಾಸನ, ಶವಾಸನ, ಪ್ರಾಣಾಯಾಮ ಮತ್ತು ಧ್ಯಾನ

ವೃಕ್ಷಾಸನ
ಪ್ರಯೋಜನಗಳು:



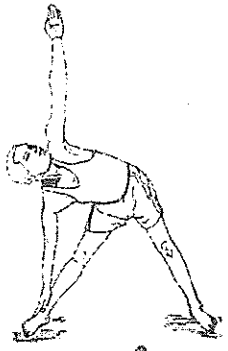
1. ಏಕಾಗ್ರತೆಗೆ ಸಹಕಾರಿ
2. ಸ್ಮರಣ ಶಕ್ತಿಯನ್ನು ವೃದ್ಧಿಸುತ್ತದೆ
3. ಕಾಲಿನ ಸ್ನಾಯುಗಳು ಬಲಗೊಳ್ಳುತ್ತವೆ



ಅರ್ಧಕಟಿ ಚಕ್ರಾಸನ
ಪ್ರಯೋಜನಗಳು:

1. ಬೆನ್ನೆಲುಬಿನ ಕಾರ್ಯಕ್ಷಮತೆ ಹೆಚ್ಚಿಸುತ್ತದೆ
2. ಉಲ್ಲಾಸವನ್ನು ಹೆಚ್ಚಿಸುತ್ತದೆ

ತ್ರಿಕೋನಾಸನ
ಪ್ರಯೋಜನಗಳು:



1. ಕಾಲಿನ ವಿಕಾರಗಳು ದೂರವಾಗುವವು.
2. ಬೆನ್ನು ಮತ್ತು ಕತ್ತಿನ ನೋವನ್ನು ನಿವಾರಿಸುವದು ಮತ್ತು ಕೈಗಳ ಬಲವರ್ಧನೆ.

ಉತ್ಕಟಾಸನ
ಪ್ರಯೋಜನಗಳು:



1. ಮೊಣಕಾಲು ಮತ್ತು ಮೀನಖಿಂಡದ ಸ್ನಾಯುಗಳ ಬಲವರ್ಧನೆ.
2. ಬೆನ್ನಿಗೆ ಚೈತನ್ಯ ಒದಗಿಸುತ್ತದೆ.

ಸಿಂಹಾಸನ
ಪ್ರಯೋಜನಗಳು:

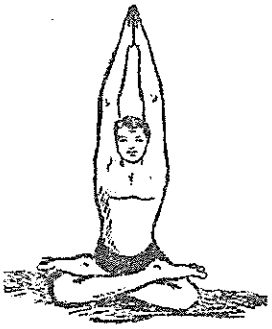


1. ನಾಲಿಗೆ, ಗಂಟಲು ದೋಷ ನಿವಾರಣೆ.
2. ಬಾಯಿಯ ದುರ್ವಾಸನೆ ತೊಲಗುತ್ತದೆ.
3. ಮುಖದ ಕಾಂತಿ ಹೆಚ್ಚುತ್ತದೆ.

ಪರ್ವತಾಸನ

ಪ್ರಯೋಜನಗಳು:

1. ಭುಜಗಳ ಪೆಡಸುತನ (ಕೊಬ್ಬು) ದೂರವಾಗುವದು.
2. ಕೈಕಾಲುಗಳ ದೌರ್ಬಲ್ಯ ದೂರವಾಗುತ್ತದೆ.



ಸಿದ್ಧಾಸನ

ಪ್ರಯೋಜನಗಳು:

1. ಏಕಾಗ್ರತೆ ಸಾಧ್ಯವಾಗುತ್ತದೆ.
2. ಮಾನಸಿಕ ಮತ್ತು ದೈಹಿಕ ಪ್ರಸನ್ನತೆ ಮೂಡುತ್ತದೆ.



ಉಪಸಂಹಾರ

ಯೋಗೋಪಚಾರ ಎನ್ನುವುದು ಕೇವಲ ದೇಹಕ್ಕೆ ಮಾತ್ರ ಸೀಮಿತವಲ್ಲ. ಅದು ವ್ಯಕ್ತಿಯ ದೇಹ, ಪ್ರಾಣ, ಮನಸ್ಸು ಮತ್ತು ವಿಜ್ಞಾನ ಈ ಎಲ್ಲಾ ಸ್ತರಗಳಲ್ಲಿ ಚಿಕಿತ್ಸೆ ನೀಡುತ್ತದೆ. ಸ್ವಂತ ಹಿತದ ಜೊತೆಗೆ ಪರರ ಹಿತವನ್ನು ಪರಿಗಣಿಸುತ್ತದೆ. ಯೋಗ ಮಾರ್ಗವನ್ನು ನಿತ್ಯ–ನಿರಂತರವಾಗಿ ಅನುಸರಿಸಿದಾಗ ಶಿಸ್ತು ಮತ್ತು ಸಂಯಮವನ್ನು ಜೀವನದಲ್ಲಿ ಅಳವಡಿಸಲು ಸಾಧ್ಯ. ಆದ್ದರಿಂದ ಯೋಗವು ಕೇವಲ ಚಿಕಿತ್ಸೆಯಾಗಿ ಉಳಿಯದೆ ಅದು ಜೀವನದ ಶೈಲಿಯೂ ಆಗಬೇಕು.

ಎಚ್ಚರಿಕೆ: ನುರಿತ ಯೋಗ ಶಿಕ್ಷಕರ ಉಪಸ್ಥಿತಿಯಲ್ಲಿ ಯೋಗಾಭ್ಯಾಸವನ್ನು ಕಲಿಯುವುದು ಅತ್ಯವಶ್ಯಕ

ಗ್ರಂಥಋಣ

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3) ಅಜಿತಕುಮಾರ (2000) "ಯೋಗ ಪ್ರವೇಶ". ರಾಷ್ಟ್ರೋತ್ಥಾನ ಮುದ್ರಣಾಲಯ, ಬೆಂಗಳೂರು.

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ವಂದನಾರ್ಪಣೆ

ಸ್ವದೇಶಿ ವಿಜ್ಞಾನ ಆಂದೋಲನ-ಕರ್ನಾಟಕದ ದೇಯೋದ್ದೇಶಗಳಲ್ಲಿ ಪ್ರಮುಖವಾದದು ಕನ್ನಡ ವಿಜ್ಞಾನ ಸಮ್ಮೇಳನ, ಅದೇ ರೀತಿಯಲ್ಲಿ ಭಾರತೀಯ ಪರಂಪರೆಯಲ್ಲಿ ಮಾತೃತ್ವಕ್ಕೆ ಪುರಾತನಕಾಲದಿಂದಲೂ ಪೂಜ್ಯನೀಯ ಸ್ಥಾನ ನೀಡುವಂತಹದ್ದು ಇಡೀ ಪ್ರಪಂಚದಲ್ಲಿ ಭಾರತದೇಶವೊಂದೇ ಎಂದು ಹೇಳಿದರೆ ತಪ್ಪಾಗಲಾರದೆಂದು ನಾನು ಭಾವಿಸುತ್ತೇನೆ. ಅದರೆ ಕೇವಲ ಮಾತೃತ್ವಕ್ಕೆ ಒತ್ತುನೀಡದೆ, ಪ್ರಸ್ತುತ ಸಮಾಜದಲ್ಲಿ ಮಹಿಳೆಯರು ಸ್ವಾವಲಂಭಿಗಳಾಗಿದ್ದಾರೆ. ಅವರುಗಳು ಕೇವಲ ಮನೆಯಕೆಲಸವಲ್ಲದೇ ಪುರುಷರೊಂದಿಗೆ ಅನೇಕ ವಿಭಾಗಗಳಲ್ಲಿಯೂ ಸಹ ಪೈಪೋಟಿನಡೆಸಬೇಕಾದಂತಹ ಪರಿಸ್ಥಿತಿ ನಿರ್ಮಾಣವಾಗಿದೆ ವಿಶೇಷವಾಗಿ ವಿಜ್ಞಾನಿಗಳು, ಶಿಕ್ಷಣ ಕ್ಷೇತ್ರ ಇತರೆ., ಪ್ರತಿಯೊಬ್ಬ ಮಹಿಳೆಯರಲ್ಲಿಯೂ ಅನೇಕ ತೊಡಕುಗಳಿವೆ. ಕೆಲವು ಸಂಧರ್ಭಗಳಲ್ಲಿ ಮಹಿಳಾ ಸಹೋದ್ಯೋಗಿಗಳೇ ನೇರವು ನೀಡದಂತಹದು ಅಥವಾ ಪುರುಷರು ಅವರ ಕೆಲಸಗಳಿಗೆ ಮೆಚ್ಚುಗೆ ನೀಡದಂತಹದು, ಇಂತಹ ಸಂಧರ್ಭಗಳಲ್ಲಿ ಮಹಿಳೆಯರಿಗೆ ಒಂದು ವೇದಿಕೆಯನ್ನು ನಿರ್ಮಾಣಮಾಡಿ ಅವರ ತೊಡಕುಗಳನ್ನು ನಿವಾರಿಸಿಕೊಳಲು ಸಹಕಾರಮಾಡಬೇಕೆಂದು ನಮ್ಮ ಮೊದಲ ಪ್ರಯತ್ನ ಪ್ರಥಮ ರಾಷ್ಟ್ರೀಯ ಮಹಿಳಾ ವಿಜ್ಞಾನ ಸಮ್ಮೇಳನ ನವೆಂಬರ್ 7 ರಿಂದ ೯ . 2008 ರಲ್ಲಿ ಬಿಜಾಪುರದ ಎಸ್. ಜಿ. ಕಲಾ ಮತ್ತು ಕೆ. ಸಿ. ಪಿ. ವಿಜ್ಞಾನ ಕಾಲೇಜಿನಲ್ಲಿ ಮಾಡಿದ್ದೇವೆ ಇದನ್ನು ನಾವು ಮುಂದಿನ ದಿನಗಳಲ್ಲಿ ಪ್ರತಿವರ್ಷವೂ ಇದೇ ಸಮಯದಲ್ಲಿ ನಡೆಸಿಕೊಂಡು ಬರಲು ನಿರ್ದರಿಸಿದ್ದೇವೆ. ಈ ನಮ್ಮ ಮೊದಲ ಪ್ರಯತ್ನಕ್ಕೆ ಅನೇಕ ಮಹನೀಯರು ನಮಗೆ ಸಹಕಾರ ಪ್ರೋತ್ಸಾಹ ನೀಡಿರುತ್ತಾರೆ ಅವರುಗಳೆಲ್ಲರಿಗೂ ನಮ್ಮ ಹೃದಯಪೂರಕ ದನ್ಯವಾದಗಳನ್ನು ತಿಳಿಸುವುದು ನಮ್ಮ ಕರ್ತವ್ಯವಾಗಿದೆ.

(1) ಮೊಟ್ಟಮೊದಲಿಗೆ ನಮಗೆಲ್ಲರಿಗೂ ಮಾರ್ಗದರ್ಶನ ನೀಡಿ ಸಮ್ಮೇಳನದ ಪ್ರತಿಯೊಂದು ಹಂತದಲ್ಲಿ ನಮಗೆ ಸಹಕಾರ ನೀಡಿದಂತಹ ಪ್ರೊ॥ ಕೆ. ಐ. ವಾಸು, ಸ್ಥಾಪಕರು, ಮಾರ್ಗದರ್ಶಕರು, ಪೋಷಕರು ಮತ್ತು ಸಂಚಾಲಕರು ರವರಿಗೆ ನಮ್ಮ ಧನ್ಯವಾದಗಳು

(2) ಈ ಸಮ್ಮೇಳನವನ್ನು ಬಿ.ಎಲ್.ಡಿ ಸಂಸ್ಥೆಯ ಆಡಿಯಲ್ಲಿ ನಡೆಸಲು ನಮಗೆ ತಮ್ಮ ಪೂರ್ಣ ಸಹಕಾರ ನೀಡಿದಂತಹ ಸಂಸ್ಥೆಯ ಅಧ್ಯಕ್ಷರಾದ ಶ್ರೀ. ಎಂ. ಜಿ. ಪಾಟೀಲ್ ರವರಿಗೆ ಮತ್ತು ಶ್ರೀ. ಜಿ. ಕೆ. ಪಾಟೀಲ್, ಪ್ರಧಾನ ಕಾರ್ಯದರ್ಶಿ ಬಿ. ಎಲ್. ಡಿ ಸಂಸ್ಥೆ ರವರಿಗೆ ನಮ್ಮ ಹೃದಯಪೂರಕ ಧನ್ಯವಾದಗಳು.

(3) ಈ ಸಮ್ಮೇಳನವು ಬಿ.ಎಲ್.ಡಿ. ಸಂಸ್ಥೆಯ ಎಸ್. ಜಿ. ಕಲಾ ಮತ್ತು ಕೆ. ಸಿ. ಪಿ. ವಿಜ್ಞಾನ ಕಾಲೇಜಿನಲ್ಲಿ ನಡೆಸಲು ಅಡಿಗಲನ್ನು ಹಾಕಿದಂತಹ ಪ್ರೊ॥ ವಿ. ಎಲ್ ಜನ್ನಾಳ್ ರವರಿಗೆ ಹಾಗೂ ಪ್ರೊ॥ ಎಸ್. ಹೆಜ್. ಲಗಳಿ, ಆಡಳಿತಾಧಿಕಾರಿ, ನಂತರ ಇದನ್ನು ಪೂರ್ಣಗೊಳಿಸಿದಂತಹ ಡಾ॥ ಬಿ. ಜಿ. ಮಠ, ಪ್ರಾಂಶುಪಾಲರು, ಡಾ॥ ಸುರೇಶ್ ಸಿ. ಪತ್ತಾರ್, ಡಾ॥ ಐ. ಎಂ. ಕುಂಬಾರ್, ಪ್ರೊ॥ ಎ. ಜಿ. ತಪಶೆಟ್ಟಿ, ಪ್ರೊ॥ ಎಸ್. ಜಿ. ಮನಗುಳಿ ರವರಿಗೆ ಹಾಗೂ ಸಮ್ಮೇಳನವು ಪೂರ್ಣ ಯಶಸ್ವಿಯಾಗಲು ತಾಂತ್ರಿಕ ಸಹಕಾರ ನೀಡಿದಂತಹ ಎಲ್ಲಾ ಮಹಿಳಾ ಭೋಧಕ ವೃಂದ, ಭೋದಕೇತರ ಸಿಬ್ಬಂದಿ ರವರಿಗೆ ನಮ್ಮ ಹೃದಯಪೂರ್ವಕ ಧನ್ಯವಾದಗಳು.

(4) ಸಮ್ಮೇಳನವನ್ನು ಉದ್ಘಾಟನೆ ಮಾಡಿದಂತಹ ಡಾ॥ ಮೆಹತಾಬ್ ಎಸ್. ಬಾಮ್ ಜೀ, ಅಧ್ಯಕ್ಷರು, ನ್ಯಾಷನಲ್ ಟಾಸ್ಕ್ ಫೋರ್ಸ್ ಫಾರ್ ಉಮೆನ್ ಇನ್ ಸೈನ್ಸ್, ಡಿ. ಎಸ್. ಟಿ, ಭಾರತ ಸರ್ಕಾರ ಹಾಗೂ ಸಮ್ಮೇಳನದಲ್ಲಿ ಗೌರವಾನ್ವಿತರಾದ ಮಿ। ಮೀರಾ ಕೌಶಿಲ್, ವಿಜ್ಞಾನಿ ಜಿ, ಜಿ.ಬಿ.ಆರ್. ಇ- ಡಿ.ಆರ್.ಡಿ.ಓ, ಬೆಂಗಳೂರು ಮತ್ತು ಡಾ॥ ಪ್ರಜ್ಞಾನ್ ಜೋಶಿ, ಅಹಮದಾಬಾದ್, ರವರಿಗೆ ನಮ್ಮ ಧನ್ಯವಾದಗಳು

(5) ನಮ್ಮ ಮೊದಲ ಮೇಲಿಕ್ಯೂಲಿ ಮಹಿಳಾ ವಿಜ್ಞಾನಿ ಪ್ರಶಸ್ತಿಗೆ ಭಾಜನರಾದ ಪ್ರೊ॥ ವಿಜಯಲಕ್ಷ್ಮಿ ಕೆ ರವೀಂದ್ರನಾಥ್, ನಿರ್ದೇಶಕರು, ಎನ್. ಜಿ. ಆರ್. ಸಿ, ಮಾನೇಶ್ವರ್ ರವರಿಗೆ ನಮ್ಮ ಹೃದಯ ಪೂರ್ವಕ ಧನ್ಯವಾದಗಳು

(6) ಈ ಸಮ್ಮೇಳನದ ಪ್ರತಿಯೊಂದು ಹಂತದಲ್ಲಿಯೂ ಪೂರ್ಣಸಹಕಾರ ನೀಡಿದಂತಹ ಪ್ರೊ॥ ಪಿ. ಕೆ. ಶ್ರೀಮಣಿ, ಅಧ್ಯಕ್ಷರು, ಸ್ವದೇಶಿ ವಿಜ್ಞಾನ ಆಂದೋಲನ-ಕರ್ನಾಟಕ, ಡಾ॥ ಡಿ. ಕೆ. ವೆಂಕಟಲಕ್ಷ್ಮಿ ಕೆ, ಜೇರ್‌ಪರ್ಸನ್, ಮಾತೃವೇದಿಕೆ, ಶ್ರೀಮತಿ ರೂಪ, ಡಾ॥ ಡಿ. ನಾಗರತ್ನ, ಡಾ॥ ಡಿ. ಸುಜಾತ ಮತ್ತು ಇತರೆ ಸ್ವದೇಶಿ ವಿಜ್ಞಾನ ಆಂದೋಲನ-ಕರ್ನಾಟಕದ ಸ್ಥಾಪಕ - ಅಜೀವ ಮಹಿಳಾ ಸದಸ್ಯರುಗಳಿಗೆ ನಮ್ಮ ಹೃದಯ ಪೂರ್ವಕ ಧನ್ಯವಾದಗಳು

(7) ಸಮ್ಮೇಳನದ ಮುಕ್ತಾಯ ಸಮಾರಂಭದಲ್ಲಿ ಆಗಮಿಸಿದಂತಹ ಎಲ್ಲಾ ಗಣ್ಯರುಗಳಿಗೆ ನಮ್ಮ ಹೃದಯ ಪೂರ್ವಕ ಧನ್ಯವಾದಗಳು

(8) ಸಮ್ಮೇಳನವು ಯಶಸ್ವಿಯಾಗಿ ಆಯೋಜಿಸಲು ನಮಗೆ ಧನಸಹಾಯ ಮಾಡಿದಂತಹ ಸಿ.ಎಸ್.ಐ.ಆರ್, ನವದೆಹಲಿ, ಡಿ.ಆರ್.ಡಿ.ಓ, ನವದೆಹಲಿ, ಇಸ್ರೋ, ಬೆಂಗಳೂರು, ಡಿ. ಎಸ್. ಟಿ, ನವದೆಹಲಿ, ಬನಸ್ಥಲಿ ಮಹಿಳಾ ವಿಶ್ವವಿದ್ಯಾಲಯ ಮತ್ತು ಇತರೆ ಜಾಹಿರಾತು ದಾರರಿಗೆ ನಮ್ಮ ಹೃದಯ ಪೂರ್ವಕ ಧನ್ಯವಾದಗಳು.

(9) ಸಮ್ಮೇಳನಕ್ಕೆ ಸಂಬಂಧಿಸಿದಂತಹ ಎಲ್ಲ ಮುದ್ರಣಗಳನ್ನು ಸಕಾಲಕ್ಕೆ ನೀಡಿದಂತಹ ರಾಷ್ಟ್ರೋತ್ಥಾನ ಮುದ್ರಣಾಲಯ, ಬೆಂಗಳೂರು ರವರಿಗೆ ಧನ್ಯವಾದಗಳು

(10) ಈ ಸಮ್ಮೇಳನ ಯಶಸ್ವಿಯಾಗಲು ಭಾರತದ ಎಲ್ಲಾ ಭಾಗಗಳಿಂದ ಆಗಮಿಸಿದಂತಹ ಮಹಿಳಾ ಪ್ರತಿನಿಧಿಗಳಿಗೆ ನಮ್ಮ ಹೃದಯ ಪೂರ್ವಕ ಧನ್ಯವಾದಗಳು

(11) ಸಮ್ಮೇಳನದ ಬಗ್ಗೆ ಜನಸಾಮಾನ್ಯರಿಗೆ ಪೂರ್ಣ ಮಾಹಿತಿ ನೀಡಿದಂತಹ ಎಲ್ಲಾ ಮಾಧ್ಯಮ ಪ್ರತಿನಿಧಿಗಳಿಗೆ ಧನ್ಯವಾದಗಳು.

(12) ಕೊನೆಯದಾಗಿ ಈ ಸಮ್ಮೇಳನ ಯಶಸ್ವಿಯಾಗಲು ಪ್ರತ್ಯಕ್ಷವಾಗಿ ಪರೋಕ್ಷವಾಗಿ ಸಹಕಾರ ನೀಡಿದಂತಹ ಎಲ್ಲಾ ಮಹನೀಯರುಗಳಿಗೆ ನಮ್ಮ ಹೃದಯ ಪೂರ್ವಕ ಧನ್ಯವಾದಗಳು.

ಹೆಚ್. ರಮೇಶ

ಪ್ರಧಾನ ಕಾರ್ಯದರ್ಶಿ, ಸ್ವದೇಶಿ ವಿಜ್ಞಾನ ಆಂದೋಲನ-ಕರ್ನಾಟಕ
ಸಂಚಾಲಕರು, ರಾಷ್ಟ್ರೀಯ ಮಹಿಳಾ ವಿಜ್ಞಾನ ಸಮ್ಮೇಳನ-2008, ಬಿಜಾಪುರ

RASHTRIYA MAHILA VIJNANA SAMMELANA
राष्ट्रीय महिला विज्ञान सम्मेलन
2ND NATIONAL WOMEN'S SCIENCE CONGRESS

7th – 9th November. 2009

ALL INDIA INSTITUTE OF SPEECH & HEARING, MYSORE

FOCAL THEME

NEED FOR WOMEN LEADERSHIP IN SCIENCE & TECHNOLOGY

Organised by

MATRU VEDIKE *(Women Scientists Forum)*

SWADESHI VIJNANA ANDOLANA-KARNATAKA

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Jointly with

ALL INDIA INSTITUTE OF SPEECH & HEARING

Manasagangothri, Mysore-570 006

Coordinated by

SWADESHI VIJNANA ANDOLANA – MYSORE

(a District unit of SVAK)

Sponsored by

CSIR, DST, ISRO & WOMEN'S UNIVERSITIES

2ND NATIONAL WOMEN'S SCIENCE CONGRESS

(Towards encouraging and empowering women scientists)

7-9th November. 2009, All India Institute of Speech & Hearing, Mysore

This National Women's Science Congress is planned essentially to bring women to the forefront of Science, Engineering, Technology, Industrial Entrepreneurship and Management which will automatically empower them to create a frontline of women scientists of the caliber of Marie and Irene Curies, Maria Mayer, Dorothy Hodgkin, Gerty Cori, Rosalyn Yalow, Barbara Mc Clintock, Rita Montalcini, Gertrude Elion, Christiaene Volhard and Zinda Buck of Modern Science or of the grandeur of Maitreyi, Gargi, and the Vedic Rishikas of ancient Bharat. Even though there were only a few well-known women leaders of science in India, those with outstanding scientific achievements are indeed very large in number in almost every field of science. This Women's Science Congress is planned to bring them all together and instill a sense of pride, confidence and camaraderie amongst them and guide them on to the positions of power and leadership.

The Science Congress would cover the entire spectrum of science, engineering and technology, *both Traditional and Modern,* encompassing the spiritual, the social and the secular (physical and material) sciences. The following areas are indicative of this wide coverage, in each of which hundreds of women scientists are working with impressionable accomplishments.

(1)Chemical, Biological and Materials Sciences (Nagarjuneeyam); (2) Physical and Mathematical Sciences (Bhaskariyam); (3) Agricultural, Horticulture, Fishery & Veterinary Sciences (Parashariyam); (4) Health and Medical Sciences including Ayurveda (Dhanvantariyam); (5) Civil, Mechanical, Aerospace and Transportation Sciences; also IT, BT, NT (Bharadvajiyam); (6) Electrical, Electronics, Communication and Energy (J. C. Boseeyam); (7) Cosmology, Geology, Geography, Archaeology, Earth Sciences, Ecology, Biodiversity, Environment (Vasundariyam); (8) Socio-Economic Sciences including Economics, politics, history; commerce & Management (Kautilyiyam); (9) Socio-cultural Sciences including Arts & Music (Bharatiyam); (10) Psycho-spiritual & Philosophical Sciences (Patanjaliyam)

In addition to these scientific themes, there would be a **Focal Theme on the Need for Women Leadership in Science & Technology**

These are the means to attract and retain more women in the domain of science and bring about cohesive solidarity amongst them. With appropriate measures, these women scientists could be brought forward to the forefront of science & technology in all aspects of teaching, research and industrial practices.

The first National Women's Science Congress was held in the historic city of Bijapur. The 2nd National Women's Science Congress is now being held in the prestigious All India Institute of Speech & Hearing at Mysore-the city of Learning and Culture. The Birth anniversary of Madame Marie Curie and Sir C. V. Raman, the two great scientists of the world, falls on 7th November. SVAK presents the prestigious Marie Curie Mahila Vijnana Puraskara on this day to outstanding women scientists. From this year onwards, SVAK will present C. V. Raman Vijnana Puraskara to an outstanding women scientist in Physics & Mathematical Sciences. In addition, the best papers in each theme would be considered for commendations and prizes if the full text of the paper has been submitted in time and the paper has been presented by the women authors.

Registration and Participation

Participation is restricted to registered women delegates (coauthorship could be by men) . The Delegate fee is

Rs. 1,000/-, with 25% concession to Collaborating Institution and SVAK Women Members. The Delegates Fee should be sent only as DD in favour of **"Swadeshi Vijnana Andolana-Karnataka" payable at Bangalore**. Group registration on single DD is welcome. For effective interaction, purposeful discussion and fruitful decisions on futuristic actions, the registration is restricted to 200 delegates on first-come-first basis.

All those who intend to participate should send an ***Abstract in English*** by e-mail, followed by a softcopy in CD and a hard copy accompanied by the ***Registration Form. Full paper*** of 10 pages should also be sent by e-mail, followed by a soft copy in CD and a hard copy along with the ***Registration Fee***. Research papers in English, Hindi or Kannada (Baraha.5.0 Version) are acceptable, but the abstract should be in English. All abstracts will appear in the Souvenir. Only those papers presented at the Congress by a women author will be published in the Proceedings after due editorial review.

SCHEDULE:	For abstract in English along with Registration Form	**: 15th September.2009**
	For Full paper along with Registration Fee.	**: 15th October. 2009**

VENUE: ALL INDIA INSTITUTE OF SPEECH & HEARING, MYSORE

Boarding and Lodging with normal facilities are provided in guest houses, and hostels. Better hotel accommodation could be arranged on special request and prepayment.

ABOUT MYSORE:- Mysore is the Cultural and Educational Capital of Karnataka. Because of history and heritage centers, in addition to the Mysore Palace, the Brindavan Gardens, the Zoo, the Chamundi Hill Temple, the Ranganathittu Bird Sanetuary, the Kabini Resorts, etc, Mysore is a famous tourist Centre. Just 150 kms from Bangalore, it is easily reached by rail, road or air.

From more information contact
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