

POPULATION AND HUMAN SECURITY*

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ABSTRACT

In his speech, Prof. M.S. Swaminathan expressed his concern for the promotion of a holistic concept of human security, encompassing health, food, drinking water, education and livelihood security. An essential requirement for promoting such a form of human security, according to him, was achieving a balance between human numbers and natural resources. Therefore, he focussed his attention on issues relating to population, poverty, environment and food and health security while delivering third Veda Prakash Memorial Oration. Further, he opined that sustainable human security with particular reference to food and health during the 21st century can be ensured if we achieve the desired demographic transition and foster production technologies on the foundation of integrated natural resource management. At the same time, he also emphasised the need for concurrent attention to on-farm and off-farm employment so that agriculture also becomes an instrument for more jobs and income.

I feel privileged to have been invited to deliver the 3rd Veda Prakash Memorial Lecture. As we enter the new century and millennium, our foremost concern should be the promotion of a holistic concept of human security, encompassing health, food, drinking water, education and livelihood security. An essential requirement for promoting such a form of human security will be achieving a balance between human numbers and natural resources. I would like to deal with issues relating to population, poverty, environment and food and health security.

The country can be divided into the following three groups of States from the point of view of fertility decline:

Group I Kerala, Tamil Nadu, Goa, Mizoram and Andhra Pradesh which have already achieved the replacement level of fertility.

* Third Veda Prakash Memorial Oration, organised by the Institute, on May 21, 1999.

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- Group II States like Maharashtra, Kamataka and West Bengal where the pace of decline in fertility in the past decade has been substantial but not yet adequate to make significant dents in growth rates.
- Group III The States of the Uttar Pradesh, Bihar, Madhya Pradesh and Rajasthan where substantial declines in fertility level are yet to be recorded.

It is anticipated that India's population may reach 1264 million in the year 2016 (Fig.1). An equally depressing factor is the decline in sex ratio (Fig.2).

**Burgeoning Population of India
In Million**

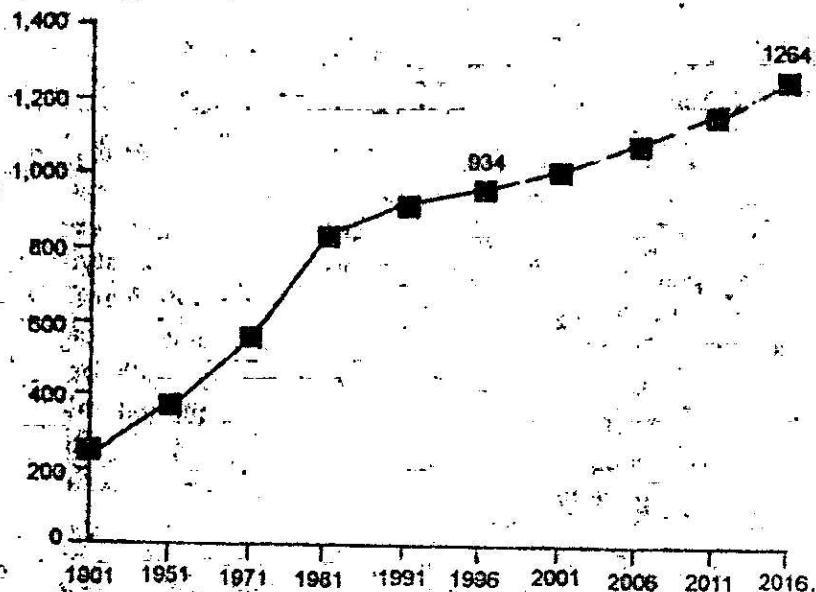


Figure 1

DECLINING SEX RATIO Number Of Females Per 1000 Males

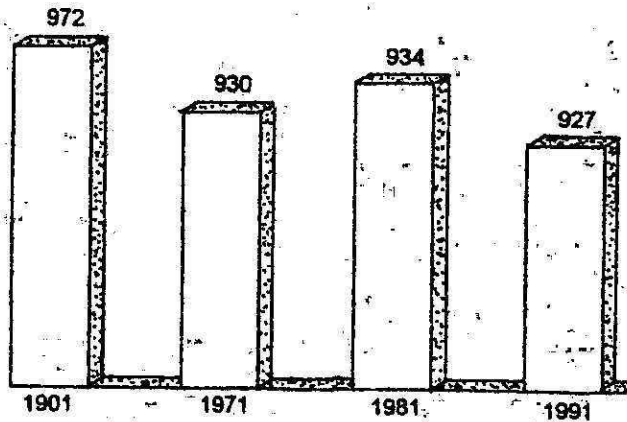


Figure 2

Here again, Kerala is the only State with a normal male:female sex ratio (Fig.3). Considering the continued prevalence of female foeticide and infanticide, it will not be surprising if the 2001 census shows a further decline in sex ratio.

F/M RATIO IN SELECTED STATES Number of females per 1000 males

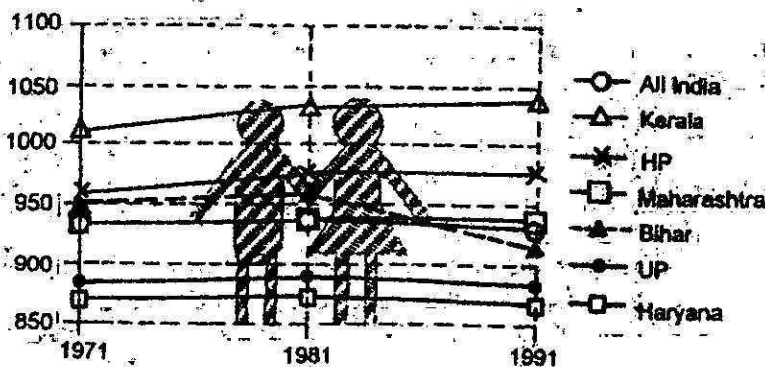


Figure 3

Children For Happiness

In 1952 the Queen of England congratulated 255 people on their hundredth birthdays and 1135 couples on their 60th wedding anniversaries. By 1996, these numbers had risen to 5218 and 11688, respectively. The data reveal an exponential rise in the number of centenarians with a doubling time of 11 years, and of diamond weddings with a doubling time of 19 years. An analysis by Prof. M.F. Perutz (phil. Transaction of Royal Society, London, 1997) indicates that such an exponential rise coincides with the beginning of a steady rise in real wages. Another important factor is the steady improvement in medical treatment at old age from 1946 onwards. While attending to the problems of the aged is becoming an important one in many industrialised countries, fighting the famine for jobs for the youth assumes greater urgency in our country.

More than half a century ago, Albert Einstein suggested that “we shall require a new manner of thinking, if mankind is to survive”. In a recent paper, J. Kenneth Small (Political and the Life Sciences, September 1997) argues that this new thinking should focus on population issues. According to him, “all of world’s people must come fully to terms with the fact that a person’s biological right to have children must be mediated by his or her social responsibility not to have too many”. This is essential to resolve the growing tension between two apparently irreconcilable trends, namely, demographic projections that world population will reach 10 to 12 billion by the year 2050; and scientific estimates that the Earth’s long-term sustainable carrying capacity at an adequate standard of living may not be must greater than two to three billion. Consuming more than the earth can regenerate is not a problem that lies in the future. Many non-renewable and renewable resources are already being used in an unsustainable manner. Today, our planet is getting polarised both in demographic and economic terms. Most developing countries are characterised by both high population growth and pervasive poverty. At the same time, a minor fraction of the world’s people consume a disproportionate amount of natural resources.

The economic inequity prevailing among members of the human family is growing. According to UNDP’s Human Development Report of 1996, “the assets of the world’s 358 billionnaires exceed the combined annual incomes of countries with 45 per cent of the world’s people”. Unsustainable lifestyles on the part of a billion and unacceptable poverty on the part of another billion thus coexist. As we near the end of this millennium, we can be proud of the collapse of skin color based apartheid. What however is disturbing is the spread of economic and technological apartheid.

The industrialised countries are now in a state of transition to ‘knowledge-based economies’, economies which are directly based on the production, distribution and use of knowledge and information. Knowledge is being codified and transmitted through computer and communication networks in the emerging ‘information society’.

Employment in the knowledge-based economy is characterised by increasing demand for more highly skilled workers. Economic growth is being increasingly determined by the configuration of national innovation systems, which consist of the flows and relationships among academia, industry and government in the development and dissemination of science and technology.

It is in this context that the extensive prevalence of nutritional anaemia among pregnant women, resulting in low birth weight children, is a cause for serious concern. There is increasing evidence of the adverse impact of low birth weight on brain development in the child. In addition, low birth weight leads to several health problems in the child's later life (Table 1).

TABLE 1
PERCENTAGE OF INFANTS WITH LOW BIRTH-WEIGHTS

South Asia		South East Asia	
Bangladesh	50	Indonesia	14
India	33	Laos	18
Nepal	26	Malaysia	10
Pakistan	25	Philippines	15
Sri Lanka	25	Thailand	13
		Fiji	18
		Vietnam	17

Source: Dr. C Gopalan, NFI Bulletin, July 1998.

On the one hand, intellectual property is becoming globally the most important asset, while, on the other hand, every third child born in India and several South Asian countries is handicapped at birth in relation to opportunities for the full expression of the child's innate genetic potential for mental and physical development. Such inequity at birth is the cruelest form of social inequity.

It is clear that human numbers should go down. The pathway to achieve this goal was indicated by the French mathematician Marquis de Condorcet, who wrote in 1795, "Population growth can be limited if people have a duty towards those who are not yet born; that duty is not to give them existence but to give them happiness." In my view, such a change in mind-set is fundamental to achieving population stabilisation in India and other developing countries.

How can we foster a ‘children for happiness’ movement? It is obvious that this involves having children by choice. Unless such a movement gains strength, any rational analysis of the reasons why we should reduce human numbers will have no impact in the real world. Taking our country, which has now the highest annual net increase in population in the world, there are States, like Kerala, where population growth is already negative (TFR – total fertility rate – of 1.7). There are other States, like Uttar Pradesh, where the TFR exceeds 3.5. It is now recognised that such a wide variation within India in achieving a demographic transition to low birth and death rates is because of variations in factors like infant and maternal mortality rates, female literacy, gender equity, age at marriage and the effectiveness of the family planning services. Gender justice and social and economic equity are vital for success in achieving a balance between human numbers and the supporting capacity of our life support systems.

TABLE 2

PARADIGM SHIFT RECOMMENDED BY THE SWAMINATHAN COMMITTEE (1995)

Existing	<i>Swaminathan Committee</i>
Strategy Target and technology driven approach	Human and social development centered. Effective implementation of Minimum Needs Programme
Think and plan centrally and act locally	Think, plan and act locally and support nationally
Awareness Generation National slogans, symbols, and educational strategies	Sensitisation and self-awareness of rural and urban communities concerning the population – supporting capacity of their ecosystem
Planning Tool Five Year Plan of the Department of Family Welfare, Government of India	Socio-demographic charter for the village/town prepared by the people
Delivery Service Contraceptive services	Integrated health security including reproductive health and user-preferred family planning devices

Inter-State variation in human and social development indicators sheds light on the pathways we should adopt for achieving a balance between human population and the supporting capacity of the ecosystem. In 1994 a Government of India Committee for

drafting a national population policy statement for the consideration of Parliament, which I chaired, recommended a paradigm shift in our population stabilisation strategy, with a view to achieving a national TFR of 2.1 by the year 2010. The Committee called for population policies which are pro-women, pro-poor, pro-nature and pro-democratic choice. A few of the major recommendations of this Committee are given in Table 2.

To reduce IMR, MMR and low birth weight among children, it is essential to work for food security at the level of each individual, since the household is not a homogenous unit with reference to nutrition. Women and girl children often tend to be relatively under-nourished.

A demographic transition to low birth and death rates can be achieved if population policies are rooted in the principles of ecology, social and gender equity and opportunities for food, health, literacy and work for all. This is why the Expert Group stressed on the need for a “pro-nature, pro-poor, pro-women and pro-democratic choice” approach to population policies. The Expert Group also recommended that the number of seats in Parliament and State legislatures should be frozen until 2011, when the desired decline of TFR to 2.1 is likely to be achieved. At present, the seats in Parliament and State legislatures are frozen until the year 2001. States which have rendered invaluable national service by achieving population stabilisation should not be penalised with reference to extent of their representation in Parliament. Hence, action to extend the period of freezing of seats upto the year 2011 is urgently called for. This should be a priority task for the new Parliament.

Bold political commitment and action are essential for achieving our population goals. Maharashtra introduced many years ago an Employment Guarantee Scheme from its own resources. Similarly, Tamil Nadu introduced 18 years ago a universal nutritious Noon Meal Programme for all school going children. Madhya Pradesh has launched an Education Guarantee programme which is now being extended at the all-India level. A study sponsored by the Government of Tamil Nadu in 1996 for initiating a Hunger-Free Area Programme in the State has revealed that the following Seven Point Action Plan can help to eliminate both protein-calorie undernutrition and hidden hunger sooner than most believe possible.

Towards a Hunger-Free India: A Seven-Point Action Plan

- Identification of the ultra-poor families by the rural population (studies reveal that about 12 per cent of the population fall under this category).
- Information empowerment on anti-poverty projects based on both computer aided extension and household entitlement cards (giving information on government projects, disaggregated by gender, age, social and economic status).

- Elimination of protein-calorie undernutrition, by ensuring that the targeted public distribution system reaches the ultra-poor.
- Elimination of hidden hunger caused by deficiencies of micronutrients, particularly iron, iodine and vitamin A; the role of horticulture, inclusion in the diet of millets and other micronutrient-rich grains and fortified salt and other products should be given integrated attention.
- Promoting the biological absorption and retention of food through the provision of safe drinking water and better environmental hygiene; attention to primary health care, and the provision of user-preferred contraceptive services.
- Ensuring economic access to food through multiple livelihood opportunities based on micro-level planning, micro-enterprises and micro-credit, all based on marketing opportunities. All development programmes must be subjected to an employment-impact assessment.
- According special attention to children and women and bringing to them the benefits of all programmes sponsored by Central and State governments and international agencies like UNICEF. Special emphasis should be given to reproductive health and to the elimination of nutritional anaemia among pregnant women, so as to ensure that the new born baby does not suffer handicaps in later life due to low birth weight. Avoiding low birth weight children by eliminating nutritional anaemia among pregnant women should be an important criterion in the measurement of the impact of hunger-free area programmes.

Emerging knowledge century

The Knowledge Century will provide opportunities for unending learning and education. However, it will help to make life rich and meaningful only if we use knowledge to build a country where every child, women and man has an opportunity for a productive and healthy life. Thanks to the modern information technology and world-wide web, we can monitor from our rooms global progress in every area of human endeavour – arts, culture, science, agriculture, industry and politics. Information explosion also necessitates that we must develop our capacity to analyse them and to separate grain from chaff. We should not forget the message contained in the following poem of T S Eliot:

*‘Where is the wisdom we have lost in knowledge?
Where is the knowledge we have lost in information?
The cycles of heaven in twenty centuries
Bring us farther from God and nearer to dust’*

With the growing expansion of proprietary control of information and innovations now taking place we should also keep in view the words of Albert Einstein:

‘Concern for man himself and his fate must always form the chief interest of all technical endeavours in order that the creation of our minds shall be blessing and not a curse.’

Humanity is at crossroads. The challenge lies in the choice between a sinking civilization marked by the expansion of capitalism, materialism, greed and environmental destruction and that of the dawn of the spiritual age of the type conceived by the great thinkers of our country like Swami Vivekananda, Sri Aurobindo and Mahatma Gandhi. We in India have no comparative advantage in becoming a world leader in materialism but we have a great opportunity to become the world leader in integrating science and spirituality. We are a pluralistic society with a rich variability in religion, language, art, culture and cuisine. Whether it be in human societies or in animal or plant communities, variability is the greatest asset. Genetic engineering, for example, thrives on biological diversity. Understanding and love of diversity and pluralism constitute the first steps towards a spiritual age. Our educational institutions should spearhead a movement for not tolerating intolerance. If we fail to take the lead in providing the spiritual roots to the technological revolution we see all around us, we would have failed to take advantage of the great opportunity our tradition, culture and ethos has provided to us for fostering a humanistic rather than a materialistic pattern of development.

It would be useful on such occasions to reflect on our successes and strengths and not get overwhelmed by the immediate problems our country is facing. We can draw up a balance sheet of the century and millennium to which we will say “goodbye” in about eleven months from now.

The 20th Century: A Balance Sheet

As we approach the end of this millennium, we can rejoice at the uncommon opportunities which the technological, information, social and democratic revolutions of recent decades have opened up for a better common present and future for humankind¹. The consensus developed at the international conferences held under the auspices of the United Nations and its specialised agencies during the nineties provides hope that the age-old human quest for opportunities for every child, woman and man to lead a healthy and productive life can get converted from a dream into reality. Of particular importance are the conclusions of the International Conference on the Child (New York, 1990), environment (Rio-de-Janeiro, 1992), human rights (Vienna, 1993), population (Cairo, 1994), poverty and social development (Copenhagen, 1995), women (Beijing, 1995), urban quality of life (Istanbul, 1996) and food security (Rome, 1996). A stripe review of

the plans of action developed at these Conferences can provide a blueprint for sustainable and equitable development.

We can celebrate the present century for the end of both skin colour based apartheid and of super-power confrontation. Famines, except those associated with civil and ethnic strife, have also become uncommon. Modern information technology has given meaning and content to the concept of global village. The prospects for adverse changes in temperature, precipitation, ultra-violet B radiation and seas levels have led to a widespread realisation that, whatever may be our political boundaries, our fate is intertwined ecologically. The threat of eco-disasters has resulted in the birth of green productivity movements. Good ecology is also becoming a good business.

The many positive achievements of the present century are being eclipsed by ever-expanding economic and gender inequity. More than a billion of the human population exist on a per capita daily income of one US dollar, while another two billion earn hardly two US dollars per day. Most developing nations suffer from crippling debt burden. The industrialised nations are getting richer because they enjoy technology and capital driven advantages in industry and technology and subsidy driven advantages in agriculture. Skin colour based apartheid is getting replaced by economic and technological apartheid. Over 800 million children, women and men currently go to bed undernourished not because there is no food in the market but because they do not have the money to buy the food essential for avoiding malnutrition. Another 2 billion are suffering from silent hunger arising from micronutrient deficiencies, like anaemia induced by iron deficiency. Every third child born in our country is characterised by low birth weight and is consequently handicapped even at birth in realising its innate genetic potential for mental and physical development. The increasing famine of jobs is leading to a famine of food at the level of households and individuals. Women and children suffer most.

Apart from poverty, damage to our life support systems of land, water, flora, fauna, forests, biodiversity and the atmosphere presents the greatest threat to sustainable human health and happiness. Areas rich in genetic diversity are often also affected by extensive genetic erosion. The poverty of tribal and rural families who have contributed significantly to genetic resources conservation and enhancement stands in contrast to the prosperity of those who have utilised the genetic material conserved by them in plant and animal breeding and genetic engineering enterprises. While there is economic reward in the exploitation of natural resources, we are yet to create an economic stake in conservation. Commercial profit and public good are yet to become mutually reinforcing.

From what I have said so far, it will be obvious that the greatest challenges for converting despair into hope during the coming century are to be found in the areas of population, ecology, economics and gender equity. Is there no affirming flame in the midst of the sea of despair we now see in the areas of sustainable food, environmental,

health and livelihood security? How are we going to meet the challenges of poverty eradication, population stabilisation, environment protection and sustainable food and nutrition security?

In my view, the affirming flames occur in the form of emerging grassroot level democratic institutions, independent mass media and ecotechnologies, based on blending frontier technologies with traditional wisdom and innovations. A synergetic fusion of political will and action, professional skill and people's participation can help to promote a job-led economic growth strategy rooted in the principles of ecology and equity. The onward march of science and technology will continue but there will be paradigm shift in science policies and strategies as a result of the introduction of a systems approach involving concurrent attention to environment-friendliness, social and gender equity, employment generation and economic viability. The concept of sustainability will get enlarged to include the social and employment dimensions, besides economic and environmental considerations.

To sum up, some of the principal tasks for building a new century of hope are:

- Achieving in all States of India appropriate demographic transitions resulting in low birth and death rates and equal sex ratios with reference to male and female children.
- Ending maternal and foetal undernutrition and malnutrition.
- Conservation and enhancement of nature and natural resources.
- Eradication of illiteracy, poverty, deprivation and hunger.
- Ensuring environmentally, socially and economically sustainable food, and livelihood security.
- Spreading a new industrial and business ethics where profit helps to promote public good and not to increased rich-poor divide.
- Promoting an understanding and love of diversity and pluralism in human societies, thereby creating an enabling environment for lasting peace and security.

It is appropriate that the UN and UNESCO have declared the 2000 as the International Year for the Culture of Peace.

Agricultural Progress for Food and Health Security

The annual growth rate in agriculture was about 0.3 per cent during 1900 to 1950. During the 1980s, the annual growth rate went upto 3.3 per cent. During this decade it has come down to about 1.8 per cent. Our population is still growing at the rate of about 2 per cent. Some foreign experts like Dr.Lester Brown are predicting that India may have to import substantial amounts of grain once again during the coming century.

Indian agriculture not only provides food for a population of nearly one billion but also provides livelihoods to nearly 65 per cent of our population. Organised industry is not employment intensive and this is why the world is witnessing “jobless economic growth”. Our agricultural strategy should aim at job-led economic growth. For this, we should take steps to safeguard the ecological foundations essential for sustainable advances in agricultural productivity. We should improve the productivity of the rainfed farming areas which cover nearly 63 per cent of the total cultivated area. We should take advantage of the diversity of growing conditions prevalent in the country which enable the cultivation of a wide range of vegetables, fruits and flowers. We should reorient our agricultural policies to face the challenges arising from the provisions of the World Trade Agreement relating to the relaxation of quantitative restrictions in imports, non-tariff barriers in areas such as phytosanitary conditions and Trade Related Intellectual Property Rights. We should take a proactive position on these issues and develop our own package of non-tariff barriers based on considerations of environmental and food security.

The World Trade Agreement and the livelihood security of India’s rural population : Proactive Steps:

The World Trade Agreement permits countries to impose non-tariff barriers based on considerations of ecological and food security. Food security today is a function of purchasing power. It is best measured in terms of million person years of jobs, rather than in million tonnes of food grains. The famine of remunerative and sustainable livelihood opportunities and not the non-availability of food in the market, is the main cause of the under and malnutrition prevailing among nearly 300 million children, women and men in the country now.

Maternal and foetal malnutrition is resulting in every third child born in the country being characterised by low birth weight. Low birth weight children suffer from several short and long term handicaps including impaired brain development (see figure 4). The coming century will be a knowledge century, placing children with reduced mental capacity at a severe disadvantage. Therefore, we should lose no further time in taking steps to ensure that jobs for Indians is the overriding consideration in designing our agricultural research and production strategies and trade policies. An employment

impact analysis should be a must in deciding on policy options in agriculture, industry and home and external trade.

We should develop a precautionary non-tariff barrier package to safeguard the livelihood security of the rural and urban poor and the ecological security of the country. Such a package of non-tariff measures for India's livelihood and ecological security could include the following:

- Invoke the food security clause for restricting imports of food and dairy products based on a careful study of their potential impact on the livelihood security of the poor.
- Pay particular attention to protecting employment intensive sectors like textiles and animal husbandry. For example, cotton cultivation and textile manufacture and trade provide livelihood opportunities to about 60 million people in the country. Likewise, the possession of one or two cows or buffaloes or small ruminants helps to improve the income and nutrition of millions of economically underprivileged families.
- Improve our educational and infrastructure development efforts in the area of sanitary and phytosanitary measures; this will call for substantial new investments in post-harvest technology.
- Improve the export potential of labour intensive products. Khadi, which was chosen by Mahatma Gandhi as the flagship of our self-reliance movement, can be declared as a geographic appellation for eco-friendly textile, as in the case of basmati rice and Darjeeling tea which are world famous for their aroma and quality. Another example will be the promotion of a green health movement based on medicinal plants and herbs. Increase in the cultivation and use of medicinal plants will help to improve the income of millions of tribal and rural families.
- Horticulture and aquaculture both provide opportunities for improving nutrition security at home and export earnings abroad. The key constraint relates to poor quality control and inadequate investment in post harvest storage, processing, packaging and transportation.

Another areas which needs careful analysis is the calculation of the aggregate Measure of support to farmers. Industrialised countries have invested during this century large amounts of public funds in improving rural and agricultural infrastructure. Investment from public funds in rural communication, electrification, transport, storage and post-harvest technology has been very high. In contrast, our investment of public funds in improving agricultural and rural infrastructure is miniscule. This is particularly true in dry farming areas and in horticulture, animal husbandry and fisheries. Hence,

current rates of subsidy alone cannot be the guiding factor in measuring “level playing fields”. We should make WTO agree to adopting more equitable methods of calculating the support from public funds extended to farming families in industrialised and developing countries, based on a calculation of funds invested by governments in agriculture infrastructure during the last 50 years.

If we do not develop a precautionary package of non-tariff barriers based on the provisions contained in the World Trade Agreement for the protection the poor as well as nature, we will not only witness extensive human misery but also face the prospect of accelerated social disintegration.

Economic Ecology: Foundation for Sustainable Agriculture

In January 1968 addressing the Agricultural Science Congress Section of the Indian Science Congress I stated:

“Exploitive agriculture offers great possibilities if carried out in a scientific way, but poses great dangers if carried out with only an immediate profit motive. The emerging exploitive farming community in India should become aware of this. Intensive cultivation of land without conservation of soil fertility and soil structure would lead, ultimately, to the springing up of deserts. Irrigation without arrangements for drainage would result in soils getting alkaline or saline. Indiscriminate use of pesticides, fungicides and herbicides could cause adverse changes in biological balance as well as lead to an increase in the incidence of cancer and other diseases, through the toxic residues present in the grains or other edible parts. Unscientific tapping of underground water will lead to the rapid exhaustion of this wonderful capital resource left to us through ages of natural farming. The rapid replacement of numerous locally adapted varieties with one or two high-yielding strains in large contiguous areas would result in the spread of serious diseases capable of wiping out entire crops. Therefore the initiation of exploitive agriculture without a proper understanding of the various consequences of every one of the changes introduced into traditional agriculture, and without first building up a proper scientific and training base to sustain it, may only lead us, in the long run, into an era of agricultural disaster rather than one of agricultural prosperity”.

Thus, in the same year when the term green revolution first came into use, I had stressed the need for concurrent attention to productivity improvement and the conservation of the ecological foundations essential for sustainable advances in agricultural productivity. I pointed out that such an integrated approach is the pathway to an ever-green revolution or sustained progress in enhancing yield per ha. Later, in March 1973, I pleaded, in my Coromandel lecture titled “Agriculture on Spaceship Earth” for a do rather than merely a don’t atmosphere in the country. The following points made in that lecture delivered 26 years ago seem to be still relevant.

“The environmental policy advocated in the richer nations is designed to protect the high standard of living resulting from the unprecedented growth in the exploitation of natural resources during the last century, from serious damage by the very processes of such growth. It is of necessity a policy based on a series of ‘dons’. This is inevitable, since the aim is to undo some of the damage already done or to prevent further damage along the same lines. Thus, there is an outcry against some of the potent agents of improved agricultural productivity such as fertilizer and pesticide.

The poorer nations, however, are faced with the desire and need to produce more food from hungry soils, more clothing and more housing. They are aware that, historically, a rise in standard of living has depended on the ability of agriculture to release manpower to other more industrial pursuits. They hence naturally wish to develop more industries and to find productive and remunerative employment for their growing population. For them, conditions of poverty and inadequate arrangements for human and other waste disposal may be greater causes of water and air pollution than the effluents from factories or fertilizer from the fields. Since the causes of pollution are by and large different, the solutions also will have to be different, and it would be a grave mistake to attempt to copy the policies now being propagated in the developed world.

It is clear, that only integrated land use involving a relevant combination of agriculture, forestry, fishery and animal husbandry, integrated strategies of nutrient supply and pest control, greater attention to organic recycling and water conservation and extensive tapping of sunlight through the agency of green plants and simple heat collectors that can help us to improve rural economy without ecological harm. We have an unique opportunity to evolve a policy for natural resource utilisation based on the principles of economics and human welfare. To do this we have to learn how to deploy two of the most potent tools employed by Nature-synergy and symbiosis. Can we do this?

We can, but for this there are three prerequisites. First, we have to shed single discipline-oriented and one-sided thinking and develop a problem-solving and integrated approach. Integration is needed not merely in the planning process, but more urgently at the action level. Second, we must launch a ‘techniracy’ (technical literacy) programme aimed at imparting technical skills to illiterate peasantry. Third, we must shun the band wagon and aping approach and generate a do rather than a don’t atmosphere. We must help our farmers to apply fertilizer, pesticide, water and other inputs wisely and should not try to create confusion about the basic truth that inputs are needed for output. A swadeshi approach is even more relevant today than when Mahatma Gandhi first advocated it.

The Green Revolution

Thomas Malthus warned humankind in 1798, about the dire consequences of unchecked population growth. The French mathematician, Marquis de Condorcet, a contemporary of Malthus, pointed out that population will stabilise itself if children are born for happiness and not just for mere existence. Thanks to dramatic advances in preventive and curative medicine, human numbers have been increasing at a rapid rate since World War II. A billion persons are now being added to the human population every 12 to 13 years. This will call for an increase in annual food grain production by 250 million tons once in every 10 years. When Malthus published his essay in 1798 the global population was 980 million. The population of India alone is now 990 million. In spite of such a rapid rise in population, food production has on the whole kept pace with the needs of the expanding population during recent decades. How did this happen?

There were four important factors which helped to keep Malthusian fears at bay. These are:

- Rapid advances in science and technology, particularly in the area of breeding new varieties and hybrids of food crops which can respond well to irrigation water and good soil fertility.
- Services like the production and distribution of good seeds, fertilizers and pesticides, as well as the organization of efficient credit and extension services.
- Public policies in the areas of land reform, rural infrastructure development input and output pricing and marketing.
- The hard work of farm women and men, who have demonstrated that whether they live in industrialised or developing countries, they will respond to technological progress and opportunities for assured and remunerative marketing.

Mutually reinforcing packages of technology, services and public policies led to the birth of what was termed in October 1968 by Dr. William Gaud of the United States of America as the green revolution.

The kind of action-reaction analysis I had made in my Science Congress address of Janwar, 1968 led to the intensification of research on integrated pest management (IPM) and the initiation of whole village operational research projects involving IPM procedures in rice and cotton (Swaminathan 1975). Also, in 1974, the mineral fertilizer industry was requested to adopt integrated nutrient supply systems (INS) involving organic manures, compost, green manures, biofertilisers and cereal-legume crop rotations (Swaminathan, 1974). Through the integration of INS and IPM procedures, technologies were developed to make the excessive use of mineral fertilizers and chemical pesticides unnecessary.

In subsequent years, the significance of my 1968 analysis has been widely realised. Genetic homogeneity enhances genetic vulnerability to pests and diseases. Excessive use of mineral fertilizers and chemical pesticides have caused soil degradation, ground water pollution and the spread of pests resistant to pesticides in several green revolution areas. This has led to warnings of impending food crisis in the coming millennium. Lester Brown and his associates (1994,1995) for example, have concluded that population rich but land hungry countries like China and India may have to resort to substantial food imports in another 30 years due to the following reasons.

- First, increasing population leads to increased demand for food and reduced per capita availability of arable land and irrigation water.
- Second, improved purchasing power and increased urbanisation lead to higher per capita food grain requirements due to an increased consumption of animal products.
- Third, marine fish production is tending to become stagnant.
- Four, there is increasing damage to the ecological foundations of agriculture, such as land, water, forests, biodiversity and the atmosphere and there are distinct possibilities for adverse changes in climate and sea level.
- Finally, no dramatic technological breakthroughs are on the horizon, which can help to halt the fatigue of the green revolution.

Since land is a shrinking resource for agriculture, there is no option except to produce more food and other agricultural commodities from less per capita land. In other words, the need for more food as to be met through higher yields per units of land, water, energy and time. It would therefore be useful to examine how science can be mobilised for raising further the ceiling to biological productivity without associated ecological harm. It will be appropriate to refer to the emerging scientific progress on the farms as an Ever-Green Revolution, to emphasise that the productivity advance is sustainable overtime since it is rooted in the principles of ecology, economics, social and gender equity and employment generation (Swaminathan, 1996).

To give an idea of the dimensions of challenges faced by all involved in developing scientific strategies and public policies for sustainable food security. I would like to refer to the situation prevailing in my country, India.

In global terms, India today has:

- 16 per cent of human population
- 15 per cent of farm animal population
- 2 per cent of the geographical area

- 1 per cent of rainfall
- 0.5 per cent of forests
- 0.5 per cent of grazing land.

Such a situation also prevails in many other countries in Asia and Africa. The demand for food and water will increase every year. At the same time, the ecological foundations essential for sustained advances in biological productivity, such as land, water, forests, biodiversity and the atmosphere are experiencing degradation or depletion. The Living Planet Index published recently by the World Wide Fund for Nature (WWF) underlines the seriousness of the situation.

Meeting the Challenges

Julian Huxley wrote in 1957, “It is as if man has been suddenly appointed managing director of the biggest business of all, the business of evolution whether he wants it or not he is determining the future direction of evolution on the earth”. It is clear that if children are to be born for happiness in the coming millennium, nature, humanity and technology must work in harmony. The present pattern of development based on the destruction of environmental capital stocks and life support systems, gross economic, social and gender inequity and jobless economic growth cannot lead to a better common future. We need a paradigm shift in our approach to technology development. Natural resource management concerns must be integrated in genetic improvement methodologies. Sir Francois Bacon once said “it would be an unsound fancy to expect that things which have never yet been done can be done except by methods which have never been tried”.

What are the new methods available to meet the first among the hierarchical needs of humankind, namely food?

Fortunately, we approach the new millennium, we are experiencing three major revolutions in science and technology, which will influence agricultural technology in a fundamental manner. It will therefore be appropriate to make a brief reference to them.

- i. the gene revolution-which provides a molecular understanding of the genetic basis of living organisms, as well as the ability to use this understanding to develop new processes and products for agriculture, the environment, and for human and animal health,
- ii. the information and communication revolution – which allows a very rapid growth in the systematic assimilation and dissemination of relevant and timely information, as well as a dramatically improved ability to access the universe of knowledge and communicate through low cost electronic networks, and

- iii. the ecotechnology revolution- which promotes the blending of the best in traditional knowledge and technology with frontier technologies such as biotechnology, space and information technologies, renewable energy and new materials.

In principle, these three types of advances – when coupled with improvements in management science and governance – greatly increase the power of a scientific approach to genetic improvement, agronomics, the integrated management of natural resources and ecosystems, and the management of local and regional development policies. Eco-technologies enable the adoption of ISO 9000 and ISO 14000 standards of environmental management. These scientific revolutions seem to be proceeding at an ever increasing pace, with most of the action occurring in a few places in industrialised nations. Also, new discoveries of great relevance to sustainable food security are coming under the purview of proprietary science.

The Gene Revolution

The past ten years have seen dramatic advances in our understanding of how biological organisms function at the molecular level, as well as in our abilities to analyze, understand, and manipulate DNA molecules, the biological material from which the genes in all organisms are made. The entire process has been accelerated by the human genome project, which has poured substantial resources into the development of new technologies for working with human genes. The same technologies are directly applicable to all other organisms, including plants. Thus, a new scientific discipline of genomics has arisen. This discipline has contributed to powerful new approaches that can be used in agriculture as well as in medicine and has helped to promote the biotechnology industry.

Several large corporations in Europe and the United States have made major investments in adapting these technologies to produce new plant varieties of agricultural importance for large-scale commercial agriculture. The same technologies have equally important potential applications for addressing food security in the developing world.

The key technological developments in this area are:

- (i) Genomics: The molecular characterization of species.
- (ii) Bioinformatics: Data banks and data processing for genomic analysis.
- (iii) Transformation: Introduction of individual genes conferring potentially useful traits into plants, tree, livestock, and fish species.

- (iv) Molecular Breeding: Identification and evaluation of useful traits by use of marker assisted selection, which greatly speeds up traditional breeding process.
- (v) Diagnostics: Identification of pathogens by molecular characterization.
- (vi) Vaccine Technology: Use of modern immunology to develop recombinant DNA vaccines for improved disease control against lethal diseases of animal and fish.

There are widespread public concerns about the potential adverse impact of genetically modified organisms (GMOs) on human health and the environment. Some of these concerns are genuine. In order to take advantage of recombinant DNA technologies without associated harm to human or ecological health, it is important that every country has in place suitable institutional structures and regulations for biosafety, bioethics and biosurveillance. A recent statement issued by the Royal Society of London on “Genetically modified plants for food use” provides guidelines for the safe handling of biotechnological applications (Royal Society, 1998). Also, the basic feedstock for the biotechnology industry is biodiversity.

The Information Technology Revolution

New communication and computing technologies will have profound implications in everyday research activities.

- (i) Access to the Internet will soon be universal, and it can provide unrestricted low-cost access to information, as well as highly interactive distance learning. The Internet will not only facilitate interactions among researchers, but also greatly improve their ability to communicate effectively with the potential users of their research knowledge.
- (ii) Computing makes it possible to process large-capacity databases (libraries, remote sensing and GIS data, gene banks) and to construct simulation models with possible applications in ecosystem modeling, preparation of contingency plans to suit different weather probabilities and market variables.
- (iii) The software industry is continuously providing new tools that increase research productivity and create new opportunities for understanding complex systems of growing conditions.
- (iv) Remote sensing and other space satellite outputs are providing detailed geographic information useful for land and natural resources management.

The Ecotechnology Revolution

Knowledge is a continuum. There is much to learn from the past in terms of the ecological and social sustainability of technologies. At the same time, new developments have opened up new opportunities for developing technologies which can lead to high productivity without adverse impact on the natural resources base. Blending traditional and frontier technologies leads to the birth of ecotechnologies with combined strength in the following areas:

- Economics
- Ecology
- Equity
- Employment
- Energy

For example, in the area of water harvesting and sustainable use, there are many lessons to be learnt from the past. In the desert area of Rajasthan, India, drinking water is available even in areas with 100 mm annual rainfall, largely because women are continuing to harvest water in simple structures called kunds. In contrast, drinking water is scarce during summer months in some parts of the North East India with an annual rainfall of 15000 mm. Thus, there is need to conserve traditional wisdom and practices which are often tending to become extinct (Anil Agarwal and Sunita Narain, 1996). The decision of the World Intellectual Property Organization (WIPO) to explore the intellectual property needs, rights and expectations of holders of traditional knowledge, innovations and culture is hence an important step in widening the concept of intellectual property. Principles of ethics and equity demand that this invaluable component of IPR gets included when the TRIPS agreement (Trade Related Intellectual Property Rights) of the World Trade Organization comes up for review in 1999. FAO has been a pioneer in the recognition of the contributions of farm families in genetic resources conservation and enhancement by promoting the concept of “Farmers Rights”. Like WIPO, UPOV (Union for the Protection of New Varieties of Crops) should also undertake the task of preparing an integrated concept of breeders’ and farmers’ rights.

The experience of the present century teaches us that unless technology and public policy are rooted in the principles of ecology, social and gender equity, employment generation and energy conservation, development will not be environmentally and socially sustainable. While technological progress, particularly in the areas of genomics, molecular breeding and information technology is rapid, much of the new knowledge and technologies are coming under monopolistic control through the system of intellectual property right (IPR). Support for public good research is shrinking, while investment in research for commercial projects are increasing at a fast pace. At the same time, it is known that knowledge is a continuum and that much of the progress in molecular breeding has become possible because of the genetic conservation traditions of rural and tribal women and men.

Also, a recent study in USA showed that 73 per cent of private patents were based on knowledge generated by public funded institutions like Universities and government laboratories (Thurrow, 1997). The ethical aspects of genetic engineering research are also assuming significance (Reiss and Stranghar, 1996).

Thus, on the one hand we need new tools to solve the serious environmental and economic issues confronting humankind: on the other hand, these are important ecological, social and ethical issues relating to the use of such new tools, particularly the recombinant DNA technology.

The Convention on Biological Diversity shows the way to approach this dilemma. For the first time, an internationally building convention views the problems of conservation, sustainable use and equitable sharing of benefits in a holistic manner. Also, for the first time, international organizations like the World Intellectual Property Rights Organization (WIPO) are looking at human creativity in an integrated manner. The edifice of both human food and health security has been built on the knowledge gained and material conserved by rural and tribal communities. Knowledge is a continuum and it is obvious that if its roots are starved, the tree of knowledge will not bear fruits for long. Traditional knowledge forms the backbone of modern society. Recognition and reward systems for traditional knowledge and genetic material should ensure that:

- Commercialisation of knowledge does not result in inhibiting the sharing of knowledge and material for public good.
- The gender dimension is internalised in benefit sharing mechanisms.
- The reward system helps to preserve and revitalise the conservation ethics of rural and tribal communities.

The emerging biological and knowledge millennium will need appropriate national, regional and global systems of knowledge creation and sharing based on Albert Einstein's dictum, "concern for man himself and his fate must always be the chief interest of all technical endeavours in order that the creation of our minds shall be a blessing and not a curse". As stressed earlier, effective mechanisms for biosafety, bioethics and biosurveillance will be needed for taking advantage of genetic engineering without associated ecological and or social harm. There must be an internationally agreed protocol on biosafety as provided in Article 19 CBD in order to ensure the environmentally safe handling of genetically modified organisms.

Genetic Engineering and Crop Improvement

The importance of information empowerment will be clear from the fact that in the referendum conducted on June 7, 98 in Switzerland, contrary to general expectation,

more than 66 per cent of people and all the 26 cantons voted against outlawing genetic alteration of animals and the release of genetically modified organisms into the environment. According to Prof. Heidi Diggelmann, President of the Swiss National Science Foundation, this was because of researchers talking to the people in the streets and clearing their concerns and fears (New Scientist, 13 June 1998).

During 1998, nearly 12 million hectares were under transgenic crops with most of the area covered by genetically modified (GMO) soybean, maize, cotton and canola (Mustard). Nearly 75 per cent of the area under GMOs was in the United States of America, where the regulatory measures in force seem to ensure that the public have confidence in the environmental and nutritional safety of GMOs. This is not the case in India as well as in European Union countries. A group of experts constituted by the Royal Society of London to go into this question have concluded that consumer confidence, based on an appreciation of the scientific evidence and the regulatory checks and balances, will ultimately decide whether or not GMOs will make a significant contribution to feeding the world's rapidly expanding population.

India's agricultural strategy for the 21st century will have to place emphasis on producing more per units of land, water, energy, time, capital and labour, though pathways that will ensure that the productivity improvement is not associated with long term ecological and/or social harm. Also agriculture has to be key instrument for producing not only more food but also more income and jobs. It is in this context that the new opportunities opened up by genomics and molecular breeding for fostering sustainable advances in crop and farm animal productivity and quality will have to be assessed carefully for their benefits and risks.

Research carried out with the new genetic technologies during the last 15 years has shown that they can help to improve crops in more precise and faster ways as compared to the traditional Mendelian methods. Designer crops based on novel genetic combinations created by moving genes across sexual barriers are now becoming available. Opportunities for breeding varieties for resistance/tolerance to biotic and abiotic stresses and drought and salinity tolerance and as well as for improved nutritional qualities are particularly important for farming families struggling to improve yields and quality under unfavourable growing conditions. It is such opportunities that are leading to increasing investment in agricultural biotechnology by both the public and private sectors in India. While industrial countries are making greater investments in medical biotechnology as a result of their priority for better health security. India's emphasis has been more on agricultural biotechnology because of the need to ensure food and nutrition security for current and future populations.

While the benefits are attractive, recombinant DNA technologies resulting in genetically modified organisms (GMOs) have also aroused widespread public concern in several respect some of which are the following:

- Direct effect of the transferred genes on the recipient organism(s)
- New possibilities for unfavourable recombinations
- Behaviour of the GMOs in field situations
- Effects on environment and biodiversity
- Nutritive properties of the food produced by GMOs

In addition, the impact of new technologies such as “gene protection technology” and the growing expansion of proprietary science on small and resource poor farming families who save seeds to raise crops, needs careful consideration and monitoring.

A Precautionary Package for the safe and beneficial use of GMOs should include the following components:

- Bioethics: Ethical codes for experimentation and field testing
- Biosafety: National and international protocols
- Biosurveillance: Policies for introduction of technologies (e.g. “terminator”) and assessment of environmental and social impact
- Food Safety: Toxic or allergenic effects as well as wholesomeness
- Consumer choice: Compulsory labelling
- Public information: Transparency, information empowerment

Through proper blends of genomics and molecular breeding, information technology and ecotechnology, it will be possible to promote an agricultural production system which is rooted in the principle of integrated natural resource management.

Conclusion

Sustainable human security with particular reference to food and health during the 21st century can be ensured if we achieve the desired demographic transition and foster production technologies on the foundation of integrated natural resource management. At the same time, there is need for concurrent attention to on-farm and off-farm employment, so that agriculture also becomes an instrument for more jobs and income. The Green Revolution provided a breathing spell for achieving a balance between human numbers and food output.

An evergreen revolution based on ecotechnologies will ensure sustainable food security for an expected population of about 1.5 billion in the coming century. This will provide the basis for launching a national movement for achieving population stabilisation through a “Children for happiness” approach.

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ABERRATIONS OF SEXUAL FUNCTION IN MEN AND THEIR MANAGEMENT

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ABSTRACT

Sexual health is an important component of reproductive health and its main purpose is for enhancement of life and enrichment of personal relations. This has also other dimensions such as development of proper sexuality, reproductive performance and prevention and control of sexually transmitted infections. But this presentation is restricted to the essentials of normal sexual function, and the major causes of sexual dysfunction and their management. Aberrations of sexual function, particularly the erectile dysfunction may be quite distressing and threatening. Therefore, the providers of reproductive health care should be knowledgeable about different aspects of this problem.

Sexual health is an important component of Reproductive Health. As defined by the W.H.O. and adopted at International Conference on Population and Development (ICPD) programme of action, "Reproductive health is a state of complete physical, mental and social well being and not merely the absence of disease or infirmity in all matters relating to the reproductive system and its functions and process. Reproductive health, therefore, implies that people are able to have a satisfying and safe sex life and they have the capability to reproduce and the freedom to decide if, when and how often to do so. It also includes sexual health, the purpose of which is enhancement of life and personal relations, and not merely counselling and care related to reproduction and sexually transmitted diseases".^{1,2} Obviously, sexual health, has different dimensions³. But this presentation is restricted to essentials of normal sexual function and the causes of sexual dysfunctions and their management.

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Sexual dysfunction is the most common of the psycho-sexual disorders. Erectile dysfunction (ED) is a major problem in the former category and it can be most distressing and threatening. ED may destroy personal image, self confidence, self esteem and marital harmony.

PHYSIOLOGICAL BASIS OF SEXUAL FUNCTION

For a rational approach to the management of these problems it is important to have a proper understanding of the basic physiological mechanisms involved and the possible aberrations of these processes. Proper sexual function in men and women depend upon the following steps⁴.

- (i) *State of Desire*: It is a sexual motive state, an anticipatory mental set.
- (ii) *Effective Vasocongestive Arousal*: This leads to erection in the male and swelling and lubrication in the female.
- (iii) *Orgasm*: In the male, it comprises emission followed by ejaculation. Emission produces a sensation of ejaculatory inevitability and is mediated by the contractions of the prostate, seminal vesicles and the urethra. In the female, it is accompanied by the contraction of the muscles that line the outer 1/3rd of the vagina; however, this may not always be subjectively experienced as such.

In both the sexes, a generalized muscular tension, perineal contractions and involuntary pelvic thrusting - at the periodicity of about 0.8 second, usually occur.

- (iv) *Resolution*: It follows orgasm and is a sense of general relaxation, well being and muscular relaxation. During this phase, men are physiologically refractory to further erection and orgasm for a variable period of time. In contrast, women may be able to respond to additional stimulation almost immediately.

The sexual response cycle is mediated by a delicate and balanced interplay between the sympathetic and parasympathetic nervous systems⁴. Vasocongestion is largely mediated by the parasympathetic (cholinergic) outflow, whereas orgasm is predominantly sympathetic (adrenargic). Ejaculation is almost entirely sympathetic, whereas emission involves a much more balanced combination of sympathetic and parasympathetic stimulation. All these reflex responses are easily inhibited by cortical influences or by impairment of hormonal, neural or vascular mechanism; α and β - adrenargic blocking agents may desynchronize emission, ejaculation, and perineal muscle contractions that occur during orgasm.

Since impotence or erectile dysfunction is a major problem, some detailed consideration of the basic mechanism of normal penile erection would be important.

MECHANISM OF NORMAL PENILE ERECTION^{5,6}

Normal penile erection occurs as a result of series of neurally mediated alterations in blood flow in two corpora cavernosa that constitute most of the mass of the penis. The initiating events are that the tactile, visual, auditory and imaginative stimuli act centrally, and primarily increases the parasympathetic outflow but also inhibits sympathetic outflow, and the local tactile stimuli also activate a penis-spinal cord-penis-parasympathetic reflex arc. This activation of the nervous system causes a release of nitric oxide (NO) mainly from the nerve endings and to a lesser extent from the endothelial cells in the corpora cavernosa of the penis. The readily diffusible NO activates the enzyme guanosine cyclase resulting in increased level of cyclic guanosine monophosphate (cGMP). cGMP, in its turn, produces relaxation of vascular smooth muscle and causes dilatation of small tortuous branches of the main cavernosal arteries, called helicine arteries and then relaxation of the smooth muscle of the trabeculae of the corpora cavernosa. This increases penile blood flow and causes engorgement of sinusoidal spaces; the swollen trabecular tissue compresses the small cavernosal veins against the thick fibrous tissue that surrounds the corpora. This prevents venous return of blood resulting in sustained engorgement of corpora cavernosa, which produces and sustains penile erection. Normally, the NO-activated cGMP, which is responsible for penile vaso dilatation leading to engorgement and erection, is degraded by a specific enzyme phosphodiesterase – type 5 (PDE-5). Any agent that would accelerate degradation of cGMP would interfere with erectile process and its sustenance. On the other hand, any substance that would inhibit degradation of cGMP is likely to stimulate and sustain erection; this is exactly what is achieved by sildenafil.

DISORDERS OF SEXUAL FUNCTION

Pathophysiological Considerations

Inhibition of “Sexual Response Cycle” may occur at one or more of the sexual response phases.⁴ Generally, both the subjective dimensions of desire, arousal and pleasure, and the objective performance, vasocongestion and orgasm are disturbed. However, inhibition of either component may occasionally occur alone. All dysfunctions may be primary or secondary. The primary dysfunction may be life-long and effective performance may never have been experienced in any situation, generally due to intrapsychic conflicts. The secondary dysfunction is acquired after a period of normal function. It may be generalized or limited to certain partners or situations; or it may be total or partial in terms of the degree or frequency of the disturbance. Although dysfunction usually occurs during sexual activity, it is useful to enquire about the function during masturbation.

In both primary and secondary dysfunctions the etiologic factors may be similar, and these may include the following⁴:

- Poor communication – almost always present;
- Fear of partner's genitalia, intimacy, etc.;
- Guilt, shame and sexual myths;
- Depression;
- Anxiety – created by marital discord, stressful life situations, aging, ignorance of behavioural norms; fear of failure, demand for performance, excessive wish for pleasing the partner etc.;
- Other related inhibitory factors are ignorance of sex organs and their functions; feeling of inadequacy; religious training: excessive modesty; puritanical aversion to intercourse;
- Inter-personal and situational causes;
- Physical factors.

Even when these primary factors are identified, secondary psychogenic elements are almost always present and are complicating.

MAJOR TYPES OF SEXUAL DISORDERS IN MEN⁴

(i) Hypoactive Sexual Desire Disorder(HSD)

This is defined as persistently or recurrently deficient or absent sexual fantasies and desire for sexual activity in men or women. The common causes are boredom in relationship, depression, psychoactive drugs, antihypertensive drugs, hormonal deficiency, or traumatic elements in childhood and adolescence.

This may be manifested as a lack of interest in sex even in ordinarily erotic situations and infrequent sexual activity leading to serious marital conflict. It may be secondary to impaired sexual function. In case of boredom as the cause there is decreased frequency with usual partner but may have normal or enhanced sex desire with others – real or fantasized, or there may be generalized anhedonia .

Remedy involves removing or alleviating the underlying cause, e.g. marital conflict, depression, other sexual dysfunction. In other cases a change in medication or occasionally androgen therapy, if it is found deficient, is effective.

(ii) Sexual Aversion Disorder

This is manifested as a recurrent or persistent extreme aversion to and avoidance of all or almost all genital sexual contact with a sexual partner. It occurs only occasionally in males, but much more often in females.

Primary aversion to sexual contact specially to intercourse may be a consequence of sexual trauma, incest, sexual abuse or rape. Other causes may be very repressive atmosphere in the family, orthodox and rigid religious training or failure in initial attempts to sexual intercourse resulting in unrealistic fear or even panic.

Treatment includes removal of the underlying cause; behavioural or psychodynamic or psychotherapy depending upon the cause, or use of antidepressant drugs – tricyclics or MAO inhibitors.

(iii) Sexual Arousal Disorder / Erectile Dysfunction

Erectile dysfunction or sexual arousal disorder or impotence is a major problem. This is defined as the inability to obtain and sustain an erection adequate for intercourse. It may be manifested by the subject's inability to attain or maintain a penile erection until the completion of the sexual act and/or by insufficient firmness for vaginal penetration. It usually remains unrecognized and untreated mainly due to shyness and ignorance on the part of the patients and even of the doctors. In India there is no information on the prevalence of impotence. In USA about 10% of adult males have the problem of chronic impotence. This may occur in young or old, and may be most depressing and threatening. It may destroy one's personal image, self confidence, self esteem and may cause strained marital relations, and may even result in non-consumation of marriage and divorce. The cause of erectile dysfunction may be psychogenic or organic or mixed. Even in cases with a primary organic cause secondary psychogenic factor may develop subsequently. Many systemic disorders may be associated with erectile dysfunction and these include hypertension, diabetes mellitus, hypercholesterolemia, renal insufficiency, hypogonadism, neurologic and psychiatric disorders and chronic illness. Genito-urinary surgery and many drugs, particularly antihypertensive and psychotropic drugs may also cause impotence⁷⁻¹².

SYSTEMATIC EVALUATION

As mentioned earlier the cause of erectile dysfunction may be psychogenic, organic or mixed. For establishing a proper diagnosis, systematic and elaborate clinical and laboratory investigations under the guidance of an experienced physician would be most important. A successful treatment outcome depends on a clinically relevant and comprehensive evaluation that illuminates the specific causes of patient's potency problem, and many unnecessary treatment failure can be traced to incorrect or inadequate assessment.

A detailed history, physical examination and basic laboratory tests are important. The work up should include medical, surgical, social and sexual histories, and systemic reviews for psychologic, metabolic, neurologic, cardiovascular and endocrinological facts. The history of intake of various drugs,

particularly the antihypertensive and psychotropic drugs is very important. The physical examination should be aimed at detecting signs of neurologic, hormonal, vascular and genital abnormalities. The basic laboratory tests consist of complete blood count, urine analysis, fasting and post-prandial blood glucose, serum cholesterol and lipid profile, blood urea nitrogen, creatinine, testosterone, TSH and prolactin levels. The patients are informed of the results; if there is any abnormality further work up is advised.

PSYCHOLOGICAL ASPECTS

Prior to commencing any treatment, a clear and detailed mental picture of the patient's sexual functioning experience and behaviour must be obtained. It is important to elucidate the immediate or currently operating causes of the patient's potency problems so that it can be modified during therapy. Therefore, it is important to find out the following:

Is there any tension and stress in the work place and/or family environment? Does he get over worked and fatigued ? Is the subject excessively anxious about his sexual performances? Does he flood himself with negative images when his partner approaches him? Is he obsessively concerned and judge his sexual response? Does he try to have sex when he has little or no desire? Does he feel guilty about his sexual fantasies and tries to suppress these? Some subjects may have morning erections or can masturbate without difficulty when they are alone, but fail to perform with a partner . Such situational patterns clearly suggest a totally psychogenic disorder. Some patients complain that they cannot attain an erection. Others may get erection but lose it in specific situations – such as when they are undressing, when they are about to have intercourse, when they are inside partner's vagina, or when there is a demand for performance, when they are with certain types of women, or when they are angry at or rejected by their partners.

During the initial interview, the availability of the partner is very useful for the diagnosis and treatment of erectile dysfunction. The partner's observations are frequently helpful in clarifying critical treatment issues, and are extremely important for the therapist to assess the couples interactions and in understanding the role of the partner in the overall dynamics of man's potency problem.

There are great variations in the response of the women to their partner's impotence. Some are very supportive and convey to their partner the message, "it is he who is important to her – and not his erect penis". Such loving attitudes rule out partner pressure as an etiological factor and are invaluable assets for sex therapy. At the other extreme are the partners who are sexually demanding and critical; they react intensely when the man does not perform to their satisfaction. Some of the women insist on vaginal penetration as their only means of gratification, objecting to any manual or oral stimulation. The pressure created by such attitude and response by the partner heightens his performance

anxiety, and is likely to create and/or aggravate his potency problem. However, the majority of the partners of impotent men tend to be excessively passive sexually. One of the aims of sex therapy with such couples is to try to overcome wife's sexual fears and to encourage her to provide her partner with more active erotic stimulation.

DIAGNOSTIC TESTS

(i) Nocturnal Penile Tumescence (NPT) Test

The basis of this test is that in a normal man there are two to four episodes of erection at night, usually in association with REM sleep. In men with psychological incompetence nocturnal erections continue to occur, whereas in men with organic impotence there is impairment or absence of these erections¹³.

(ii) Intra-cavernosal Injection of Vaso-active Drugs^{14,15}

This simple test has revolutionized the investigation of impotence. The procedure consists of an injection of vasodilator drugs like papavarine-pentolamine mixture or prostaglandin (PGE-1) into the penis. This causes dilatation of cavernosal arteries and relaxation of trabecular smooth muscles resulting in cavernosal engorgement, this in turn produces veno-occlusion preventing venous return of the blood thus leading to erection. Normal men will respond with a full and sustained erection. Therefore, attainment of full erection, particularly with lower doses of the drug would indicate that vascular mechanisms are normal, whereas failure to achieve an adequate erection after ICIVAD with maximum dose would imply significant vascular problem. During ICIVAD, it is important to provide adequate privacy, visual sexual stimulation and tactile penile stimulation by self-stroking or a vibrator. Only then the best potential erection can be evoked, and failure to use these measures may result in false-abnormal responses.

The outcome of a diagnostic ICIVAD test can vary with the drug used¹⁵. Probably, a papavarin-pentolamine mixture or pure PGE-1 gives most useful results. Pure papavarin is not reliable in identifying vascular insufficiency, it may sometimes produce poor erection in normal men i.e. a false negative response.

(ii) Penile Duplex Ultrasound Study^{16,17}

This allows simultaneous ultrasound (US) visualization of penile structure and Doppler measurement of arterial blood flow. The US findings of fibrosis and calcification in corpora would indicate cavernosal damage and if this is severe any attempt for revascularization would be contraindicated. During USG cavernosal arteries are studied for thickening and calcification of the vessel wall and changes in vessel diameter after ICIVAD.

The Doppler study provides information on arterial wave form, and gives measurements of the peak systolic velocity (PSV) and the end diastolic velocity (EDV). The resistance index (RI) can be calculated from these parameters. Slow PSV indicates arterial insufficiency. Persistent end diastolic flow and low RI are indicative of venous leak.

(iv) Other Tests

(i) *Hormone assays*: Hormonal studies have been widely used, and many a times not found useful. High blood levels of prolactin and low free testosterone level may be relevant.

(ii) *Blood glucose studies*: The study of blood glucose – fasting, post-prandial and after a glucose load, may be valuable for the diagnosis of diabetes mellitus.

MANAGEMENT OF ERECTILE DYSFUNCTION

Many problems are simple and superficial and may be resolved with proper education, counselling and reassurance. Anti-anxiety and anti-depressant drugs may be indicated in some cases. Hormone therapy can be beneficial only in properly diagnosed cases.

Sex Therapy

A brief course of sex therapy is considered the treatment of choice for patients whose impotence is either totally psychogenic or has a significant psychogenic element. Kaplan⁹ advocates a modified approach which differs from original sex therapy described by Masters and Johnson¹⁸ in three respects:

- (a) the programme considers disorders of desire in addition to genital dysfunction;
- (b) this therapy adds a psycho-dynamic dimension to exclusively behavioural approach of the Masters and Johnson and
- (c) it is a more flexible, individualistic treatment approach.

Single patients as well as couples are treated. Therapists of either gender are trained to work alone with patients of either gender. Different and specific behavioural protocols are used for treating each of the seven different psychosexual syndromes.

The new sex therapy approach consists of an integration of behavioral cognitive and psychodynamic techniques. The basic strategies of the method are to modify the currently operating causes of the patient's impotence (which often is a performance anxiety) with behavioural methods, and to use brief psychodynamic interventions to deal with any deeper emotional conflicts or hidden marital struggles that impede his recovery.

A brief course of sex therapy is successful in improving potency in about 80 per cent of men with uncomplicated erectile disorder. However, this technique is not likely to be effective in alcoholics or substance abusers or who have severe personality disorder or serious marital problems and they are angry to each other. This therapy is also contraindicated in (a) primary disorder of sex desire, (b) clinical depression, and (c) psychotic states in either partner.

Some drugs and physical techniques have been recently developed that are useful adjuvants in the treatment of psychogenic impotence. These include antianxiety and antipanic agents, and new sexually stimulating agents or techniques⁹.

Use of Local Vaso-Active Drugs¹⁹

Intra-cavernosal injection of various vaso active drugs has been found to be very useful in 80 to 90 per cent of men. These include injection of papavarine-pentolamine mixture or prostaglandin E-1 (PGE-1). More recently, intra –urethral installation of PGE-1 pellets has been found to be effective. These cause vasodilatation by direct action on smooth muscles of the blood vessels leading to cavernosal engorgement and subsequent vano-occlusion, resulting in sustained erection. Compared to papavarine, PGE-1 gives better and well-sustained effect.

Initially, these drugs are administered by the physician, but later on the patients can be taught to self-administer these at home to obtain erection and have sexual intercourse. These can be used as a confidence booster for men with psychogenic problem as well as a long term therapy in men with neurogenic or mild to moderate vasculogenic impotence.

Arterial revascularization,²⁰ penile prosthesis and the use of vacuum-induced erection devices⁹ will not be discussed in this presentation.

Sildenafil : (A New Discovery)²¹⁻²³

In a preliminary study, 30 minutes after oral administration of sildenafil a visual sexual stimulation was provided, and this resulted in penile erection in two hours. More recently, a two-part study on the efficacy of different doses of sildenafil in men with organic, psychogenic or mixed erectile dysfunction was conducted. In part I of this study, 532 men took placebo or different doses of sildenafil for 24 weeks the drug caused dose-dependant increases in erectile function. In part II , a 12 week trial on 329 men who could increase the dose of sildenafil or placebo on their own initiative, the drug was found to be more effective than the placebo. The effects of the drug were measured in terms of an index of erectile function, a patient log and a global efficacy questionnaire²⁴ and these were compared with the responses of those on placebo. Significant improvement was noted in all the three groups of men receiving the drug.

Sildenafil is to be taken by the men one hour before the planned sexual activity. It is available in three doses – 25mg, 50 mg, and 100 mg tablets, and the recommended dose is 50 mg.

Sildenafil acts by inhibiting breakdown of cGMP in corpora cavernosa by specific phosphodiesterase-type-5(PDE-5). It would be important to mention that cGMP is also involved in other signalling pathways. The large family of PDEs tend to be tissue specific; for example, PDE-1 in cardiac muscle, PDE-3 in platelets, PDE-6 in retina and similarly the blood vessels, kidneys and the brain have specific PDEs. Therefore, inhibition of breakdown of cGMP in other tissues are likely to produce much more widespread side effects. But interestingly, no such side effects were reported in the above studies, which however were of short duration. Although such information is reassuring, these have limitations. More meaningful information would be available only from long – term clinical use of this drug. Furthermore, the responses elicited in men with compromised health status are likely to be different from the effects noted in normal healthy men.

It has been approved by the Food and Drug Administration (FDA), USA and regulatory agencies in several countries. In USA, more than 130 sildenafil related deaths have occurred by November, 1998. This drug should not be prescribed in men who have one or more cardio-vascular risk factors – e.g. subjects taking nitrates, age over 45 years, family history of heart disease at younger age (<55 years), blood pressure more than 140/90 mm Hg, men taking anti-hypertensive medication, blood HDL cholesterol <35 mg/dL and lack of exercise. Unaccustomed sexual activity may also bring out silent cardio-vascular disorders. This also should not be prescribed to men with history of heart attack, stroke or life-threatening arrhythmia in past six months. Another safety issue arises from visual disturbances, particularly the blue/green confusion may be hazardous for the Airline Pilots. Other drug related complaints recorded during the trial are headache, flushing, dyspepsia and rhinitis. Another important aspect often overlooked is the female partners, particularly those in post-menopausal age may be illprepared for any increased sexual activity.

For many couples, sildenafil therapy after proper investigations by experienced physicians may substantially improve sexual function and the quality of life. But there are several pitfalls. Besides the serious side effects mentioned above, it would not be effective in the following clinical conditions: 1) in the absence of prior sexual arousal, there would be no activation of the NO/cGMP pathway; and 2) In men with erectile dysfunction caused by severe arterial deficiency, loss of trabecular smooth muscles or incompressible cavernosal veins. In view of all these, only an adequately trained and experienced physician would be able to make judicious and safe use of this drug. Furthermore, a note of caution is warranted. With the ready availability of the drug over the counter it is likely to be increasingly used by the primary care physicians who do not have

adequate background and expertise. Because of increasing demand this may also be used in conditions where it is not indicated. This may prove hazardous.

CONCLUDING REMARKS

Sexual health is an important component of reproductive health. Its main purpose is enhancement of life and personal relations. Sexual dysfunction is most common of psychosexual disorders and among them erectile dysfunction is a major problem. In this presentation, the physiological basis of different steps of sexual response cycle and particularly of normal penile erection has been described and their patho-physiological aspects discussed.

The cause of erectile dysfunction may be psychogenic, organic or mixed. For any rational management of the problem, it is very important to establish a correct diagnosis of the case through systematic clinical and laboratory investigations and by judicious use of a variety of diagnostic tests.

Many problems may be relatively simple and superficial, and may be resolved through proper education, counselling and reassurance. The anti-anxiety and anti-panic drugs may prove valuable adjuncts in some cases. In other cases, systematic sex therapy with or without the use of some suitable adjuvants may be effective. In suitable cases, use of different locally vasoactive drugs and penile vacuum pump may be very helpful. The newly discovered orally effective drug, sildenafil has great promise. However, at the present state of development it should be used under the supervision and guidance of an experienced physician.

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MALE FACTORS IN UNEXPLAINED INFERTILITY

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ABSTRACT

When a couple fails to achieve a pregnancy despite no reasons found during evaluation, or even after correction of factor(s) identified as probably responsible for infertility, it is termed as unexplained infertility. Completeness or adequacy of investigations for unexplained infertility varies from centre to centre depending upon the expertise, experience and facilities available. More extensive are the investigations, there are more chances of finding the cause of infertility. However, it is to be remembered that inspite of complete infertility work-up, some areas are inaccessible to conventional methods of investigation e.g. sperm transport and function in female genital tract beyond cervix and in vivo fertilization. Thus, in some couples with unexplained infertility, hidden male factors may be responsible.

Definition of infertility varies. According to the World Health Organization (WHO), if a couple fails to achieve pregnancy after two years of regular unprotected sexual cohabitation the couple is considered to be infertile. According to the American Fertility Society, failing to conceive after one year of regular unprotected sexual cohabitation is considered to be infertility. In upto 50 per cent of cases of infertility male factor(s) may be the cause. In about 15 to 20 per cent of these couples a concomitant female factor may be present¹.

When a couple has failed to establish a pregnancy despite no reasons uncovered by evaluation, or even after correction of factor(s) identified as probably responsible for infertility, it may be termed as unexplained infertility (UI). The reported overall prevalence of unexplained infertility ranges from 6 to 27 per cent²⁻⁴. In spite of complete infertility work-up, some areas are inaccessible to conventional methods of investigation. These areas include sperm transport beyond cervix, in vivo fertilization, and implantation. In the first two processes, the male partner is

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clearly involved; it is impossible to detect abnormalities in sperm transport or function with conventional semen analysis. Thus, in some couples with unexplained infertility, hidden male factors may be responsible.

OBJECTIVES AND GUIDING PRINCIPLES FOR FURTHER EVALUATION

The objective would be to systematically investigate the basis for infertility, so that effective testing and treatment can be offered. For a systematic approach in evaluating UI the following guiding principles should be remembered:

- I. To determine whether previous investigations were complete according to the current reference standards.
- II. To re-evaluate whether the results of all previous investigations and observations were appropriately interpreted.
- III. To remember that sometimes the normal and compatible factor(s) noted at the outset of diagnostic evaluation may be changed during the course of prolonged investigations.
- IV. To be aware that many of the processes of conception are inaccessible for evaluation.

The adequacy of evaluation varies depending on the expertise, competence and facilities available at the centre, and the perseverance of the couple in completing an extensive evaluation. The more exhaustive the investigations, there are more chances of diagnosing the underlying cause. Apparently, the boundary between the explained and unexplained infertility is a shifting one. This emphasizes one of the major difficulties to decide who truly qualifies as having unexplained infertility.

The important prerequisites for proper evaluation are that one needs to be knowledgeable, and to have a clear understanding about:

- (1) the regulation of male reproductive processes and their physio-pathological considerations and
- (2) the possible causes of male infertility and how to investigate these factors.

Therefore, a brief review of the current status of knowledge in these fields would be very helpful.

MALE REPRODUCTIVE PROCESSES

Spermatogenesis and Sperm Maturation^{1,5}

These processes are regulated by intricate balanced mechanisms involving the hypothalamus-pituitary-testis axis, and various accessory sex organs. The GnRH secreted by the hypothalamus regulates the synthesis and release of FSH and LH from the pituitary. The FSH stimulates the Sertoli cells within the seminiferous tubules, and these produce various proteins including inhibin, androgen binding protein (ABP), aromatase etc. The actions of FSH on the germinal cells are mediated through the Sertoli cells. The LH acts on the Leydig cells located in the intertubular spaces, and stimulates production of testosterone, a part of which gains entrance into the tubules. The ABP binds the testosterone and ensures high level of androgen within the tubules throughout. The intratesticular concentration of testosterone in the human is about 200-300 times greater than that of peripheral circulation, and it has profound influence on germ cell development and differentiation. There is evidence to indicate that the androgen probably acts on preleptotene and pachytene spermatocytes, and on the round and elongated spermatids.

Spermatogenesis is an orderly development process progressing from spermatogonia through primary spermatocytes → secondary spermatocytes → spermatids (round and elongated) to spermatozoa. This comprises three phases - mitosis, meiosis and spermiogenesis. The last phase involves complex cyto-differentiation; the acrosome and flagellum are formed, and the existing structures are remodelled. The developing germ cells are completely enveloped by the Sertoli cells which provide them nutritional support. In the human, the whole cycle of spermatogenesis takes about 75 days. For the initiation as well as maintenance of spermatogenesis the actions of both FSH and androgen are needed.

During transit through the epididymes the spermatozoa are exposed to specific proteins and other substances, and they acquire forward progressive motility and the fertilizing capacity. This process of maturation of spermatozoa is androgen dependent. High level of androgen in the proximal part of the epididymis is maintained by dual source of supply - one through the systemic blood circulation and the other from the seminiferous tubular content reaching the epididymes through efferent ductules. The mature sperms are stored in the tail of epididymes and the proximal part of the vasa deferentia, from where those are excreted during ejaculation.

Sexual Function and Ejaculation

Sexual response in men initiates with sexual desire followed by vasocongestive arousal resulting in erection of phallus and culminates into ejaculation. During ejaculation sperms suspended in testicular and epididymal fluid are propelled to the distal part vasa, and when it reaches near the common ejaculatory duct there is a reflex contraction of the sphincter at the neck of the

urinary bladder. This prevents any retrograde ejaculation and ensures antegrade ejaculation through penile urethra. Retrograde ejaculation may result in infertility.

During ejaculation the spermatozoa pass through the vasa deferentia and the secretions of the prostate and seminal vesicles. The prostate secretes acid phosphatase and citric acid, the latter being the only zinc-binding ligand in prostatic fluid. The seminal vesicles secrete a number of substances including fructose, bicarbonates, prostaglandin, prolactin (PRL) and high molecular weight zinc-binding ligands. The first sperm-rich fraction of the ejaculate initially gets exposed to the prostatic secretion with high zinc concentration which stabilizes sperm chromatin. The high volume seminal vesicular secretion is added to the ejaculate at the end. Some of its products directly stimulate sperm motility. It also helps in maintaining the balance of zinc concentration, thus ensuring optimal sperm chromatin stability. Alterations in sperm chromatin stability, either a decrease or an increase, may lead to infertility.

Post-Ejaculatory Events

Once deposited in the vagina, normal spermatozoa are capable of traversing through the female genital tract i.e. the cervical canal, uterine cavity (where capacitation of sperms takes place) and the utero-tubal junction, to reach the outer third of the fallopian tube. This is achieved mainly through the innate motility of the spermatozoa, although the sperms may derive some assistance from uterine contractions during their ascent in the female reproductive tract¹. Usually, at this site in the fallopian tube the sperms are capable of recognizing the ovum, penetrating its investing membranes and fusing with the oocyte resulting in fertilization. This latter process is facilitated by the acrosomal enzymes, and the fertilization rate correlates better with normal sperm head morphology rather than sperm motility⁶. Normal acrosomal structure and function are essential for fertilization. The fertile life span of human spermatozoa in female genital tract is about 48 to 72 hours.

Alterations in the above mentioned physiological states or processes can lead to infertility.

PATHOLOGICAL BASIS OF MALE INFERTILITY

Male infertility may be observed in association with any one or more of the following disorders:¹⁻⁷

(a) Disorders of hypothalamic-pituitary function; (b) Testicular disorders; (c) Ductal defects - congenital or acquired; (d) Infections / inflammation of accessory reproductive organs; (e) Seminal abnormalities due to known/unknown causes; (f) Sexual and/or ejaculatory dysfunction; (g) Abnormal sperm function; (h) Immunological defects; and (i) Iatrogenic causes.

STANDARD INVESTIGATIONS FOR MALE INFERTILITY^{1,7,8}

A systematic investigation for the male partner should include the following:

- (1) A detailed history including previous investigations and treatment;
- (2) Systematic and thorough physical examination;
- (3) Semen analysis-routine and special tests;
- (4) Scrotal, inguinal and pelvic ultrasonography and Doppler study;
- (5) Hormonal and other special studies;
- (6) Sperm-cervical mucus interactions; and
- (7) Testicular FNAC/biopsy.

The extent and nature of these investigations would vary from case to case.

Detailed History

The value of extensive history cannot be underestimated. This should include the following:

- a) Duration of infertility - primary or secondary;
- b) Previous investigations and their appropriate interpretation and treatments;
- c) Detailed medical, surgical, personal and family history;
- d) Drugs used for other associated disorders; addictions - smoking, alcohol and others
- e) Sexual habits, coital frequency and patterns;
- f) Infection and inflammatory conditions of the genito-urinary tracts;
- g) Environmental and occupational factors; and
- h) Stress and febrile reactions, which may cause temporary deterioration of semen quality.

The duration of infertility provides important prognostic information about future fertility for the couple. When the duration of involuntary infertility is three years or less, there is better chance of spontaneous pregnancy for the couple. If the

duration is longer than three years, there is a possibility of having severe biological problem. In cases with secondary infertility, the longer the time gap since the last fertilization greater are the chances of having an acquired disorder as the cause.

Previous investigations and treatment should be carefully reviewed to note: (a) whether the investigations were complete, and the results and observations were interpreted appropriately; and (b) the treatment was prescribed and taken correctly, and what was the result thereof.

The history of diseases with possible adverse effect on fertility would include the following:

- a) Diabetes mellitus and neurological disorders that may cause erectile and ejaculatory dysfunction; these may also damage spermatogenesis and accessory gland function.
- b) Tuberculosis may cause epididymitis and prostatitis and may be associated with impairment of sperm maturation and transport.
- c) Chronic respiratory tract diseases including bronchiectosis, chronic bronchitis and sinusitis may sometimes be associated with immotile cilia syndrome (including sperm cilia).
- d) Congenital absence or dysgenesis of vas deferens or secretory disturbance in the epididymes as in Young's syndrome, may be associated with fibrocystic disease of the pancreas.
- e) High fever exceeding 38°C may suppress spermatogenesis for a period upto six months.
- f) Mumps associated with orchitis may be a possible cause of acquired testicular damage.
- g) Alcohol abuse or heavy smoking may adversely affect spermatogenesis and / or sperm function.

Some therapeutic drugs may adversely affect fertility by causing temporary or permanent damage to spermatogenesis, and these include the following:

- a) Cancer chemotherapy drugs or irradiation, sulphasalazine, nitrofurans, niradazole and colchine have direct toxic effect on spermatogenesis.
- b) Hormone treatments such as high doses of corticosteroids, androgens, anabolic steroids, antiandrogens, progestogens, estrogens and LHRH

agonists/antagonists may suppress gonadotropin secretion and thereby cause testicular inhibition/atrophy.

- c) Drugs like cimetidine and spironolactone antagonize androgen action.
- d) Antihypertensives and tranquilizers may interfere with erectile function.

Any surgical procedure, particularly under general anaesthesia, may cause temporary depression of male fertility. Certain surgical procedures may adversely affect fertility directly. Surgical treatment of urethral valve, prostatectomy and bladder neck incision for correcting stricture may produce retrograde ejaculation. After reparative surgery for urethral stricture, hypospadias, epispadias and vesicular extrophy, there may be ejaculatory disturbances. Repair of inguinal hernia, hydrocelectomy or any other inguinal surgery may damage the vas deferens resulting in partial or complete obstruction. The history with date and post-operative complications of operations for varicocele and testicular torsion or maldescent should be recorded.

Physical Examination

A thorough examination of the male genital organs is most essential. It should include assessment of the degree of androgenization and presence of any gynecomastia. Development of the scrotum and phallus and the position of the urethral meatus are to be ascertained. The size, consistency and the position of the testes are to be noted; similarly to look for any enlargement, nodularity and tenderness of the epididymes; presence or absence of normal vasa deferentia. For detecting the presence of any varicocele the subject has to be examined standing along with valsalva manuvre.

A careful examination to exclude any major systemic disorder that may adversely affect the reproductive function would be important.

Laboratory Investigations

Semenology

Normal semenology characters (WHO): Spermatozoa- (a) Density: 20 million/ml; (b) Motility: grade "A"/RLP > 25%; grade "A"+B" > 50%; (c) Morphology: > 30% with normal head forms; (d) Immunological: no agglutination (MAR-mixed agglutination reaction). In immunobead test <10% sperms coated with antibody.

Seminal plasma- (a) Volume: > 2 ml; pH: 7.2 to 7.8; (b) Appearance and consistency: normal; (c) Leucocyte: <1 million/ml; (d) Culture: negative/ bacteria:<1000/ml (e) Biochemistry: normal.

Other relevant laboratory investigations

The nature and extent of these investigations will vary from case to case.

DIAGNOSTIC CATEGORIES OF MALE INFERTILITY

The W.H.O. Guidelines⁸ have provided a diagnostic categorization of male infertility which aims at therapeutic strategies rather than at academically detailed sub-classification without direct impact on clinical management. The author has somewhat modified this list from his personal experience and this is reproduced below.

- a) Male accessory sex gland infection/inflammation.
- b) Acquired testicular damage.
- c) Congenital abnormalities.
- d) Varicocele with seminal abnormalities.
- e) Endocrine causes.
- f) Isolated seminal plasma abnormalities.
- g) Idiopathic oligospermia / asthenospermia / teratozoospermia or various combinations thereof.
- h) Azoospermia – obstructive / idiopathic (non-obstructive).
- i) Systemic cause.
- j) Iatrogenic cause.
- k) Sexual and/ or ejaculatory dysfunction.
- l) Immunologic cause.
- m) No demonstrable cause ("Unexplained infertility").

It may be noted from the list of above mentioned "diagnostic categories" that the possibility of Unexplained Infertility may be considered only after the other known or demonstrable causes of infertility have been excluded. It has also been mentioned earlier that the boundary between the explained and unexplained infertility is a shifting one, as the diagnostic and management ability varies from centre to centre depending on the expertise, experience and facilities available. Naturally, some of the known or demonstrable causes may be missed in some

centres, and may be picked up in another reasonably well equipped centre. These "Often-Missed" categories are separately described below. Still a few more difficult areas would be left out. This latter condition would be discussed later on under "Truly Unexplained" male infertility.

Often-Missed Causes of Male Infertility

(1) Varicocele; (2) Reproductive tract infection and/or inflammation - chlamidia, ureaplasma and other infections; epididymo-orchitis; vesiculitis; prostatitis; leucocytospermia, oxydative stress; (3) Hyperprolactinemia; (4) Immunological factors; (5) Iatrogenic causes; from wrong treatment or by drugs used for other purposes; exposure to heat or radiation; (6) Psychogenic disorders/ psycho-sexual dysfunction; (7) Continued azoospermia following V.E. anastomosis done on wrong signal from testicular biopsy report, implying obstructive azoospermia; (Seminal germ cell morphology(SGCM) and semen biochemistry may be of great value in the differential diagnosis of obstructive and non-obstructive azoospermia- Roy et al.,1985, 1996,1997); (8) Retrograde ejaculation; (9) Sperm ultrastructural defects (a) Immotile cilia syndrome(Kartegener's syndrome): (b) Absence of dynein arms.

Truly Unexplained Infertility

These are mainly related to abnormal sperm function. Transport of spermatozoa through the upper female genital tract and their ability to fertilize the oocyte are two main obscure areas for the conventional evaluation of infertility. Under this group the following conditions may be included:

(1) Disorders of sperm chromatin stability; (2) Defect in sperm transport through upper female genital tract; (3) Capacitation defect; (4) Sperm-zona binding defect; (5) Impaired acrosome reaction; (6) Reduced acrocin activity; (7) Altered sperm membrane integrity; (8) Oocyte penetration defect.

Normally, chromatin decondensation and nuclear swelling take place when the sperms penetrate egg cytoplasm. Infertility may occur due to sperm chromatin dysfunction under the following circumstances; (a) If nuclear swelling occurs before fertilization, it would prevent fertilization, because chromatin compactness is required for successful penetration of oocyte investment. This may be due to poor chromatin stability resulting from low zinc content in seminal plasma arising from a disturbance in ejaculatory sequence or a relative preponderance of seminal vesicular secretion in sperm-rich fraction of seminal plasma, compared to prostatic secretion. (b) On the other hand, high sperm chromatin stability will resist decondensation, which would prevent fertilization. This may be related to hypofunction of seminal vesicles resulting from infection and /or inflammation, or from hypoandrogenism.

In such cases, simultaneous measurements of serum testosterone, seminal "corrected " fructose, PRL, citric acid, zinc:fructose molar ratio in split ejaculates along with nuclear decondensation study would help in clarifying the position.

During the past decades several methods for assessing human sperm functions have been introduced, and the IVF has provided a unique opportunity to determine the predictive value of these new tests. With this new technology, several defects at different stages of temporal sequence of events taking place in human fertilization have been detected in patients with, otherwise, unexplained infertility. The functional tests include (1) Sperm mitochondrial activity index (SMAI); (2) Follicular fluid (FF)-induced hyperactivation of sperms, a potential marker of capacitation of spermatozoa; (3) Sperm-zona pellucida binding test; (4) Acrosome intactness test; (5) Acrosome reaction; (6) Sperm membrane integrity evaluation by hypoosmotic swelling test (HOST); (7) Zona-free hamster oocyte penetration assay. Electron microscopic studies have helped in detecting ultra-structural defects of spermatozoa.

These are difficult to perform and are not in easy reach for routine investigations. Furthermore, their indiscriminate use is not going to help. Various functional tests judiciously used in combination with other relevant studies, along with critical clinical assessment would be useful.

CONCLUSION

Completeness or adequacy of investigations for unexplained infertility varies from centre to centre depending upon the expertise, experience and facilities available. Because of this shifting boundary between the explained and the unexplained infertility, it is difficult to decide who would qualify to be called having truly unexplained infertility.

More extensive are the investigations, there are more chances of finding the cause of infertility. Many of the known / demonstratable causes of male infertility are often missed. Judicious use of various sperm function tests in combination with different semen biochemistry parameters and critical clinical judgment may clinch the diagnosis in many of these "truly unexplained" infertility.

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GEOGRAPHICAL INFORMATION SYSTEMS - A POTENTIAL TOOL FOR PLANNING AND MANAGEMENT IN HEALTH CARE

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ABSTRACT

This paper presents Geographical Information System (GIS) which could be extremely useful in public health for analyzing spatial and non-spatial data. The GIS helps in indicating longitudinal trends, mapping population at risk, stratifying risk factors, planning and targeting interventions, forecasting epidemics, monitoring diseases and interventions over time, determining geographical distribution and variation of diseases (prevalence and incidence). Infrastructure like health centres, schools and water points can also be assessed with the help of GIS.

Health is one of the gifts of nature to man and every effort should be directed to achieve and maintain it. However, health of the community is not a result of the medicines and medical technology. It is also controlled by the effective health care delivery system. The planning and management in health care is an inter-disciplinary function which in turn is an end product of coordination between health and non-health sectors. Such an useful and viable coordination may be sought from experts in Geographical Information Systems (GIS) technology. In GIS, spatial data are linked with non-spatial data to get information for improvement in planning and management of health care.

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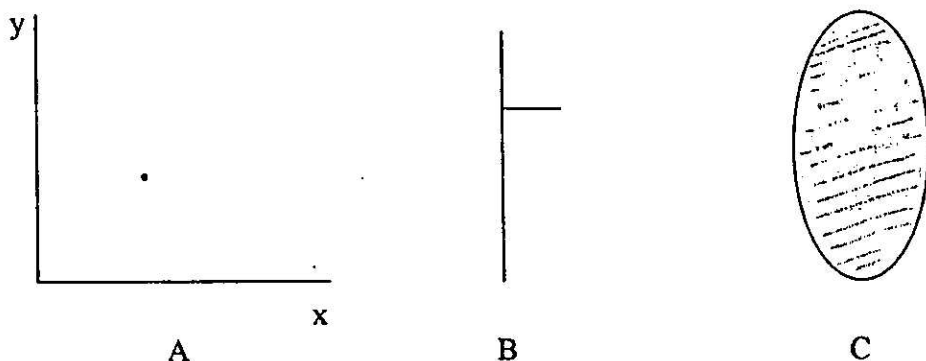
Concept of GIS

GIS stands for Geographical Information Systems. GIS is a powerful computerized system of hardware, software and procedures designed for input, storage, retrieval at will, manipulation, analysis and display of data.

Each piece of information is related in the system through specific geographical coordinates (e.g. latitude & longitude) to a geographical context. This can be a health facility, a laboratory, a village, a road, a hospital, a block, a district, a region, a country or a group of countries. The information can be displayed and represented in the form of graphs, charts and maps. In a sense, GIS is a special purpose digital database in which a common spatial coordinate system is the primary means of reference. GIS has the ability to perform numerous tasks utilizing both spatial and some aspatial information stored within them².

Types of Geographical data used in GIS

Spatial data: All geographical data can be reduced to three basic geographical phenomenon and in principle be represented by a point, line or area plus, a label saying what it is. So a well or a Sub-centre or a PHC or a CHC or a hospital could be represented by a point entity consisting of a X, Y coordinate; a road could be represented by a series of X, Y coordinates; a cyclone affected area or a floodplain could be represented by an area entity covering a set of X- Y coordinates (Fig. 1).



“A” represent a point, “B” a line and “C” an area feature.

Fig. 1

The labels could be the actual names as given here, or they could be special symbols. Remote Sensing data or satellite data (in both forms i.e. digital and paper format or imagery), etc. could be very useful source for spatial data because of synoptic coverage and coverage of very wide region, repetitive data gathering

capability, spatial information, real time data collection, computer compatibility, cost effective information and appearance of invisible things as sensor of satellite can sense or capture the radiation outside the visible range. Some disadvantages like atmospheric effect, scene surface characteristics, imaging characteristics of the sensor and stability and orbit characteristics of the platform are possible in satellite data.

Non-spatial/ aspatial data: Non-spatial data include information about the features. For example, name of roads, schools, forests, population or census data of the area, number of vehicles, number of patients, number of Sub-centres, number of *anganwadi* in a village or block or district, number of PHCs, number of CHCs, number of hospitals, etc.

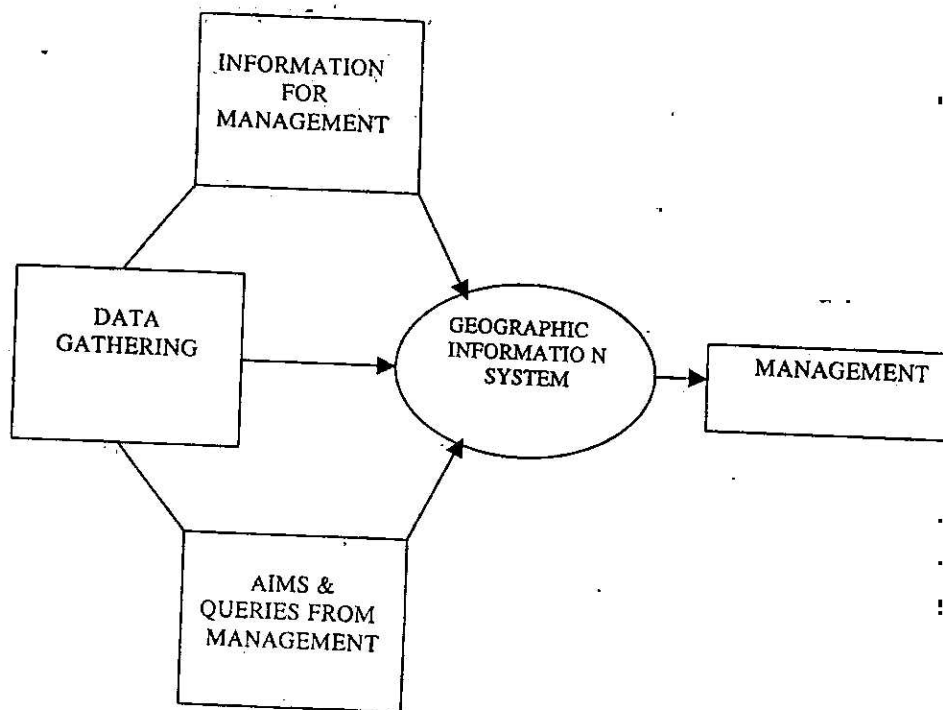
Components of GIS

Geographical Information Systems (GIS) have three important components.

Computer Hardware: The general hardware component of a GIS consists of a digital computer and other devices such as a digitizer, plotter, etc. The computer or central processing unit (CPU) is linked to a disk storage unit which provide space for storing data and programmes.

GIS Software Modules: Many softwares like INTERGRAPH, ILWIS, ACH-INFO, etc. are available for GIS system in the market. The software package for a GIS consists of five basic technical modules. These basic modules are sub-systems for (i) Data input and verification; (ii) Data storage and database management; (iii) Data output and presentation (display and reporting); (iv) Data transformation; and (v) Interaction with the user (query input).

The Organizational Aspect of GIS: The GIS needs to be placed in an appropriate organizational context (Fig. 2). It is simply not sufficient for an organization to purchase a computer and some software and to hire or retain one or two enthusiastic individuals and then to expect instant success. Just as in all organizations dealing with complex products, as in manufacturing industry, new tools can only be used effectively if they are properly integrated into the whole work process and not tackled on as an afterthought. To do this properly requires not only the necessary investment in hardware and software, but also in retaining of personnel and managers to use the new technology in the proper organization context.



Organizational set up of Geographic Information System (GIS).

Fig. 2

Data Representation and Structure in GIS

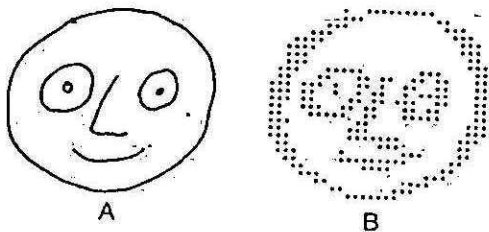
Data in GIS systems are represented by two methods

Raster Method

The simplest raster method consists of data represented as an array of grid cells (Fig. 3). Each grid cell is referenced by a row and column number and it contains a number representing the type or value of the attribute being mapped. In raster method, a point is represented by a single grid cell; a line by a number of neighbouring cells strung out in a given direction and an area by an agglomeration of neighbouring cells.

Advantages of raster methods include (i) simple data structure, (ii) overlay and combination of mapped data are easy, (iii) various kinds of spatial analysis are easy and (iv) technology is cheap.

Disadvantages include (i) less beautiful maps; (ii) network linkages are difficult to establish; (iii) a serious loss of information; and (iv) projection transformation is time consuming, unless spatial algorithms or hardwares are used.



"A" represents vector method, "B" raster method.

Fig. 3

Vector Method

The vector representation of an object is an attempt to represent the object as exactly as possible.

Advantages of vector method include (i) good representation of different data structure; (ii) compact data structure; (iii) accurate graphics; (iv) topology can be completely described with network linkages; and (v) retrieval, updating and generalization of graphics and attributes are possible.

Disadvantages include (i) complex data structures; (ii) combination of several vector polygon maps or polygon and raster maps through overlay creates difficulties; (iii) display and plotting are expensive; and (iv) spatial analysis and filtering within polygons are impossible.

Common GIS Capabilities for Data Maintenance and Manipulation

- **ADD/DELETE/CHANGE:** Interactive editing of the alignment, length, text font, and attribute of graphic entities (points, lines and areas as appropriate).
- **MOVE/ROTATE:** Move an entity (point, line, polygon, or group of pixels) to a new position.
- **STRETCH/RECTIFY:** Adjust co-ordinates to fit a true base.
- **TRANSFORM SCALE:** Adjust co-ordinates to match a given scale.
- **TRANSFORM PROJECTION:** Adjust co-ordinates to match a given projection.

- *ZOOM/WINDOW*: Enlarge/reduce area of attention.
- *CLIP AND MODIFICATIONS*: Cut out area of attention as a separate part. Modifications in colour, text, line, dimensions, etc. are possible.
- *JOIN/EDGE MATCH*: Join two or more adjacent maps ensuring continuity of line and text information across the join.
- *POLYGON OVERLAY AND MERGE*: Intersect two polygon networks to create a new polygon network.
- *3-D PROJECTION AND DISPLAY*: Create a 3-dimensional view of the data (block diagram, usually with hidden line removal).
- *RASTER TO VECTOR*: Convert (scanned) raster data to a set of lines (vectors).
- *VECTOR TO RASTER*: Convert line and polygon data to pixels.
- *GENERALIZATION AND SMOOTHING*: Data reduction algorithms for changing data structures with scale (e.g. polygon to a point). Removal of excess co-ordinates in digitized lines.
- *DATA RETRIEVAL AND REPORTING*: Simple routines for counting items, reporting areas and perimeters, simple distance, simple Boolean search, etc. Results are written to a text file for further processing.

GIS Applications in Health Sector

GIS provides an excellent means of collecting, updating and managing epidemiological surveillance and related information management and analysis. GIS serves as a common platform for convergence of multi-disease surveillance activities, standardized georeferencing of epidemiological data facilities and standardized approaches to data management. As such, a GIS can serve as an entry point for integrating disease surveillance activities³ where appropriate. In data analysis, a GIS provides an excellent means of visualizing and analyzing epidemiological data⁴, thus revealing trends, dependencies and inter-relationships that would be more difficult to discover in other formats. A GIS facilitates the convergence of multisectoral data, including population information, environmental information, health and other resources into a common platform for analysis.

GIS can be applied to obtain data for planning and management in the following ways:

- 1) Generate thematic maps (ranged color maps or proportional symbol maps to denote the intensity of a mapped variable).
- 2) Allowing for overlaying of different pieces of information.
- 3) Create buffer areas around selected features, for example a radius of 2 Km. around a stagnated water body where *Anopheles* can breed, a radius of 10 Km. around a health centre to denote a catchment area, etc.
- 4) Carry out specific calculations, for example the proportion of the population falling within a certain radius of a health facility, school, etc.

- 5) Calculate distances e.g. the distance of a community to a health facility.
- 6) Permit a dynamic link between databases and maps so that updates are automatically reflected on the maps.
- 7) Permit interactive queries of information contained within the map, table or graph.
- 8) Process images such as aerial or satellite images to allow information such as temperature, rainfall, soil type and landuse to be easily integrated, and spatial correlation between potential risk factors and the occurrence of diseases to be determined.
- 9) Provide a range of extrapolation techniques, e.g. extrapolating sentinel site surveillance to unsampled areas.

Conclusion

Geographical Information System (GIS) could be extremely useful in public health for analyzing spatial and non-spatial data. The GIS helps in indicating longitudinal trends, mapping population at risk, stratifying risk factors, planning and targeting interventions, forecasting epidemics, monitoring diseases and interventions over time, determining geographical distribution and variation of diseases (prevalence, incidence). In addition, infrastructure like health centres, schools and water points can also be assessed with the help of GIS.

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SOCIO-DEMOGRAPHIC FACTORS INFLUENCING ANTE-NATAL CARE - A COMMUNITY BASED STUDY

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ABSTRACT

This paper analyses the influence of socio-demographic factors like maternal age, maternal education, maternal occupation, caste, number of living children and distance of medical facility on utilisation of ante-natal care services. Also, the relation between these factors and quality of ante-natal care received is examined. In addition, the authors recommend (i) training of all Traditional Birth Attendants (TBAs) and retraining, wherever necessary, of other health personnel; (ii) development of necessary skills and tools required for supervisory staff at all levels; (iii) properly planned logistics and uninterrupted supply of required equipment in all health facilities; and (iv) education and motivation of women for utilisation of available health care services.

Care of mother and child occupies a paramount place in our health service delivery system. Sincere efforts are being made in the country to bring about an improvement in the health status of the mother and child. An important aim of the national health policy is to achieve 100 per cent ANC coverage.¹ Today, in developing countries, the mothers are illhoused, poorly nourished, and largely ignorant of what is good for them and their babies. Until people prosper and economic benefits become widely spread, prenatal surveillance can provide the care needed to offset some of the harmful effects of large scale poverty and under development.² In support of this view, it has been almost universally observed that the vast majority of deaths in child birth occur among emergency admissions of women who had no previous care whatsoever. The national Child Survival and Safe Motherhood Programme of India has enunciated that a minimum of three ante-natal visits covering the entire period of pregnancy can be considered satisfactory and should be the target.³

Systematic studies in developing countries like India show that ante-natal care is effective but it is, however, scarce. Hence, it has become necessary to understand factors influencing utilisation of ante-natal care services and quality of ante-natal care in different areas of the country.

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This study was therefore conducted in Srikalahasthi ICDS project area of Andhra Pradesh to analyse the factors affecting utilisation of ante-natal care services.

MATERIALS AND METHOD

The study was conducted in July, 1998 as a part of the Integrated Child Development Services Project.

The Study Area

Chittoor district had a population of 34,83,733. Sex ratio of the district was 966 females per 1000 males. The literacy rate in the district was 49.8 per cent. Scheduled Castes and Tribes in the district form 18.4 per cent and 3.2 per cent of population respectively. The district had 79 primary health centres, 548 sub-centres, 11 government hospitals, one teaching hospital and one super speciality hospital. The birth rate and death rates were 23.4 and 9.4 per cent respectively. Besides the government facilities, the MCH services are provided by private clinics and hospitals and health centres run by voluntary organisations.

Sample Size and Study Population

The study was conducted in Srikalahasthi ICDS project which had five mandals (new primary health centres). From each primary health centre, two villages were selected randomly, one village from sub-centre headquarter villages and the other from non-sub-centre headquarter villages. From the ten villages thus selected, all the lactating women (140) formed the study sample.

Data Collection

The lactating women (140) were interviewed using a structured pre-tested interview schedule. Information pertaining to ante-natal care, socio-demographic and maternal factors was collected by trained field investigators.

Study Variables

The socio-demographic and maternal characteristics like maternal age, maternal education, maternal occupation, caste, number of living children and distance of medical facility, all of which had a bearing on utilisation of ANC were considered. Among the mothers who received ANC, the quality of ANC services was graded as good, average and poor. For this purpose a scoring system was devised wherein points were allotted to different components of ANC care as follows:

Number of antenatal check-ups

Nil = 0, 1 or 2 = 1, 3 or more = 2

TT Immunisation

Fully immunised = 2

Partially immunised = 1

Not immunised = 0

Recording of weight, fundal height, foetal heart, urine examination, blood examination and estimation of blood pressure (0 for 1 each) making up a maximum score of 10.

FINDINGS AND DISCUSSION

A total of 140 lactating mothers were interviewed to determine the nature and extent of ante-natal care services used by them. Table 1 presents the pattern of utilisation of ante-natal care (ANC) services in relation to socio-demographic and maternal factors. A cut-off point of three ante-natal check ups was taken to designate utilisation of ante-natal care services as satisfactory or unsatisfactory.

TABLE 1

SOCIO-DEMOGRAPHIC AND MATERNAL FACTORS INFLUENCING UTILISATION OF ANTE-NATAL CARE (ANC) SERVICES

Factors	Received lesser than 3 ANC check-ups (Unsatisfactory)	Received at least 3 ANC Check-ups (Satisfactory)	Total	Chi.sq. value, Df, P value	Odds ratios	(95% CI)
1. Maternal age (Yrs)						
≤ 19	4(20.0)	16(80.0)	20(100.0)	1.095 df=2 P>0.05	1.00	(0.47-6.40)
20-29	31(29.2)	75(70.8)	106(100.0)		1.65	
≥30	5(35.7)	9(64.3)	14(100.0)		2.22	(0.36-14.08)
Total	40(28.6)	100(71.4)	140(100.0)			
2. Maternal education						

Factors	Received lesser than 3 ANC check- ups (Unsatisfactory)	Received at least 3 ANC Check-ups (Satisfactory)	Total	Chi.sq. value, Df, P value	Odds ratios	(95% CI)
3. Maternal occupation						
House wife/farming	36(29.0)	88(71.0)	124(100.0)	0.113 df=2	1.00	(0,18- 2,13)
Skilled/Un- skilled	4(25.0) 40(28.6)	12(75.0)	16(100.0)	P>0.05	0.81	
Total	40(28.6)	100(71.4)	140(100.0)			
4. Caste						
OC	1(3.1)	31(96.9)	32(100.0)	18.81 df=4 P<0.01	1.00	(1.51- 48.0)
BC	15(26.3)	42(73.3)	57(100.0)		11.10	
SC/ST	24(47.0)	27(53.0)	51(100.0)		27.55	
Total	40(28.6)	100(71.4)	140(100.0)			
5. Number of living children						
1	15(25.4)	44(74.6)	59(100.0)	1.37 df=4 P>0.06	1.00	(0.52- 3.13) (0.44- 4.31)
2	17(30.4)	39(69.6)	56(100.0)		1.28	
≥3	8(32.0)	17(68.0)	25(100.0)		1.38	
Total	40(28.6)	100(71.4)	140(100.0)			
6. Distance of medical facility						
<5km	16(32.7)	33(67.30)	49(100.0)	0.65 Df=2 P>0.05	1.00	(0.32- 1.69)
≥5km	24(26.4)	67(73.6)	91(100.0)		0.74	
Total	40(28.6)	100(71.4)	140(100.0)			

(Figures in parentheses indicate percentages)

The study revealed that 28.6 per cent of mothers had received lesser than three ante-natal check-ups while the National Family Health survey (1992) in Andhra Pradesh has observed 30.9 per cent of mothers to have received lesser than three ante-natal check-ups⁴.

Most of the mothers in the age group of ≥ 30 years of age had received unsatisfactory ante-natal care (35.7%) followed by the mothers in the age group of 20-29 years (29.2%) and ≤ 19 years (20.0%) respectively. But the differences were not found to be statistically significant. Unsatisfactory utilisation of ante-natal care services was high (40%) among illiterate mothers as compared to literate mothers (15.4%) and the difference was found to be statistically significant. Illiteracy with OR and 95 per cent CI of 3.67 (1.52-9.03) showed strong and significant association with unsatisfactory utilisation of ante-natal services (Table 1). Similarly, studies conducted in South Kanara district of India and Saudi Arabia have demonstrated significant relationship between education, socio-economic status and ante-natal and delivery practices.^{5, 6}

Unsatisfactory utilisation of ante-natal care services was high (29.0%) among housewives/farming occupation groups as compared to skilled/unskilled worker groups. But the difference between the groups was not statistically significant.

All the 140 mothers included in the study were Hindus. Among them the Scheduled Castes/Scheduled Tribes group had received lesser than three ante-natal check-ups (47%) followed by backward castes group (26.3%) and other castes group (3.1%). The difference between the groups was found to be statistically significant. Backward Castes group of mothers and Scheduled Castes/Tribes group with the OR and 95 per cent CI of 11.10 (1.51-48.0) and 27.55 (3.53-583.16) respectively were found to have strong and significant association with unsatisfactory utilisation of ANC services.

Mothers with at least three living children had the highest (32%) utilisation of unsatisfactory ante-natal care services compared to mothers who have two children (30.4%) and one child (25.4%) respectively, but the difference between the groups was not found to be statistically significant (Table 1).

More mothers who resided within five km from a medical facility centre had received lesser than three ante-natal check-ups as compared to other group. A study in South Kanara district of India observed that factors like illiteracy, low socio-economic status and high parity had greatest influence on use of ante-natal care services. The factors like maternal age, nuclear family and non-availability of nearby health facility had a substantial influence on restricting mothers from using ANC.⁵

Table 2 presents the socio-demographic and maternal factors which influence the quality of ante-natal care. Among the mothers who received ANC, 99 (70.7%) had received good ANC whereas ANC of average quality was received by 11 mothers (7.9%) while the rest of the mothers (21.4 %) had only poor ANC.

There was a direct relationship between educational status and good quality of ANC. Among illiterate mothers only 57.3 per cent of mothers had good quality ANC while in case of literate mothers, 86.2 per cent had good quality ANC. Likewise, 30.7 per cent of illiterate mothers had poor ANC and 10.7 per cent of literate mothers had poor ANC. The difference between these two groups was found to be statistically significant. Mothers in the occupation group of housewife/farming had received good ANC (71.8%) as compared to the occupation group of skilled /unskilled workers (62.5%). The difference between the groups was not found to be statistically significant.

TABLE 2

FACTORS INFLUENCING THE QUALITY OF ANTE-NATAL CARE RECEIVED

Factors	Good(%) (ANC Score ≥ 7)	Average (%) (ANC Score 4-6)	Poor (%) (ANC Score ≤ 3)	Total (%)	Chi.sq. value & signific ance
1. Maternal age (Years)					
≤ 19	15(75.0)	3(15.0)	2(10.0)	20(100.0)	24.79 P < 0.01
20-29	75(70.8)	8(7.5)	23(21.7)	106(100.0)	
≥ 30	9(64.3)	0	5(35.7)	14(100.0)	
Total	99(70.7)	11(7.9)	30(21.4)	140(100.0)	
2. Maternal education					
Literate	56(86.2)	2(3.1)	7(10.7)	65(100.0)	18.5 P<0.01
Illiterate	43(57.3)	9(12.0)	23(30.7)	75(100.0)	
Total	99(70.7)	11(7.9)	30(21.4)	140(100.0)	
3. Maternal occupa- tion					
House wife/farming	89(71.8)	8(6.5)	27(21.7)	124(100.0)	2.97 P>0.05
Skilled/un- skilled	10(62.5)	3(18.7)	3(18.8)	16(100.0)	
Total	99(70.7)	11(7.9)	30(21.4)	140(100.0)	
4. Caste					
OC	29(90.6)	2(6.3)	1(3.1)	32(100.0)	16.05 P<0.01
BC	43(75.4)	4(7.0)	10(17.6)	57(100.0)	
SC/ST	27(52.9)	5(9.8)	19(37.3)	51(100.0)	
Total	99(70.7)	11(7.9)	30(21.4)	140(100.0)	
5. Number of living children					
1	49(83.1)	3(5.1)	7(11.8)	59(100.0)	9.43 P>0.05
2	36(64.3)	5(8.9)	15(26.8)	56(100.0)	
≥ 3	14(56.0)	3(12.0)	8(32.0)	25(100.0)	
Total	99(70.7)	11(7.9)	30(21.4)	140(100.0)	
6. Provider of ante-natal care					
Trained personnel	91(77.8)	11 (9.4)	15(12.8)	117(100.0)	21.29 P<0.01
Untrained personnel	8(34.8)	0	15(65.2)	23(100.0)	
Total	99(70.7)	11(7.9)	30(21.4)	140(100.0)	
7. Distance of medical facility					
< 5 km	34(69.4)	6(12.2)	9(18.4)	49(100.0)	1.19 P>0.05
≥ 5 km.	65(71.4)	5(5.5)	21(23.1)	91(100.0)	
Total	99(70.7)	11(7.9)	30(21.4)	140(100.0)	

(Figures in parentheses indicate percentages)

OC=Other Castes, BC=Backward Castes, SC/ST=Scheduled Castes/Scheduled Tribes

Mothers in the age group of ≤ 19 years of age had received good ANC (75%) followed by mothers in age groups of 20-29 and ≥ 30 years (70.8%) and (64.3%) respectively. The difference between the groups was found to be statistically significant. Similarly, in a study in South Kanara district of India, 53.5 per cent of mothers in the age group of 20-29 years and 40 per cent of mothers in the age group of ≥ 30 years received good ante-natal care.⁵ This may reflect the high parity among older age groups and a consequent indifference to ANC.

Mothers in the other castes (OC) group had received good ante-natal care (90.6%). Socially disadvantaged groups which include backward castes group and scheduled castes/tribes groups had received a good ante-natal care in 75.4 per cent and 52.9 per cent of cases respectively. The difference between these groups was found to be statistically significant. Mothers with one living child had received good ANC in 83.1 per cent of cases followed by mothers with two children and $\geq$ three children who had received good ANC in 64.3 per cent and 56 per cent of cases respectively. But the difference between the groups was not found to be statistically significant.

Good ante-natal care was delivered by 77.8 per cent of trained personnel and 34.8 per cent of untrained personnel. The difference between the groups was found to be statistically significant. The distance of medical facility did not have any impact on quality of ante-natal care received, 69.4 per cent of cases with distance of medical facility ≤ 5 km had received good ANC and 71.4 per cent of cases with distance of medical facility > 5 km had received good ANC.

An attempt was made to examine the relationship if any, between number of ANC checkups and quality of ante-natal care. From Table 3, it is observed that mean ANC score was increasing with increasing number of ante-natal check-ups up to three ante-natal check-ups.. But, subsequently it has reached almost a plateau. This may be due to the fact that many of the interventions going into the quality of care could be covered in three visits which also happen to be the minimum number of ante-natal visits prescribed.

This study revealed that socio-demographic factors which include illiteracy and socially disadvantaged castes (BCs and SCs/STs) had significant influence on restricting mothers from using ante-natal care. Also among the factors which can influence the quality of ante-natal care, advanced maternal age (20-29 years and ≥ 30 years), socially disadvantaged caste (BC&SC/ST) and untrained personnel providing ante-natal care were found to have significant negative relationship with quality of ante-natal care.

TABLE 3**NUMBER OF ANC CHECKUPS AND QUALITY OF ANTE-NATAL CARE**

Number of ante-natal check-ups	Number of lactating mothers	Mean ANC score
1. 0	1	0.00
2. 1	21	1.71
3. 2	17	5.82
4. 3	28	7.14
5. 4	19	6.17
6. 5	12	7.41
7. >6	42	6.93
Total	140	

(Maximum score was taken as 8 which excludes points for number of ante-natal check-ups).

As the national health policy of India recommends ANC coverage of 100 per cent, we therefore need to concentrate our efforts to improve literacy among women and also, adopt and implement social welfare schemes for socially disadvantaged caste groups (BCs & SCs/STs). Several studies^{5,7,8} on quality of ante-natal care reveal some common problems that undermine the effectiveness of ante-natal care such as shortage of trained personnel, lack of supervision, lack of essential equipments in health facility such as haemoglobinometers, sphygmomanometers, lack of uninterrupted availability of items such as iron tablets and tetanus toxoid and under-utilisation of existing facilities.

These problems are to be sorted out by (i) Training of all Trained Birth Attendants (TBA's) and retraining wherever necessary of other health personnel; (ii) development of necessary skills and tools required for supervisory staff at all levels; (iii) properly planned logistics and uninterrupted supply of required equipment for all health facilities; and (iv) education and motivation of women for utilisation of available health services.

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**FAMILY WELFARE PROGRAMME IN INDIA UNDER TARGET SETTING AND
TARGET FREE APPROACHES: AN OVERVIEW**

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ABSTRACT

An attempt has been made in this paper to give a general overview of India's family welfare programme under the target setting as well as under target free approaches. In the process of highlighting the salient features and discussing the experience in these two approaches, it is realised that under target setting approaches, the quality of services has been deteriorated and also the choice for contraceptive methods has been reduced mainly due to its overdependence on sterilisation and also due to the rigid implementation of the target-based approach. On the other hand, under target free approach, the inflation of service statistics has been reduced and the quality of services has been improved. Now, the potential contraceptive users are tried to be covered. It is also realised that Reproductive and Child Health care may make further improvement in the quality of programme by making it more women-centred, gender-sensitive and a comprehensive programme. However, it is suggested that the most important thing for proper implementation of the programme is the change in attitude and mindset of the staff as a whole.

India is the second most populous country in the world with a population of 846.3 million in 1991 as per census enumerations with 439.2 million males and 407.1 million females. The country inhabits about 16 per cent of the world population on a 2.4 per cent of world's total quota of land with a population density of 273 per sq. km. for the year 1991. Not only is the size of population large, its rate of growth is horrifying especially in absolute number. With the present annual growth rate of 2.1 per cent, the approximate number of population of Australia is added every year to India's population. Thus, India faces the pollution problem of population explosion.

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The burgeoning population continues to have an adverse impact on the economic situation and on the quality of life of the people. This has caused virtually an upsurge of interest in the problem of population growth with at least two action orientations:

- i. to control or restrict the number of children born to couples through contraception; and
- ii. to understand the social, cultural, physiological and psychological factors affecting reproduction and use of contraception in India.

Though India is the first country in the world to have a national policy and programme for population control and has launched the family planning programme in early fifties, its performance has remained a matter of great concern.

Evolution of Family Welfare Programme In India

In India, one of the first measures that the health panel of the Planning Commission took on 11 April, 1951 was to appoint a committee to report on population growth and family planning programmes with Dr. Sushila Nayar, Mrs. Dhanvati Rama Rao, Mr. R.A. Gopalaswami, Dr. Gyan Chand and Dr. A.C. Basu as members.¹ Interestingly, India took the pride of becoming the first country in the world to have a nationwide population policy and family planning programme which started in 1952 (renamed as family welfare¹ programme in late 1970s). The programme was started as a part of general development programme but family planning performance targets were not fixed till 1965. Until then, the emphasis was on the rhythm method and the family planning programme was a part of the health programme. But in 1965, the then Union Minister for Health, Dr. Sushila Nayar declared for the first time the need for fixing family planning targets in the meeting of the Central Family Planning Council held at Chennai on December 31, 1965. The target setting was started with the idea to achieve the objective of family planning programme, i.e. to reduce the birth rate as fast as possible, so the programme became target-oriented one. The objective of the programme failed as the Family Welfare Programme (FWP) received a severe setback during the seventies due to the rigid implementation of the target-based approach. It was also realised that, though the contraception prevalence rate (CPR) was increasing but the corresponding decline in fertility was lower than expected mainly due to the following reasons:

- i. acceptance of family planning by older and higher parity couples,
- ii. poor promotion in the concept of birth spacing, and
- iii. inflated target achievements reported by the workers.

In this process, the quality of service had been deteriorated and also the choice for contraceptive methods had been reduced.

In the meantime, it was realised that in order to tackle the problem of rapid population growth in an effective manner, the satisfaction of clients must be taken into account and this can be achieved by taking care of maternal and child health, the reduction of the unmet need for the family planning and the improvement in the quality of the services. Thus, from 1 April, 1996, the FWP was implemented all over India by the Government of India on target free approach. So, all the contraceptive targets were removed from that date. This was done for the sake of quality of services and to ensure client satisfaction.

As mentioned earlier that India has the distinction of being the first country in the world to launch a nation-wide family planning programme with full Government support, it is of interest to critically assess the shifts in the approach and also the identification of gaps in the policy and the programmes. Therefore, in this exercise, the salient features of the target free and target setting approaches of FWP in India are highlighted in detail covering the positive and negative aspects of these two approaches.

India's Family Welfare Programme under Target Setting Approach (TSA)

The main goal of target setting approach was to increase the CPR and then, in turn, to reduce the birth rate at the earliest possible time by fixing the method specific numerical target for contraceptive acceptance for each worker. TSA was considered as an effective management tool after 1965 for:

- Intensifying the level of effort of the programmes.
- Using all available resources to achieve the targetted population goal.
- Assessing that the programme is moving in the desired direction.
- Putting pressure on the workers to increase CPR under the assumptions that the unmet need is high, i.e. a large number of women who want to stop child bearing or delay their next pregnancy are not using family planning methods.
- Existing delivery system is not adequate to reach all individuals unless a special effort is made.³

In order to achieve the objectives of the target setting approach and also to make it more acceptable, certain health care aspects were introduced from time to time in the family welfare programme. For example, the introduction of health aspects, maternal and child health (MCH) aspects, nutritional aspects and introduction of universal immunization programme (UIP) which were expanded into the Child Survival and Safe Motherhood (CSSM) Project, etc.

However, it is important to mention that the FWP faced a severe setback in the late seventies due to its over-dependence on sterilization. The Indian experience suggests some of the important consequences as follows:

- Targets have a skewed emphasis on specific methods.
- Inadequate attention was given to the quality of the family planning services. Quantity was given preference over the quality of the services.
- Poor counselling to clients.
- Poor follow-up services for family planning acceptors.
- Lack of informed choices for clients.
- Client's needs are generally neglected by the family planning workers.
- Inflated target achievement reported by the workers, especially in the case of temporary methods.
- Though the CPR has increased substantially but the reduction in the birth rate was not satisfactory mainly due to the acceptance of family planning by older and higher order couple and also due to the poor promotion of the concept of birth spacing.
- Long-term demand generation activities are neglected. Motivational and educational activities (IEC activities) were given a very low priority.

Therefore, these consequences can be considered as the limitations of TSA. Thus, the TSA was severely criticised by many and the alternatives to the target setting were suggested by researchers based on the need to strengthen MCH care; the reduction of unmet needs for family planning; and efforts to improve the quality of care and the quality of services.

Further, the Government of India (GOI) recognised the limitations of TSA and the FWP approach was made target free approach (TFA) from April 1, 1996.

Indian Family Welfare Programme under Target Free Approach (TFA)

The withdrawal of targets is not an immediate consequence, rather it is a cumulative effect of criticisms of TSA. During 1980 and 1995, few State Governments and Ministry of Health and Family Welfare, GOI, had decided to withdraw the method-specific-target approach on an experimental basis from one or two districts in each State. This was done to get first-hand experience of the impact on the programme without any target and to search for alternative approaches to manage the programme, without using target achievements as a monitoring tool. Based upon the experiences and feedbacks of withdrawal of method-specific-target approach from different States and also based on the recommendations made in the International Conference on Population and Development (ICPD) at Cairo, Egypt, held during September 5-13, 1994 and also

based on the recommendations made by Dr.Swaminathan Committee (1994), it was decided by the Government of India to withdraw family planning method targets from the entire country from April 1, 1996.

The family welfare programme in India was made target free basically to ensure the satisfaction of clients by providing better quality of services. Even though the targets were withdrawn from April 1, 1996, training of staff and other preparatory work were completed only in later part of 1997-98.

A review of the implementation process of the TFA in different States also shows that, while in many States the target setting approach was totally withdrawn, there were yet a number of States where it remained in variant forms.

The following are the points that highlight the implementation of TFA at national level:

- Process of implementation of TFA varied considerably across the country. In some States, the TSA was still prevalent in various forms.
- Most of the States would have preferred a gradual approach to the withdrawal of family planning targets.
- The period between April 1996 and October 1997 was a transitional phase in which staff members were not sure of the content of TFA, or how to monitor the programme.
- The performance of total acceptors had gone up by 3.6 per cent during April to August, 1997 as compared to the corresponding period of the previous year.
- The decline in service statistics also reflected the reduction in pressure to inflate the figures of family planning acceptors, often observed under TSA.
- Sensitisation process at different levels of staff at district and block has been observed in all the States with varying degree.
- Improvement in the MCH care has been noticed in several States.
- Younger and lower order couples are not being motivated for the use of temporary methods to have space between births.

New Focus of Family Welfare Programme under Target Free Approach

The importance of TFA was already established by the mid of 1997. Then it was realised to the extent that the national family welfare programme from a segregated approach under family planning and MCH services to that of integrated approach under Reproductive and Child Health (RCH) services. As a

next step to TFA, the RCH programme of the Ministry of Health and Family Welfare was launched in October, 1997.

Thus, the RCH project involves recognition of Child Survival and Safe Motherhood (CSSM) and related programmes into RCH package of programs by adding components of sexually transmitted diseases (STD) and reproductive tract infections (RTI). This integration will reduce the overlapping of programmes and thereby save on administrative financial inputs.

The following are the main thrust of RCH :

- Community participation in planning and prioritizing need by the community.
- Client-centred approach of services by the health care providers.
- Upgrading the existing facilities.
- Improved training including client approach – gender sensitivity and technical skill.
- Emphasis on good quality care.
- Absence of pressure of contraceptive targets on health providers and also absence of pressure on acceptors of contraception because of no incentives.
- Multi-sectoral approach.
- Making services gender sensitive, also involving men.
- Life cycle approach.
- Effective supervision and monitoring.
- Increase in participation by non-governmental organisations (NGOs).
- Choice of methods.
- Technical competence.
- Information to clients.
- Interpersonal relations.
- Mechanism to encourage continuity care.

CONCLUSION

Under the Target Setting Approach (TSA), the family planning method-specific targets were fixed to achieve long-term demographic goals but these targets became an end in itself and not the means to bring about the expected decline in the birth rates. This numerical method-specific target-based approach suffered setback due to the poor quality of services provided to the clients under the FWP and it could not meet the needs of an individual client. Therefore, a need arose to introduce decentralised participatory approach with emphasis on clients' satisfaction and quality of services under target free approach discarding the target setting approach. Based on the experience gained during the experimental approach and also based on recommendations of International Conference on Population and Development, Cairo and Dr. Swaminathan Committee, the TFA for the FWP was expanded throughout the country from April 1996. Quality of the programme has improved since then, particularly the coverage and care of pregnant women. Now the grassroot workers are not only providing MCH services and not merely choosing women for sterilisation, their credibility among the community has also improved. Inflation of service statistics has been reduced. Quality of services has been improved and the potential contraceptive users are tried to be covered.

The intention of RCH programme is also laudable which may make desirable behavioural changes that would lead to change in the quality of the programme, RCH project may make the programme more women centred, gender sensitive and a comprehensive one. Thus, the target free approach should continue to be implemented as a fundamental concept of the RCH programme. However, if the mindsets and attitudes of staff do not change, there may not be a big change in the implementation of the programme.

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FACTORS INFLUENCING ACCEPTANCE OF FEMALE STERILISATION FROM PRIVATE HEALTH CARE PROVIDERS IN KERALA

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ABSTRACT

This paper examines the factors which influence the utilisation of sterilisation services from private health care providers in Kerala, a State well known for its demographic achievements and for policies promoting equitable distribution of health and educational facilities. The National Family Health Survey (NFHS) 1992-93 data on source of sterilisation for 1662 ever-married women who had undergone female sterilisation, the most popular method family planning in the State as elsewhere in India, was used for this study. The participation of private sector in providing sterilisation services was limited as compared to their interest in delivering other health care services. In fact, these services were mostly availed of by persons from higher educational and economic strata. Though quality of private sector was better than public sector, it was found that a considerable proportion of women who used private sector resources were still dissatisfied with the quality of service they received, even after paying for these services.

The improvement in the role of non-bureaucratic private provider is recommended on ground that in one way it increases the overall resources as well as decreases the burden of family welfare of the government.¹ The family welfare services in India are available free of cost through hospitals in urban areas and through primary health centers and sub-centers in rural areas. Besides this family planning camps are conducted periodically to provide sterilisation services to the couples. In fact the government played a major role in initiating contraceptive use by the target group by spreading the message of family planning across the country and there by developing a desire among them to limit their family size. The private sector, which collects user charges, came to scene, after government played a major role in providing these services.

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Today, private sector plays an important role in providing family planning services in India. While analyzing source of family planning services in India,² it was found that the majority of the users were depending on private providers for the supply of temporary methods like condoms and pills, which can be easily obtained from shops/other private sector outlets. But, for IUD/Copper-T, which requires clinical atmosphere, the proportion relying on private providers was lesser. The level of acceptance of permanent methods of male/female sterilisation from private providers was also very low.

The willingness to pay is an important factor which determines the utilisation of these kind of services from non-subsidised private sector. Evidences show that the acceptors who had received family planning services from private providers would like to have better facilities and better environment and were willing to pay.³ Therefore, quality of services was another factor which influence the client while choosing the source of supply. There are also studies which argue that women may use private sector services because of its superior quality as compared to public sector services.^{2,4} Another study,⁵ showed that the level of contraceptive morbidity reported in India and in a few selected States was lesser among acceptors of sterilisation from private sources than acceptors from public sources.

Here we are interested in acceptance of the most popular method of female sterilisation from the private providers in Kerala. As per National Family Health Survey (NFHS) 1992-93, the proportion accepting female sterilisation from private providers was the highest in Kerala (23.2%). In fact the level of use was much less when compared to utilisation of other family planning services from private health care providers, reflecting a lower level of participation of private sector in delivery of family planning services. Experience of other developing countries shows that utilisation of family planning services from private providers is positively related with the economic condition of the women⁶. Differentials in utilisation of family planning services from private sector by economic background³ by place of residence and educational background of women are reported in India also.² It is necessary to examine the extent of disparities in utilisation of sterilisation services from private providers, between different sub-groups of population in Kerala, characterized by universal literacy and extension of medical services.

Also little is known about the quality of services in private sector in Kerala. But there are a few studies^{7,8} on quality of services by public sector in family welfare programmes in the State, which represents the pitfalls in pre-sterilisation check up, maintenance of aseptic conditions and provision for meeting women's needs after sterilisation. Therefore along with differentials in level of utilisation of sterilisation services from private sector, the author has included the users' perception of quality of services provided in each sector in the analysis. Here, source of sterilisation is classified into public and private sectors

based on ownership. Services under direct control of the government were taken as public sector and the rest were treated as private sector.

METHODOLOGY

The study is based on National Family Health Survey (NFHS) 1992-93 data pertaining to Kerala State. Information on 1,662 women (out of the sample of 4,332 ever-married women) who have undergone sterilisation is considered for analysis. The NFHS also gives information on rating of care during sterilisation and problems after sterilisation. The source of sterilisation for these 1,662 sterilised women is analyzed by background characteristics of the user as well as available quality of health care indicators mentioned. Logistic regression analysis is used to understand the chance of using private sector among different sub-groups of population and to study the relative performance of public sector and private sector in terms of users satisfaction.

FINDINGS

Differentials in Acceptance of Female Sterilisation

Table 1 presents the source of female sterilisation by background characteristics of the women. It can be seen from the table that a higher proportion of women who got sterilised at older ages had accepted the method from private providers. The level of acceptance of sterilisation from private providers is showing an increasing trend. The private sector increased from 20.2 per cent among those who adopted sterilisation five years prior to the survey date to 31.8 per cent in five years. Analysis by children ever born shows that proportion of adopting sterilisation from private providers is to be marginally higher among women with fewer children.

Rural/urban differentials in acceptance of sterilisation from private providers is only marginal. About 24.4 per cent among urban and 22.6 per cent among rural users had accepted this method from private providers. Religionwise differentials showed that the level of use was the lowest among Hindus (19.4%), whereas 31.6 per cent among Muslims and 28.0 per cent among Christians got sterilised from private sector outlets.

The level of use from private sector was found to be higher among women with higher educational background. 51.6 per cent among the high school educated woman got sterilised from private providers and only 9.2 per cent among illiterates had obtained the same from private providers. The Standard of Living Index (SLI)⁹ based on facilities in the household of the women is used as proxy for understanding the economic background of the women. The relationship between the standard of living (SLI) of the women and acceptance of sterilisation from private sector outlets was almost similar as in the case of educational background. The proportion of women who got sterilised from private sector varied according to SLI. It was 9.5 per cent among low SLI category, 22.5 per cent among medium SLI background and 57.8 per cent among high SLI background. This may be due to the inter-relationship between variables such as education and religion and therefore the picture becomes more clear only through multivariate analysis. The non-working women were more likely to prefer private sector than working women (Table 1).

TABLE 1

**PERCENTAGE DISTRIBUTION OF STERILISED WOMEN BY TYPE OF PROVIDER
AND BY BACKGROUND CHARACTERISTICS OF THE ACCEPTORS**

	Public	Private	Total
Age at sterilisation	81.7	18.3	100(548)
Less than 25 years	73.9	26.1	100(637)
30 years and above	70.8	29.2	
Years lapsed since sterilisation			
Less than 5 years	68.2	31.8	100(516)
More than five years	79.8	20.2	100(1032)
Children ever born			
Less than 3	74.7	25.3	100(649)
3 & above	78.2	21.8	100(1011)
Place of residence			
Urban	75.6	24.4	100(475)
Rural	77.4	22.6	100(1187)
Religion			
Hindu	80.6	19.4	100(1048)
Muslim	68.4	31.6	100(263)
Christian	72.0	28.0	100(346)
Educational level			
Illiterate	90.8	9.2	100(293)
Literate-primary	82.9	17.1	100(690)
Middle school complete	75.9	24.1	100(404)
High school and above	48.4	51.6	100(275)
Standard of Living Index (SLI)*			
Low	90.5	9.5	100(654)
Medium	77.5	22.5	100(738)
High	42.2	57.8	100(270)
Work status			
Yes	84.0	16.0	100(480)
No	74.0	26.0	100(182)
Total	76.9(1276)	23.1(386)	100(1662)

*Source: Computed from NFHS92-93, Kerala data. Figures in paraenthesis denote the total number of cases. *standard of living index is based on type of house, facilites for cooking, drinking water, toilet facilites, ownership of livestock and ownership of consumer goods (Roy and Jayachandran 1996)*

Logistic regression analysis has been applied to understand the effect of each variable on the use of contraceptives from private providers. Here the source of sterilisation (0 if public and 1 if private) is the dependent variable. The variables such as the age at sterilisation and children ever born have been dropped since they don't have any direct relationship with utilisation of sterilisation services from private providers. The results presented in Table 2 give the multiplicative effect of each predictor variable on acceptance of

sterilisation from private providers keeping all other predictor variables as constant.

TABLE 2
ODDS RATIO FROM LOGISTIC REGRESSION ANALYSIS OF ACCEPTANCE OF
STERILISATION FROM PRIVATE PROVIDERS

	Odds ratio
Year of lapsed since sterilisation	
Less than 5 years	1.7729*
More than five years#	1
Place of residence	
Rural#	1.3296
Urban	1
Educational level	
Illiterate#	1
Primary-middle school	1.6540**
Middle school complete	2.0139*
High school and above	4.4547*
Religion	
Hindu#	1
Muslim	2.2202*
Christian	1.3731
Standard Living Index (SLI)	
Low#	1
Medium	2.2235*
High	8.1173*
Working Status	
Yes	0.8157
No#	1

*level of significance<.01 percent

**level of significance<.05 percent

#indicates the reference category

It can be seen that the variable years lapsed since sterilisation, educational level, religion and standard of living of the respondents have a positive relationship with acceptance of sterilisation from private providers. The acceptance level was 77 per cent higher in the case of women who have adopted sterilisation during the last five years prior to the survey. The odds of accepting sterilisation services from private providers by literates increased as compared to illiterates. The muslims were 12.2 per cent more likely to rely on private sector for sterilisation services than Hindus. Though Christians were more likely to rely on private providers for sterilisation services, the relationship was insignificant. The ratio was found to increase with every increase in standard of living. The odds multiplied to 2.22 for medium SLI category to a very high value of 8.12 for high SLI category. Though the working women were less likely to depend on private providers, the relationship was found to be insignificant. The relationship between work status and

acceptance of sterilisation from private providers becomes clear only if analysed by nature of work done by the women.

Quality of Services

Data on rating of quality of care received during sterilisation and on problems due to sterilisation operation will be useful to study about users' perception about the quality of care by each sector during the time of sterilisation. The rating of sterilisation care varied widely between public and private sectors. The care during sterilisation operation is excellent/very good (62.5%) in private sector and only 46.3 per cent in public sector. As compared to public sector (5.6%) the proportion reporting quality of service to be not so good/bad is lesser in private sector (1%). Similarly, the problems due to use of a method, i.e. contraceptive morbidity was reported to be lesser in private sector (14.5%) than in public sector (19.5%).

TABLE 3

PERCENTAGE DISTRIBUTION OF ACCEPTORS OF FEMALE STERILISATION BY RATING OF CARE RECEIVED DURING STERILISATION AND PROBLEMS AFTER ACCEPTANCE OF STERILISATION, KERALA 1992-93

	Public	Private
Rating of care during sterilisation		
Excellent/Very good	46.3	62.5
Alright	48.1	36.5
Not so good/Bad	5.6	1.0
Total	100	100
Problems after sterilisation		
Yes		
No	19.4	14.3
Total	80.6	85.7
	100	100

Source: computed from Kerala data from NFHS 92-93

Table 4 gives odds ratio obtained from logistic regression with rating of care during sterilisation (0, if excellent/very good or 1, if otherwise) as dependent variable and source of supply (0, if public 1, if otherwise) as predictor variable. Similar exercise is repeated by taking problem after sterilisation (1, if Yes or 0, if No) as dependent variable and source of supply as predictor variable.

It can be seen that a user who had accepted sterilisation from a private provider is more likely to report that the quality of service he/she received is better than a user who had accepted it from public sector. This observation was significant. As compared to public sector, the odds (.6968) of reporting problems due to sterilisation is lesser in private sector.

TABLE 4

**RESULTS OF BIVARIATE LOGISTIC REGRESSION ANALYSIS RATING OF
CARE AND
PROBLEMS AFTER USE OF A METHOD**

	Odds ratio for dependent variable	
	Rating of sterilisation care as	Problems after sterilisation
Independent variable	1	1
Public provider	1.9317*	.6968
Private provider		

**level of significance < .01 percent*

***level of significance < .05 percent*

The available information regarding user's perception of quality of care gives an indication that the overall performance of private sector is better than public sector. But such a conclusion is premature because these perceptions are bound to vary based on user's characteristics which are not considered in this analysis.

CONCLUSION

In Kerala where government family planning programme is popular for a long time, there has been a gradual shift from public sector to private sector. The role of private sector in providing sterilisation care services is still limited as compared to other health care services in the State. Pricing seems to be the differentiating factor as the private sector seems to be catering to the needs of people for higher educational and economic strata. The quality of service reported in private sector is better than in public sector.

Though the contraceptive use among the Muslims is low, the preference for alternative sources for sterilisation services is much higher among them. The need for privacy due to fear of religious reasons or preference for a female doctor might have forced them to seek services from private providers. As expected, differentials by place of residence were insignificant due to availability of transport and communication facilities in the State.

Though unregulated, performance of private sector is better than public sector. But care has to be taken to see whether the clients are able to exercise their rights over the quality of service even after paying for these services. As in a few cases, the clients from this sector were not satisfied with the amount of care they received. Along with this,

care has to be taken to improve the quality of service in public sector which is catering to majority of the population of the State.

ACKNOWLEDGEMENT

This paper is part of my M.Phil thesis submitted to Janawaharlal Nehru University, New Delhi. Help rendered by Professor Muralidhar Vemuri for conducting this study is gratefully acknowledged.

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**HEALTH COMPLICATIONS PREVALENT AMONG NON-INSULIN DEPENDENT
DIABETES MILLITUS (NIDDM) PATIENTS OF HISAR CITY (HARYANA)**

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ABSTRACT

An attempt has been made in this study to investigate the prevalence of morbidity, diabetic coma and hypoglycemia among 150 NIDDM patients of Hisar city. The study revealed that twenty eight per cent of total patients were suffering from only hypertension while 6.67 per cent were obese and 4.67 per cent had ischemic heart disease (IHD). The study has further shown that twenty seven patients (18%) had combination of hypertension+Obesity or hypertension+IHD or hypertension+obesity+IHD or HOI and other complications. The occurrence of diabetic coma was found only in 16.44 per cent. Forty three per cent of subjects had positive family history of diabetes

Diabetes, the word comes from the Greek language, means to pass through, to flow through, and millitus means sweet. Hence, this is merely a description of what is happening in our body (a fluid containing sugar passes through body). It is not a disease, but a whole spectrum of disorders, characterized by impaired insulin secretion and impaired tissue sensitivity to insulin^{1,2}. Heart disease is an important concomitant of diabetes millitus which may be the result of several pathological mechanisms resulting in varied cardiac manifestations in diabetes³. It has a definite positive association with ischemic heart disease (HD)⁴ and between obesity and metabolic complications such as insulin resistance, hyperinsulinemia and diabetes millitus⁵. Although specific microvascular disease contributes significantly, atherosclerosis remains the main important cause of morbidity and mortality in long standing diabetes⁶. Vascular disease is a major long-term complication of diabetes, 60 per cent of diabetic patients die of coronary heart disease⁷.

So keeping all these in view, the present investigation had been planned to assess the prevalence of morbidity and other health complications in NIDDM patients of Hisar city, Haryana (India).

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METHODOLOGY

A list of 354 NIDDM patients was prepared by collecting information from patients coming to various hospitals like university dispensary, civil hospital and private nursing homes at OPD time and blood analysis laboratories. From the list, 150 NIDDM patients (both males and females) above 40 years of age were randomly selected who were living in different areas of Hisar city.

FINDINGS

Hypertension was found to be the most prevalent complication among NIDDM subjects. Twenty eight per cent of patients were suffering from hypertension only while on the whole 46 per cent were suffering from hypertension along with other complications such as obesity, ischemic heart disease (IHD), constipation, etc. On age-wise distribution, it was observed that as the age increased, the percentage of subjects having complications also increased. In the age group of 40-50 years, maximum patients (50.68%) were having no complications while 30.14 per cent were suffering from hypertension followed by obesity (6.85%) and hypertension, obesity, IHD[HOI] and renal diseases. In the age group of 50-60 years, 43.48 per cent of patients had no complications while 21.74 per cent were suffering from hypertension followed by obesity (10.87%) and similar percentage of patients (4.35%) were suffering from either IHD or hypertension and obesity or HOI and gall bladder disease. Among patients of more than 60 years of age, less percentage of patients (22.58%) were having no complications than other age groups. Maximum patients (25.81%) were suffering from hypertension followed by hypertension and IHD or HOI and constipation (16.13%), IHD (9.68%) and HOI and gall bladder disease (6.45%) . If we add up all the cases of one complication in each age group, it was found that 39.73 per cent of 40-50 years, 41.30 per cent of 50-60 years and 67.74 per cent of patients of more than 60 years of age were suffering from hypertension. Similarly, 15.07, 26.09 and 25.81 per cent were suffering from obesity and 9.59, 15.22 and 48.39 per cent of patients were suffering from IHD, respectively.

On sex-wise distribution, it was found that 43 per cent of male and 42 per cent of female patients had no complications. It was found that more females (35.48%) were suffering from only hypertension than their male counterparts (22.73%) while almost similar percentage of male and female patients were suffering from obesity only. If we add up all cases of one complication, it was found that 43.18 per cent of male and 50 per cent of female patients were suffering from hypertension followed by 21.59 and 19.35 per cent from obesity and 23.86 and 12.90 per cent from IHD, respectively.

TABLE 1
COMPLICATIONS PRESENT IN DIABETIC PATIENTS IN RELATION TO AGE, SEX
AND BMI(Kg/m²)

					Compli cations					
Varia bles	To tal (n =1 50)	Hypert ension	Obesit y	IHD	Hypert ension +Obesi ty	Hypert ension + IHD	HOI+C onstipa tion	HOI+ Renal disea ses	HOI+ Gall blader disea ses	Absenc e of these compli cations
Age (yrs)										
40- 50	73	22 (30.14)	5 (6.85)	2 (2.74)	2 (2.74)	1 (1.37)	0	3 (4.11)	1 (1.37)	37 (50.68)
50- 60	46	12 (21.74)	5 (10.87)	2 (4.35)	2 (4.35)	0	2 (4.35)	1 (2.17)	2 (4.35)	20 (43.48)
>60	31	8 (25.81)	0	3 (9.68)	1 (3.23)	5 (16.13)	5 (16.13)	0	2 (6.45)	7 (22.58)
Sex										
Male	88	20 (22.73)	6 (6.82)	6 (6.82)	3 (3.41)	5 (5.68)	5 (5.68)	2 (2.27)	3 (3.41)	38 (43.18)
Fem ale	62	22 (35.48)	4 (6.45)	1 (1.61)	2 (3.23)	1 (1.61)	2 (3.23)	2 (3.23)	2 (3.23)	26 (41.94)
BMI(Kg/m ²)										
<28. 00	11 1	29 (26.13)	1 (0.90)	5 (4.50)	1 (0.90)	6 (5.41)	4 (3.60)	2 (1.80)	3 (2.70)	60 (54.05)
28.0- 34.9	34	11 (32.35)	7 (20.59)	1 (2.94)	4 (11.76)	0	3 (8.82)	2 (5.88)	2 (5.88)	4 (11.76)
35- 39.9	5	2(40.0)	2(40.0)	1(20. 0)	0	0	0	0	0	0
Total	15 0	42 (28.0)	10 (6.67)	7 (4.67)	5 (3.33)	6 (4.0)	7 (4.67)	4 (2.67)	5 (3.33)	64 (42.67)

Figures in parentheses indicate percentages

IHD-Ischaemic Heart Diseases

HOI-Hypertension+Obesity+IHD

Multiresponse table.

On the basis of BMI classification, it was found that 54 per cent of patients with BMI<28.00 had no complications and as BMI increased there was an increase in percentage of patients with complications. The data revealed that 26,13,32,35 and 40 per cent of patients with BMI<28.00,28.0-34.9 and 35.0-39.9 were suffering from hypertension only, respectively. Similarly, 0.90, 20.59 and 40 per cent were suffering from obesity and 4.50, 2.94 and 20.0 per cent were suffering from IHD only. If we add up all cases of hypertension, it was found that 40.54,64.71 and 40 per cent patients with BMI < 28,28.0-

34.9 and 35.0-39.9 were suffering from hypertension. Similarly, 9.91, 54.94 and 40.0 per cent were obese and 18.02, 23.53 and 20 per cent were suffering from IHD, respectively.

On the whole it was found that 57.33 per cent of subjects were having complications while 42.67 per cent of them were having no complications. Forty six, 20.67 per cent and 19.33 per cent of patients were suffering from hypertension, obesity and IHD and a smaller number of them also suffer from constipation, renal diseases and gall bladder diseases.

Occurrence of diabetic coma, its symptoms and hypoglycemia are presented in Table 2. It was found that occurrence of diabetic coma was maximum (41%) in patients of above 60 years of age and minimum (10%) in patients of 50-60 years of age. On sex-wise distribution, it was found that diabetic coma occurred in more male (26%) than female (11%) patients. On the basis of BMI, it was observed that occurrence of diabetic coma (9%) was less in patients with low BMI (<28) than patients with >28BMI (20-23%). Unconsciousness + jadedness and unconsciousness + jadedness + headache were found the most prevalent symptoms of diabetic coma.

All the patients were managing diabetes by oral hypoglycemic agents (OHA) and were not taking insulin injection in routine. However insulin injection taken by patients is given in Table 3. It was found that majority of the patients (90%) had not ever taken insulin injections while only 10 per cent had taken insulin injections during some of the special conditions such as during operation, delayed wound healing, delivery time, fracture and uterous removal. With regards to age, maximum patients (13%) of 40-50 years of age, 12 per cent patients of above 60 years of age and 4 per cent patients of 50-60 years of age, took insulin injection. On sex-wise ditribution, it was found that more female (14%) patients had taken insulin injection than male patients (7%).

TABLE 2

**OCCURRENCE OF DIABETIC COMA, ITS SYMPTOMS AND
HYPOGLYCEMIA
IN RELATION TO AGE, SEX AND BMI OF SELECTED DIABETIC PATIENTS**

		Age (years)		Sex			BMI(K g/m ²)	
	40-50 (n=73)	50-60 (n=46)	>60 (n=31)	Male (n=88)	Femal e (n=62)	<28 (n=111)	28- 34.9 (n=34)	35- 39.9 (n=5)
No Diabetic Coma	61 (83.56)	41 (89.13)	18 (58.06)	65 (73.86)	55 (88.71)	90 (81.08)	26 (76.47)	4 (80.0)
Diabetic coma	12 (16.44)	5 (10.87)	13 (41.94)	23 (26.14)	7 (11.29)	21 (9.01)	8 (23.53)	1 (20.0)
Sympto ms								
Unconsi ousness +Jadde d	7	0	2	9	0	7	2	0
U+J+He adache	0	0	8	6	2	6	2	0
U+J+Fel l down	0	0	2	0	2	2	0	0
Jaadde d	1	2	0	3	0	0	3	0
U+J+Po lyuria	1	0	1	0	2	1	0	1
J+Tired	1	0	0	1	0	1	0	0
U+Tired	1	0	0	1	0	1	0	0
U+Polyu rea	0	1	0	1	0	1	0	0
Uncons ciousne ss	1	2	0	2	1	2	1	0
Hypogly cemia	34 (46.58)	22 (47.83)	18 (58.06)	41 (46.59)	33 (53.23)	53 (47.75)	18 (52.94)	3 (60.0)
No Hypogly cemia	39 (53.42)	24 (52.17)	13 (41.94)	47 (53.41)	29 (46.77)	58 (52.25)	16 (47.06)	2 (40.0)

Figures in parentheses indicate percentages

U=Unconsciousness

J=Jadded

TABLE 3
FREQUENCY OF INSULIN INJECTION INTAKE DURING SPECIAL CONDITIONS IN RELATION TO AGE, SEX AND
BLOOD SUGAR LEVELS

	Total (n=150)	Insulin Injection Taken		Reasons for taking insulin injection				
		No (n=134)	Ywa (n=16)	During Operatio n (n=6)	During delayed would hbealing (n=3)	During delivery (n=3)	During fracture (n=2)	During uterous removal (n=2)
Age (Years)								
40-50	73	63(86.30)	10(13.70)	4(40.0)	1(10.0)	3(30.0)	0	2(20.0)
50-60	46	44(95.65)	2(4.35)	1(50.0)	1(50.0)	0	0	0
>60	31	27(87.10)	4(12.90)	1(25.0)	1(25.0)	0	2(50.0)	0
Sex								
Male	88	81(92.05)	7(7.95)	2(28.57)	3(42.86)	0	2(28.57)	0
Female	62	53(85.48)	9(14.52)	4(44.44)	0	3(33.33)	0	2(22.22)
Blood Sugar(mg/100ml)								
Fasting								
<100	49	43(87.76)	6(12.24)	5(83.33)	1(16.67)	0	0	0
100-120	58	55(94.83)	3(5.17)	1(33.33)	0	0	2(66.67)	0
120-200	31	29(93.55)	2(6.45)	0	2(100.0)	0	0	0
>200	12	7(58.33)	5(41.67)	0	0	3(60.0)	0	2(40.0)
Postprandia l								
180-200	64	58(90.63)	6(9.37)	5(83.33)	1(16.67)	0	0	0
200-225	26	24(92.31)	2(7.69)	1(50.0)	1(50.0)	0	0	0
225-300	40	36(90.0)	4(10.0)	0	0	2(50.0)	2(50.0)	0
>300	20	16(80.0)	4(20.0)	0	1(25.0)	1(25.0)	0	2(50.0)

Figures in parentheses indicate percentages

TABLE 4
FAMILY HISTORY OF DISEASES AND COMPLICATIONS OF SELECTED DIABETIC PATIENTS

Complica tions present in patients	Total (n=15 0)	Complications present in parents										
		Diab etes	Hyper tension	Obesit y	IHD	Hyperte nsion+O besity	Hypert ension +IHD	Hypert ension +Obesi ty+IHD	Consti pation	Gall bladder diseas es	Renal Proble ms	Absen ce of diseas es
Hyperten sion	42	19	4	1	0	1	2	4	0	0	0	14
Obesity	10	4	0	2	2	0	0	0	0	0	0	3
IHD	7	2	0	2	2	0	0	0	0	0	0	5
Hyperten sion+Obe sity	5	4	0	2	2	2	0	0	0	0	0	4
Hyperten sion+IHD	6	4	3	0	2	0	0	0	0	0	0	1
HOI+Con stipation	7	1	1	0	0	0	0	0	0	0	0	1
HOI+Ren al Problems	4	4	2	0	1	0	2	0	0	0	0	1
HOI+Gall bladder disease	5	4	2	0	0	0	2	0	0	0	0	1
No above complicat ions	64	16	14	4	0	0	4	0	0	0	0	3
Total(n=1 50)		64(4 6.47)	26(17 .3)	12(8.0)	9(6.0)	3(2.0)	10(6.67)	6(4.0)	0	0	0	66(44. 0)

HOI=Hypertension+Obesity+IHD(Ischaemic Heart Diseases)

Multiple response table

Figures in parentheses indicate percentages.

Data regarding family history of diabetes and prevalence of complications are given in Table 4 . Forty two patients who were suffering from hypertension, their parents (19) had diabetes followed by hypertension and hypertension+obesity+IHD while parents of 14 subjects had no diseases. Ten patients were suffering from obesity, four of their parents had diabetes and two of their parents had either obesity or IHD. Sixty four patients were having no complication, whereas their parents had diabetes, hypertension, obesity and IHD. Some of the patients who were suffering from certain complications, their parents also exhibited the presence of some related diseases. On the whole it was found that 42 per cent of parents had family history of diabetes followed by hypertension (17%), obesity (8%) , Hypertension+IHD (6%) while 44 per cent of patients had no family history of any disease.

DISCUSSION

A complication is a disease or adventitious condition coexistent with and modifying a primary disease. Diabetic patients can develop acute as well as long term complication including hypertension, ketoacidosis, tuberculosis, infection of skin, urinary tract and feet. The long term complications include atherosclerosis, hypercholesterolemia microangiopathy, nephropathy and neuropathy.

It was found that as age increased, there was an increase in percentage of patients having complication, hypertension, obesity and IHD. Hypertension was found most prevalent complication in patients of all age groups. While earlier study reported that approximately 60 per cent of type 2 diabetics suffered from hypertension⁴. Diabetic subjects are likely to develop hypertension⁹. The association between NIDDM and hypertension is reported to be independent of age and obesity¹⁰. When the two diseases coexist, hypertension antedates the diagnosis of diabetes eight times more commonly than the reverse sequence^{11,12}. One possible reason is the diabetogenic effect of drugs used to treat hypertension. While other workers found that hypertension in diabetic is associated with increased exchangeable body sodium⁹.

Obesity is the result of excessive expansion of adipose tissue mass. A close association between obesity and diabetes has long been recognised in the present study, obesity was found the second most prevalent complication in the diabetic patients. The data revealed that as age and BMI increased, there was an increase in percentage of patients suffering from obesity. A higher percentage of male patients were suffering from obesity than the female patients.

Obesity has been shown to be an independent risk factor for NIDDM¹³. The incidence of NIDDM increased with age¹⁴. In the present study, out of 150

diabetics, 29 cases (19.33%) had been suffering from IHD which appears to be quite high incidence when compared with survey conducted earlier by Solanki et.al. (1972) who reported incidence of IHD to be 11 per cent ¹⁵. However, it was comparable to that reported by other workers ^{16,17,18}. A higher incidence of IHD (40%) was also reported by some workers ^{19,20}. Chances of heart disease doubled in obese persons, where chances of getting diabetic were three and a half times greater than non-obese subjects ²¹.

It has been seen in the present study that the incidence of IHD increased with the advancement of age of the patients. This is consistent with the previous findings ^{22,23}. It has also been pointed out that an incidence of IHD in diabetes is more after the age of 40 years ¹⁶. Highest incidence of IHD in the 5th and 6th decades of life has also been observed by other workers ^{24,25}.

On sex-wise distribution, it was found that 43 per cent of male and 41 per cent female of patients had no complications. Hypertension was more prevalent in females than their male counterparts. Similar to the results of present study, female preponderance has also been reported ^{25,26}. Higher incidence of hypertension in males was also reported earlier ^{22,23} and similar incidence of hypertension in both males and females has been reported in an earlier study ¹⁶.

The data revealed that higher percentage of male patients suffered from obesity and IHD than the female patients.

On the basis of body mass index (BMI), it was found that majority of patients with BMI below 28 were having no complications and as BMI increased there was decrease in percentage of patients with no complications. It was found that with increase in BMI, percentage of patients having hypertension, obesity, IHD and other complications also increased.

Multiple regression analysis showed age, WHR, BMI and female sex were correlated with diabetes ²⁷. It was found that the percentage of patients having hypoglycemia increased with an increase in age and BMI.

The percentage of patients who had taken insulin injection, increased with increase in fasting and postprandial blood glucose level. It was observed that insulin injections were taken only during emergencies. In earlier study it was reported that out of 316 NIDDM patients, 199 (62.9%) were on insulin and other 117 (27.1%) on OHA ²⁸.

In the present study, it has been found that there is definitely a strong relationship between family history and diabetes. Some workers earlier reported that prevalence of diabetes in first degree relatives of known diabetics varied

from 12.1 to 15.4 per cent²⁹ and 70 per cent³⁰. Those with positive family history of diabetes and those with a large number of relatives affected with the condition had a greater chance of developing diabetes³¹.

Heredity plays an important role in conferring susceptibility to diabetes. The closer the blood relationship a person to a diabetic, the greater are the chances of developing the disease. The familial tendency to diabetes undoubtedly exists but certainty about its exact mode of transmission has not yet been identified. Some workers reported that parental history of NIDDM influences the insulin response to the oral glucose load³². NIDDM results from action of at least one major susceptible gene which is to be identified³⁴. Some workers reported that a greater risk of NIDDM transmission is from mother than father^{30,34}.

CONCLUSION

Thus the study indicated the high prevalence of hypertension, heart diseases, positive family history of diabetes and other complications. So, diet counselling and health education of the patients are essential so that patients can control these problems.

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