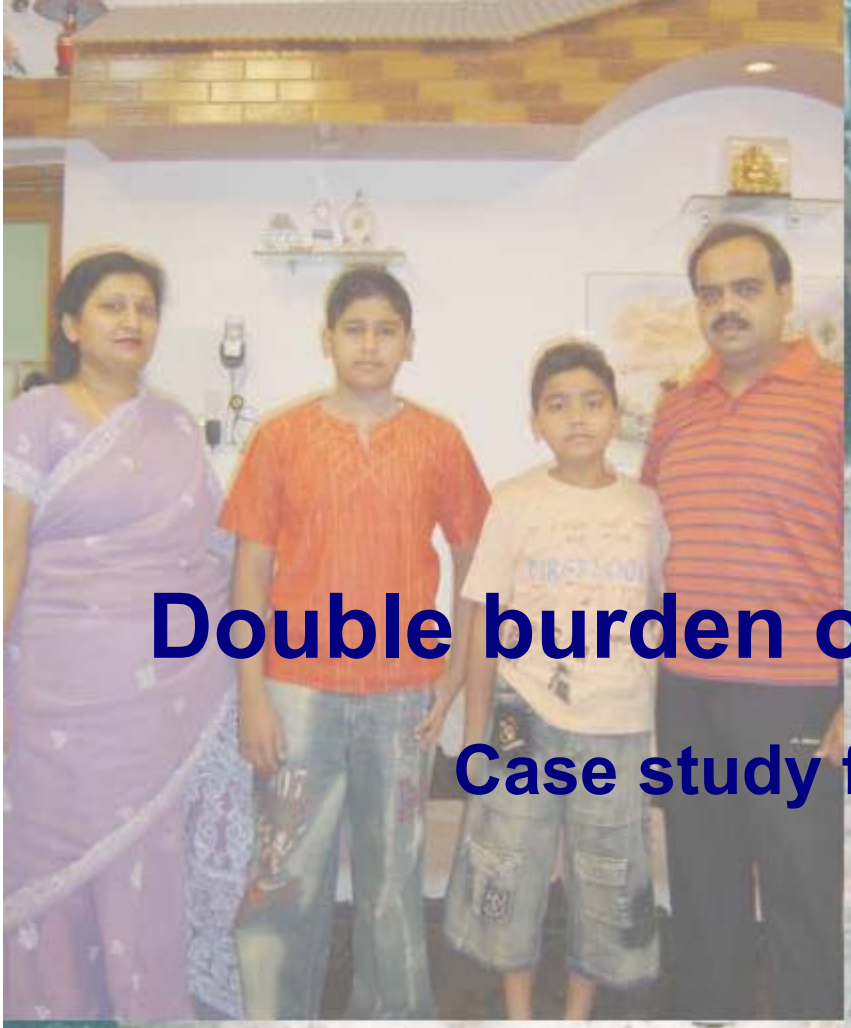

FAO
FOOD AND
NUTRITION
PAPER 84

Double burden of malnutrition

Case study from India

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1. INTRODUCTION

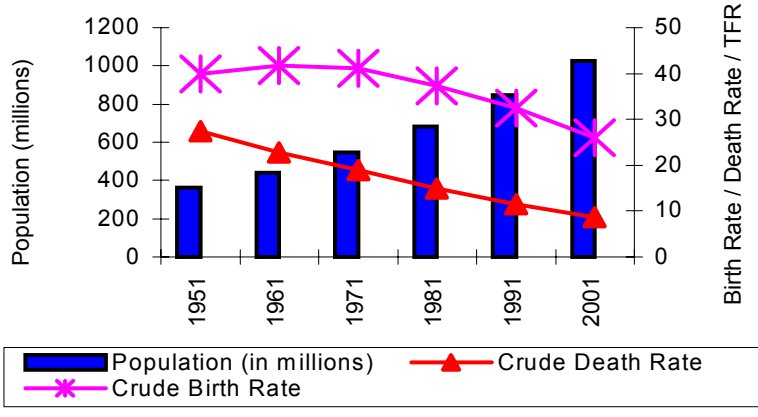
India is a vast and varied subcontinent. With 2.4percent of the global land mass it has been supporting over one sixth of the worlds population. As of 2001 India's population is 1028 million; they live in two hundred and twenty million households in 35 states and union territories (Annexure 1.1 Map of India). As a developing country with high population density India's planners recognized right from the time of India's independence the importance of planned growth of the economy with emphasis on human resource development. Policy makers recognized that the optimal nutrition and health as prerequisites for human development. Article 47 of the Constitution of India states that "the State shall regard raising the level of nutrition and standard of living of its people and improvement in public health among its primary duties". Over the last five decades successive Five-Year Plans laid down the policies and multi-sectoral, multi-pronged strategies to combat nutrition related public health problems and improve nutritional and health status of the population.

Currently the country is in the midst of rapid socioeconomic, demographic, nutrition and health transition. While the country is yet to overcome poverty, under-nutrition and communicable diseases, it is increasingly facing problems related to affluence due to industrialisation, urbanisation and economic betterment. Over the last two decades over-nutrition and obesity have emerged as public health problems; there has been increase in prevalence of diabetes and cardiovascular diseases especially in urban areas; the magnitude of the problem varies between states, urban and rural areas and different socioeconomic strata. It is a matter of concern that these diseases occur a decade earlier in Indians and affect even poorer segments of population and those in rural areas. The case fatality rates are reported to be higher in poor and rural population probably due to delays in diagnosis and treatment. The impact of ongoing socioeconomic, demographic and life style transition on nutritional status and health implication of ongoing nutrition transition are reviewed in this document.

1.1 **Demographic transition**

Demographic transition is a global phenomenon. Technological advances and the improved quality and coverage of health care resulted in a rapid fall in the crude death rate (CDR) from 25.1 in 1951 to 9.8 in 1991. In contrast, the reduction in crude birth rate (CBR) has been less steep, declining from 40.8 in 1951 to 29.5 in 1991 (Registrar General of India, 1951-2001). As a result, the annual exponential population growth rate has been over 2 per cent in the 1971-1991 period. Census 2001 confirmed that the pace of demographic transition in India

Figure 1.1: Population and Growth Rate



Source: Census of India 1951-2001

has been steady even though it is slow and that the India has joined China as the population billionaire (Figure 1.1).

Population projections for the period 1996-2016 carried out by the Registrar General of India (Registrar General of India, 1996) is shown in Text box 1.1. In spite of the fact that there has been substantial reduction in birth rates, population growth continue for the next three decades because of:

- the large size of the population in the reproductive age-group (accounting for an estimated 60 per cent of the total population growth);
- higher fertility due to the unmet need for contraception (contributing to around 20 per cent of population growth); and
- high wanted fertility due to the prevailing high infant mortality rate (IMR) (estimated contribution of about 20 per cent to population growth). Most of the growth in population in India between 1996-2016 is due to with increase of 15-19 year age group- the working age population (Figure 1.2). The Malthusian assumption that population growth will lead to overcrowding, poverty, under-nutrition, environmental deterioration, poor quality of life and increase in disease burden has been challenged in the last few decades. The rapid growth during the last two decades has shown that population can be a major resource for economic growth (Text Box 1.2). If India successfully faces the challenge of providing young, better-educated, skilled, well-nourished and healthy workforce, appropriate employment with adequate remuneration, there can a be a rapid improvement in economic status of the people and the country.

Text Box 1.1 POPULATION PROJECTIONS 1996-2016

The population will increase from 934 million in 1996 to 1264 million in 2016

Between the periods 1996-2001 and 2011-2016 there will be a decline of:

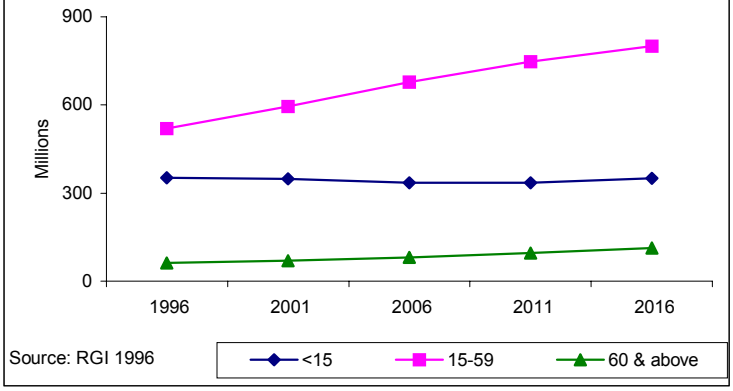
- Crude Birth Rate from 24.10 to 21.41
- Crude Death Rate from 8.99 to 7.48
- Natural Growth Rate from 1.51percent to 1.39percent
- Infant Mortality Rate

Male from 63 to 38

Female from 64 to 39

Source: Registrar General of India 1996

Figure 1. 2 : Projected Population-India



Text Box 1.2 Economic implications of demographic transition

The next two decades will witness:

- Increase in the 15-59 age group from 519 –800 million
- Low dependency ratio

Challenge is to ensure:

- Adequate investment in HRD
- Appropriate employment with adequate emoluments for the labour force

Opportunity is to:

- Utilize available abundant human resources to accelerate economic development

The current phase of demographic transition also represents a major opportunity for improving health and nutritional status of the population. In the under 15-year age group there will be no increase in numbers. The health and nutrition infrastructure will therefore be not grappling with ever increasing number of

children needing health and nutrition care and will be able to concentrate on quality and coverage of health and nutrition services to achieve improvement in health and nutritional status. If the felt needs for health and nutrition of the literate aware 15-59 years age group are met there can be massive improvement in nutrition and health status. Appropriate counseling will enable them to adopt life style and diets which will prevent escalation in over-nutrition and attendant non-communicable disease risk. Increasing numbers of the population beyond 60 years would necessitate provisions for the management of the nutritional and health problems in this age group.

1.2 **Economic transition**

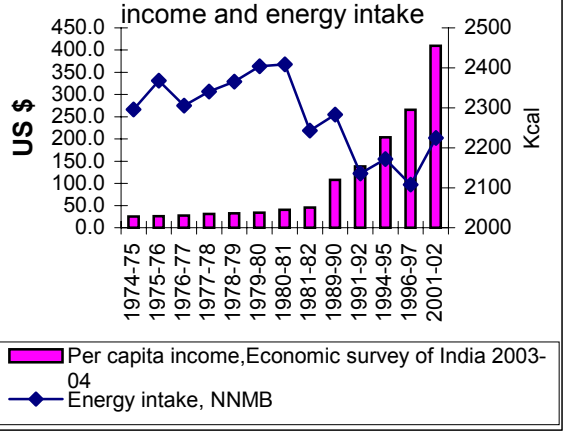
Table 1.1 Economic Indicators

	1950-51	1960-61	1970-71	1980-81	1990-91	2000-01
GDP at current prices (Million US $)	2195	3729	9706	29926	117461	440856
Per capita net national product, at 1993-94 prices (US $)	85	102	115	123	168	237
Poverty (percent)*			54.9	44.5	36	26.1

*Source: Government of India 2003, *Source: Planning Commission of India, 2003-04*
1US $ equals to Rs. 43.5, Registrar General of India 1951-2001

Right from fifties India has adopted the concept of a mixed economy for overall agricultural and industrial development. In the last decade the service sector has become the sector with high growth. Over the last three decades, there has been a steady increase in GDP and per capita net national income; the GDP growth rate has accelerated in the nineties; in 2000 per capita net national product has risen to US $ 237 (Government of India, 2003). Agriculture remains a major determinant of GDP growth and major sector for rural employment. Over years there has been slow but steady reduction in poverty (Table 1.1); in 2000 poverty has declined to 26.2 percent (Planning Commission, 2004). Rise in per capita income (Figure 1.3) over the years is not matched by increase in energy consumption (NNMB, 1979-2002). There are large inter-state differences in per capita income and poverty ratios.

Figure 1.3:Time trends in per capita income and energy intake



1.3 Social transition

Table 1.2 Social Indicators

	1950-51	1960-61	1970-71	1980-81	1990-91	2000-01
Population (million)	359	434	541	679	839	1019
Urban population (percent)	17.3	18	19.8	23.1	25.5	27.7
Literacy rate (percent) Male	27.16	40.4	45.96	56.38	64.1	75.85
Literacy rate (percent) female	8.86	15.35	21.97	29.76	39.3	54.16
Literacy rate (percent) Total	18.33	28.3	34.45	43.57	52.2	65.38

Source: Government of India 2003

Improvement in the quality of life is the central pillar of India's planned development. Over years, adult literacy rate has improved from 18.3percent in 1951 to 65.4 in 2001 (Table

1.2). India today has the largest trained manpower in science, administration and technology. Attempts are underway to ensure universal primary education, improve secondary and vocational education (Government of India, 2003). Simultaneously there are efforts to ensure that higher and technical education gets due attention (Table 1.3) (Department of Education, 2002). Over the years urban population has continued to grow because of rural-urban migration. In 2001, 30 percent of Indians live in urban areas. It is projected that there will be 26 megacities (more than 10 million population) by 2015; of these five will be in India. Urban amenities have failed cope with the increase in population. However cities and towns have become the engines of social change, rapid economic development and improved access to education, employment, and health care. Access to safe drinking water (38 percent in 1981 and 68 percent in 2001) and good environmental sanitation (less than 30 percent) continues to elude rural and urban population (Registrar General of India, 1951-2001). With better communication and transportation it is possible to link urban and rural areas both economically and socially, creating an urban-rural continuum of communities and achieve sustained, rapid improvement in quality of life of both.

Table 1.3: Sex-wise enrolment by stages (in millions)

Year	Primary (I-V)			Middle/Upper primary (VI-VIII)			High/Hr Sec./Inter (IX-XII)		
	Boys	Girls	Total	Boys	Girls	Total	Boys	Girls	Total
1970-71	35.7	21.3	57.0	9.4	3.9	13.3	5.7	1.9	7.6
1980-81	45.3	28.5	73.8	13.9	6.8	20.7	7.6	3.4	11.0
1990-91	57.0	40.4	97.4	21.5	12.5	34.0	12.8	6.3	19.1
2000-01	64.0	49.8	113.8	25.3	22.0	42.8	16.9	10.7	27.6

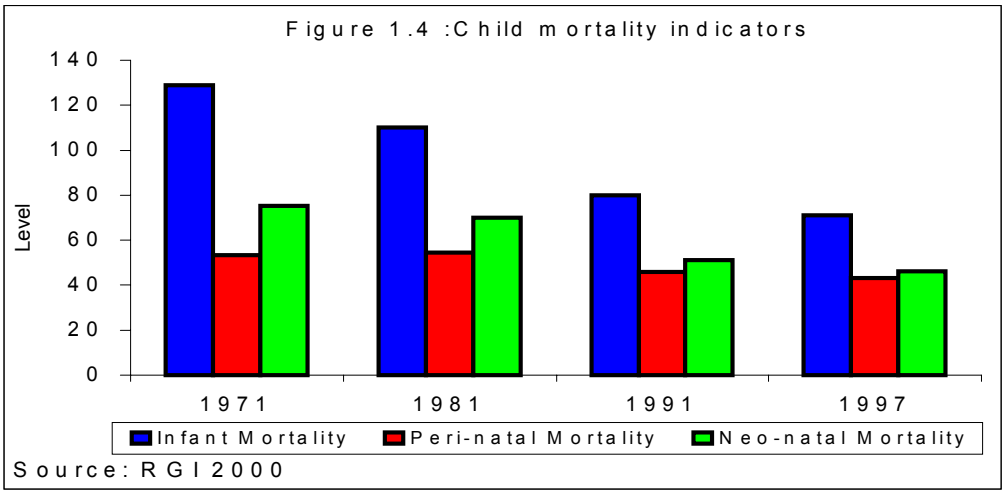
Source: Department of Education, 2002

1.4 **Health transition**

Table 1.3 Health indicators

	1950-51	1960-61	1970-71	1980-81	1990-91	2000-01
Birth rate (per 1000)	39.9	41.7	41.2	37.2	33.9	25.8
Death rate (per 10000)	27.4	22.8	19	15	12.5	8.5
Life expectancy at birth (in year) Male	32.5	41.9	46.4	50.9	58.6	63.8#
Life expectancy at birth (in year) Female	31.7	40.6	44.7	50	59	66.9#
Life expectancy at birth (in year) Total	32.1	41.3	45.6	50.4	58.7	

Source: Government of India 2003; *Source: RGI 2000; **Source: United Nations Development Programme, 2003; #, 2001-2006



There has been a steady but slow reduction in birth rate, death rate, infant mortality rate and under five mortality rate over the last five decades (Registrar General of India, 1971-2000) (Table 1.3). The country still has high infant, perinatal and neonatal mortality (Figure 1.4). There has been steady but slow reduction in death rate and improvement in longevity.

Access to health services is still sub optimal especially in remote areas with high morbidity. Immunization coverage is low (complete immunization at 12 months was 35.4percent in 1992-93 and 42.0 in 1998-99) and child morbidity and mortality rates are high (NFHS-1 and NFHS-2). India's share in global communicable disease as well as in maternal and perinatal problems is high and has not shown substantial reduction in the last two decades (Text Box 1.3) (Planning Commission, 2002). Estimated disease burden due to communicable diseases and ischemic heart disease is shown in Table 1.4. Diabetes and cardio-vascular disease have shown a sharp rise in the last two decades; India faces dual disease burden- with high communicable and rising non-communicable disease prevalence (World Bank, 1993).

Text Box 1.3 India's share in global health problems

- 26percent of the childhood vaccine preventable deaths
- 20 per cent of maternal deaths
- 68percent of leprosy cases
- 30percent of tuberculosis cases
- 10percent of HIV infected persons

Source: Tenth Five-Year Plan, Planning Commission 2002

Table 1.4 - Burden for five major diseases (Millions of DALYs)

Disease & sex	Age (years)					
	0-4	5-14	15-44	45-59	60+	Total
Diarrhea						
Male	42.1	4.6	2.8	0.4	0.2	50.2
Female	40.7	4.8	2.8	0.4	0.3	48.9
Worm infection						
Male	0.2	10.6	1.6	0.5	0.1	13.1
Female	0.1	9.2	0.9	0.5	0.1	10.9
Tuberculosis						
Male	1.2	3.1	13.4	6.2	2.6	26.5
Female	1.3	3.8	10.9	2.8	1.2	20
Ischemic heart disease						
Male	0.1	0.1	3.6	8.1	13.1	25
Female	**	**	1.2	3.2	13	17.5

*** Less than 0.05 million, DALY=disability adjusted life year.*
Source: World Development Report 1993

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1.2 Registrar General of India.1996. *Population Projections 1996-2016*. New Delhi.
1.3 Government of India. 2003. *Economic Survey of India 2003-04*. New Delhi
1.4 Planning Commission. 2004. *Annual Plan 2003-04*.. Government of India. New Delhi
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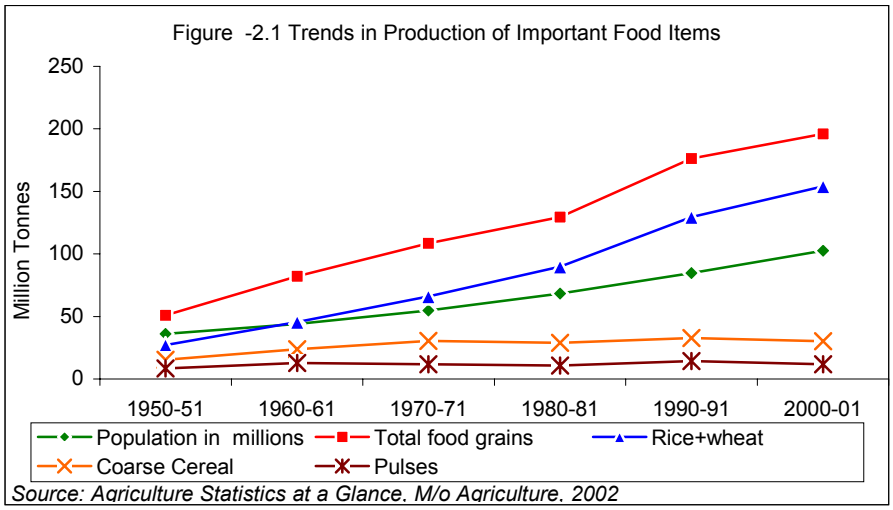
Annexure 1.1

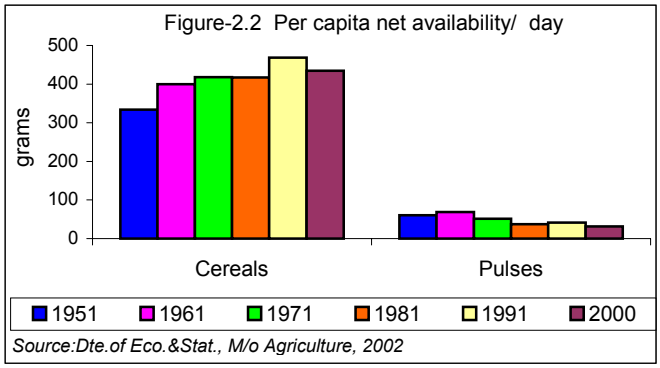
India and its states (Census India)

2. Sustainable Food Production to meet Nutritional Needs



Nutritionists view agricultural as input for dietary intake while farmers look for returns for their investment. The green revolution in showed that food grain production could be increased four fold if farmers are assured of returns for their investment (Figure 2.1). However pulse and coarse grain production has stagnated. (Ministry of Agriculture. 2002a).

2.1 Cereals and Pulses



Over the last five decades per capita net availability of cereals has been showing improvement and by 1991 it was sufficient to meet the RDA (Figure-2.2). However, the per capita pulse availability and consumption, has declined. Pulses are major source of protein among the poorer segments of the population and so this trend has to be reversed (Ministry of Agriculture. 2002b).

2.2 Horticulture

Vast areas of India are sub-tropical and agro-climatic conditions are well suited for cultivation of vegetables, fruits and plantation crops. Horticultural products provide higher yield per hectare and the sale price is higher and in addition they can sustain agro-industries. As a result greater area being brought under horticulture and there is increase in production of fruits and vegetables. In 2000, India has produced 46.6 million tones of fruits and 96.5 million tones of vegetables per year.. Less than 1percent of these are processed. Loses during packaging and transport are about 30percent. Per capita vegetable and food consumption continues to be low except among the urban affluent segments of population because of problem in access and affordability. Investment for creation of essential infrastructure for preservation, cold storage, refrigerated transportation, rapid transit, grading, processing, packaging and quality control will enable the horticultural sector to achieve full economic potential and also provide vegetables and fruits at affordable cost through out the year and

enable the micro-nutrient needs of the population to be met through a sustainable food-based approach.

2.3 National Agricultural Policy

The National Agricultural Policy (Ministry of Agriculture, 2000) has emphasized on crop diversification, horticulture and food processing for sustainable agriculture growth. NAP and Tenth Five-Year Plan (Planning Commission, 2002) have set a target of a 3.97percent growth for agriculture. This is to be achieved through:

- Growth that is based on efficient use of resources and conserves soil, water and bio-diversity;
- Growth with equity, i.e., growth which is widespread across regions and covers all farmers;
- Growth that is demand driven and caters to domestic markets as well as maximizes benefits from exports of agricultural products in the face of the challenges arising from economic liberalisation and globalisation;
- Growth that is sustainable technologically, environmentally and economically

With the increasing economic growth and improved access it is expected that there will be dietary diversification and increase in consumption of pulses, vegetables, fruits and dairy products. Once dietary diversification at affordable cost is possible for the majority of the population to have balanced diet, it will be possible to achieve nutrition security.

References

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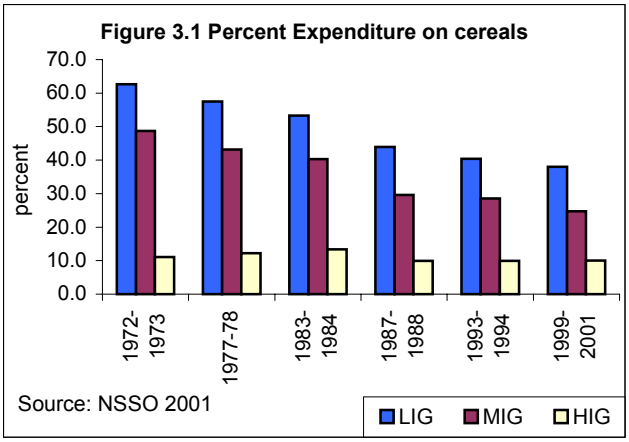
2.3 Ministry of Agriculture.2000. *National Agriculture Policy*. Government of India. New Delhi.

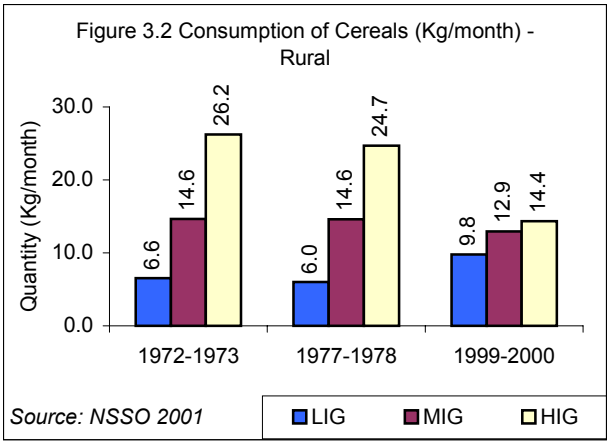
2.4 Planning Commission. *2002*. *Tenth Five-Year Plan.* New Delhi

3. Consumption expenditure on food

The National Sample Survey Organization (NSSO, 1975-2000), a permanent survey organization, was set up in the Department of Statistics of the Government of India in 1950. NSSO has been carrying out Consumer Expenditure Surveys quinquennially since 1972-73 providing time series data in rural and urban areas of all states of India. Based on the data on household monthly per capita consumption expenditure (MPCE) of 12 MPCE classes (with expenditure ranging from less than $5 to $30), household food "consumption" at the national and state level is computed. NSSO surveys have excellent sampling design, large sample size, explicitly stated estimation procedure, and national coverage but do not provide any insight into actual dietary intake of the household or individual and intrafamilial distribution of food.

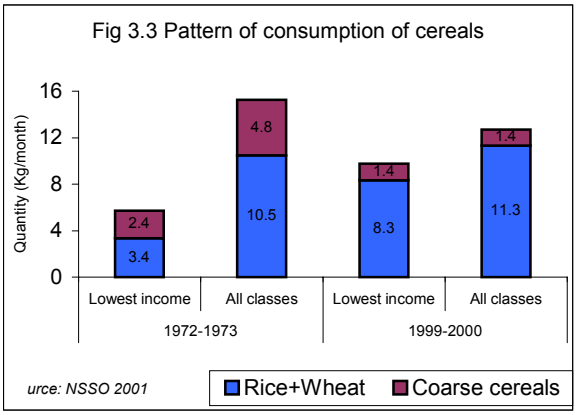
3.1 Cereals





Data from NSSO survey from 1972 to 2000 shows that in the lowest (LIG) and middle-income groups (MIG), the expenditure on cereal has declined. However, in the highest income group (HIG) expenditure on cereals forms relatively low proportion of the total expenditure and the proportion have remained essentially unaltered over the last three decades (Figure 3.1) Analysis of data for lowest, middle and higher income groups shows that quantity (in Kg/month) of cereals consumed by lowest income group has increased inspite of reduction in the proportion of expenditure on cereals (Figure 3.2) because over the years there has been a reduction in relative cost of cereals especially these supplied through the Public Distribution System (PDS). There has been a decline in the household consumption of cereals in the middle -income group. The reported per capita "consumption" of cereals in high-income households in rural area in 1972-73 was 26.2 Kg (about 1Kg/day). This has declined to 14.4Kg in 1999-2000. Data from diet surveys conducted by National Nutrition Monitoring Bureau (NNMB, 1979-2002) have shown that average dietary intake of cereals even in the highest income group never exceeded 400g/day. It would therefore appear that reported high cereal consumption expenditure among highest income group households, especially, in rural areas might be due to cooked food being shared with guests, relatives and servants. Sharing of cooked food with guests and servants has declined over the last two decades, accounting for the steep reduction in "consumption" of cereals in high-income group

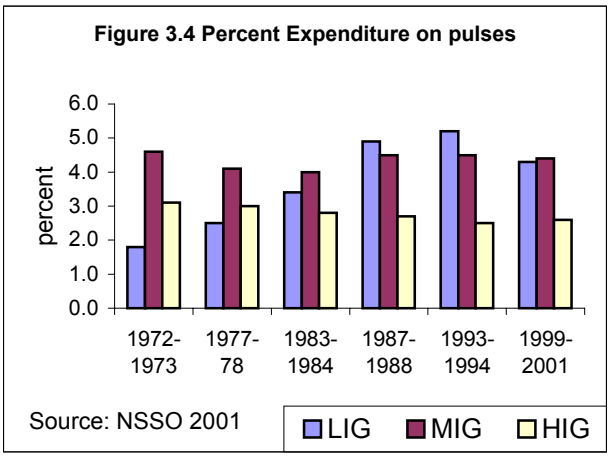
households. Simultaneous increase in consumption expenditure on cereals in lower income group confirms this.

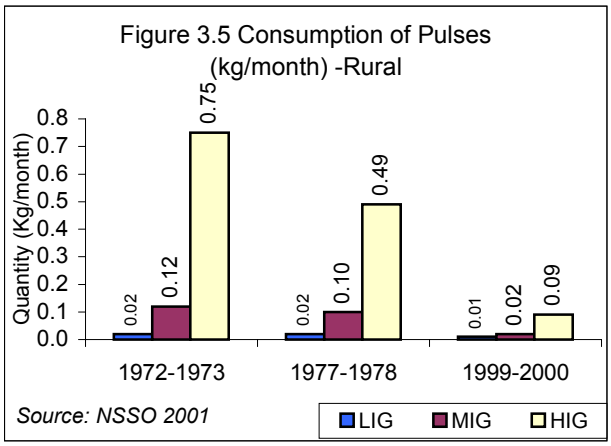


With the availability of wheat and rice through PDS, the poorer segments of population have changed over to rice and wheat as staple cereals. There is decline in consumption of coarse cereals rich in micronutrients and minerals (Figure 3.3). The Tenth Five Year Plan (Planning Commission, 2002-2007) envisages that locally produced and procured coarse grains should be made available through Targeted Public Distribution System (TPDS) at subsidized rates. This may substantially bring down subsidy cost without any reduction in the energy provided; improved micro nutrient intake from coarse cereal will be an added beneficial. This will also improve targeting, as only the most needy are likely to buy these coarse grains.

3.2 Pulses

Between 1972-2001 there has been a substantial increase in the proportion of expenditure on pulses to total expenditure in the lowest income group (Figure 3.4). Expenditure on pulses has remained relatively unaltered in the middle and the highest

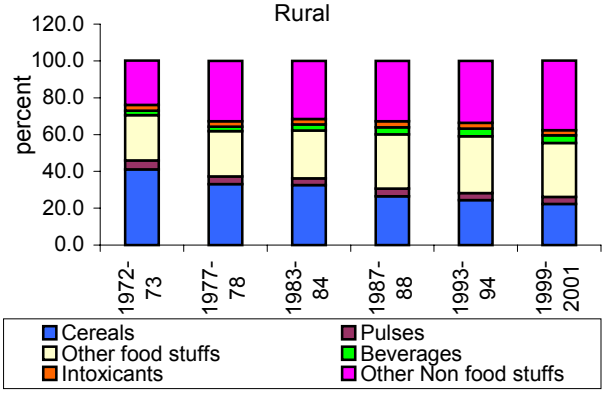




income group. In spite of increased expenditure on pulses, there is a decline in household "consumption" of pulses in all the income groups both in the urban and rural areas (Figures 3.5). Data from NSSO 2000 survey shows that middle and upper income groups spend more on milk and animal products so that their protein intake are not adversely affected. Pulses are the major source of protein in the lowest income group. In order to ensure adequate protein intake in this group, it is essential to invest in steps to increase cultivation of a wide variety of pulses and legumes, so that they could be made available at an affordable cost to the poorer segments of population, perhaps through TPDS.

3.3 Time trends in Monthly per capita expenditure (MPCE)

Figure 3.6 Percentage Distribution of MPCE-Rural



Source: NSSO 2001

MPCE on different food and non-food items over the last three decades is shown in Figure 3.6. The proportion of expenditure on foodstuffs has shown a considerable decline in the last three decades; (70.6 percent in 1972 to 55.3 percent in 1999-2000) this is mainly due the decline in cereal prices. Expenditure on pulses, vegetables, other foods and beverages have increased. However pulse and vegetable intake among poor remains low. There are massive urban rural and inter district/state differences in the cost of vegetables, milk, fish, and meat. Therefore data on time trends in quantities consumed for these foodstuffs state wise or expenditure group wise is not readily available from NSSO surveys. The country depends on diet surveys for such information.

3.4 Nutrient Intake Computed from NSSO surveys

Based on household expenditure on food NSSO computes energy, protein and fat intake of the population. Over the last three decades the overall energy and protein consumption in rural areas has shown a small decline; energy and protein consumption in urban areas has remained unaltered;, there has been an increase in the fat consumption both in rural and urban areas (Table 3.1).

Table 3.1 Average daily Percapita nutrient intake

	Energy (Calorie		Protein (g/day)		Fat (g/day)	
	Rural	Urban	Rural	Urban	Rural	Urban
1972-73	2266	2107	62	56	24	36
1983	2221	2089	62	57	27	37
1993-94	2153	2071	60.2	57.2	31.4	42
1999-2000	2149	2156	59.1	58.5	36.1	49.6

Source: NSSO 2001

Table 3.2 Average Per Capita Calorie consumption by Expenditure Classes

Expenditure Classes	Rural			Urban		
	1972-73	1977-78	1993-94	1972-73	1977-78	1993-94
Lower 30 percent	1504	1630	1678	1579	1701	1682
Middle 40 percent	2170	2296	2119	2154	2438	2111
Top 30 percent	3161	3190	2672	2572	2979	2405

Source: NSSO 2001

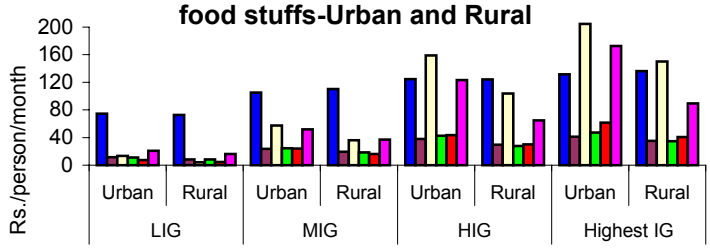
Changes in energy consumption in different income groups in urban and rural areas is shown in Table 3.2; energy consumption has shown a small increase in both urban and rural poor and a substantial decline among the urban and rural rich. As had been indicated earlier the data on household consumption expenditure in high-income groups would include the cooked food shared with guests and servants and there fore has to be

interpreted with caution. There is massive interstate differences consumption expenditure on food.

3.5 Urban Rural Differences

Data from NSSO 55th round (1999-2000) on urban rural differences in consumption expenditure is given in Figure 3.7. Major food expenditure was on cereals in urban and rural poor. Dietary diversification is mainly seen in middle and high-income group both in urban and rural areas; diversity is greater in urban areas perhaps because of access to wider variety of foodstuffs.

Figure 3.7 Value (Rs) of Consumption of food stuffs-Urban and Rural



LIG-Low income Group, MIG-Middle Income Group, HIG-High Income Group

Source: NSSO 2001

Cereals | Pulses | Milk | Oil | Egg, fish, meat | vegetables, fruits

Summary

To sum up data from NSSO consumption expenditure surveys indicate that

- There has been a reduction in consumption expenditure on food mainly due to reduction in cost of cereals.
- In spite of steep decline in cost, cereal consumption has not increased except in the lowest income group. The question why in spite of rising per capita incomes and declining cost of cereals, there is no significant increase in cereal consumption has been debated widely by economists and nutritionists in India. The consensus view is that this might be because cereal requirements have been met.
- In spite of increased expenditure on pulses, consumption among all segments has declined due to the soaring cost of pulses; pulse consumption is very low in poor.
- Rural population consumes more cereals, less pulses and less oil and fat as compared to urban population.
- Dietary diversification is seen mainly in middle and high-income groups in urban and rural areas; increasing incomes and availability of diverse foodstuffs; in the nineties has accelerated this trend.
- Over years there has been only a small increase in energy consumption among the poor inspite of the steep decline in cost of cereals. Among the middle and high income group the energy consumption has declined
- The energy consumption in urban high-income group is associated with higher amount of sugar, oil, milk and milk products and lower amounts of cereals. Adequate energy consumption coupled with sedentary life styles appears to be the major factor for the steep increase in obesity in this group.

References

3.1 NSSO National Sample Survey Organization. 1975-2000. *Reports of NSSO*. Department of Statistics, Government of India.

3.2 NNMB National Nutrition Monitoring Bureau. 1979-2002. *NNMB Reports*, National Institute Of Nutrition, Hyderabad.

3.3 Planning Commission. *2002*. *Tenth Five-Year Plan.* New Delhi

4. Dietary intake data from nutrition surveys

National Nutrition Monitoring Bureau (NNMB, 1979-2002) provides data on dietary intake (by 24 hour dietary recall) and nutritional status (anthropomentry and nutritional deficiencies) in 10 states of India (Kerala, Karnataka, Andhra,Tamil Nadu, Maharashtra, Orissa, Gujarat, Madhya Pradesh, West Bengal and Uttar Pradesh) from 1975. NNMB is the only survey that provides data on time trends in intra-family distribution of food and dietary intake and nutritional status of all age groups over the last three decades. The proposal to expand the network to cover all the states did not materialise over the next two decades. In order to get data on dietary intake and nutritional status of individuals in other states, a one-time survey (district nutrition survey) was carried out in mid nineties. Both NNMB survey in 1994 and one time survey in mid nineties used the same methodology of data collection from representative sample of the ho3useholds in all the states. The combined data was reported as India Nutrition Profile (Department of Women and Child Development, 1995-96).

INP provides data on dietary intake and nutritional status of all age groups, in all states of the country, in urban and rural areas in mid nineties. Both NNMB and INP surveys have used 24-hour dietary recall for assessment of food intake. The amounts consumed were compared with the Recommended Dietary Allowance (RDA) for Indians drawn up by the Indian Council of Medical Research (ICMR) published in 1989 (ICMR 1989). Reference Indian man is between 20-39 years of age and weighs 60 kg free, physically fit and is moderately active. Indian woman is defined as between 20-39 years of age, weighs 50 kg and is moderately active.

Household food intake obtained by 24-hour dietary recall is used to compute the average intake of the household members expressed per consumption unit (CU) per day (NNMB 1981). The Consumption Unit for different age and sex groups were worked out on the basis of the energy requirements by taking the energy consumption of an average adult male doing sedentary work as one consumption unit (Text Box 4.1).

Text Box 4.1 Consumption Unit

Adult male (Sedentary worker)	1.0
Adult male (Moderate worker)	1.2
Adult male (Heavy worker)	1.6
Adult female (Sedentary worker)	0.8
Adult female (Moderate worker)	0.9
Adult female (Heavy worker)	1.2
Adolescent – 12 to 21 years	1.0
Children – 9 to 12 years	0.8
Children – 7 to 9 years	0.7
Children – 5 to 7 years	0.6
Children – 3 to 5 years	0.5
Children – 1 to 3 years	0.4

Source: NNMB 1981

Nutrient intake is computed using Nutritive Value of Indian Foods (NIN, 2004) a publication by National Institute of Nutrition (NIN) which was first published in 1971. Since then it has under gone many reprints. Analysis of iron content of Indian food stuffs by newer techniques have shown that the available iron is only about 50 percent of the earlier values reported and hence in the latest edition values for iron content have been revised.

4.1 Food intake in urban and rural areas

Table 4.1 Food Intake in Rural and Urban areas (g/consumption unit /day)

	NNMB						INP (1995-96)		RDA
	Rural				Urban Slums		Rural	Urban	
	75-79	88-90	95-96	00-01	75-79	93-94			
Cereals & Millets	505	490	450	457	416	380	488	420	460
Dairy products	116	92	85	85	42	75	126	143	150
Pulses & Legumes	34	32	29	34	33	27	33	55	40
Vegetables Green leafy Others(includes tubers)	8 54	9 49	15 47	18 57	11 40	16 47	32 70	23 75	40 60
Fruits	13	23	24	25	26	26	15	37	50
Fats & oil	14	13	12	14	13	17	14	21	20
Sugar & jaggery	23	29	21	23	20	22	20	22	30

Source: National Nutrition Monitoring Bureau (NNMB), India Nutrition profile (INP). Survey Population: Rural & urban. Sample Size: NNMB, Rural, 33048 (1975-79), 14391 (1996-97), 30968 (2000-01), 32500 (1975-80), 5447 (1993-94); INP (46457)

Data from NNMB and INP surveys (using 24 hour dietary recall method) show that in the mid nineties average intake of cereals were near RDA, intake of pulses, vegetables and fruits are low (Table 4. 1). There is significant difference in food intake between states. The reported intake of foodstuffs is higher in INP as compared to NNMB data; this is attributable to higher dietary intake especially cereals and pulses in the non-NNMB states, which were covered in the INP. Dietary intake was higher in some states with high per capita income (Punjab) but not in others (Maharashtra) suggesting that greater per-capita income is not always be associated with higher dietary intake. Both NNMB and INP data showed that cereal intake was higher in some of the poor states (Orissa in NNMB, Uttar Pradesh in INP survey); perhaps because majority of the population are working as manual labourers and require high cereal intake, NSSO (NSSO, 1975-2000) consumer expenditure surveys show similar interstate differences. Consumption of cereals is higher in rural areas; however consumption of pulses, milk and milk products, fruits and fat and oils are higher in urban areas.

4.1.1 Time Trends in food intake

Data on time trends in food intake in rural areas and urban slums in nine states is available from repeat surveys conducted by the NNMB (Table 4.1). Data from NNMB surveys shows that over the last three decades there has been some decline in cereal consumption both in urban and rural areas. Over this period there has been a substantial decline in the cost of cereals and improvement in availability of cereals. The decline is therefore not due to economic constraints. Over the same period there has been a decline in the consumption of pulses, which are a major source of protein in Indian diets. This is partly attributable to the soaring cost of pulses and inability of the poor to purchase adequate pulses inspite of higher expenditure on pulses. In spite of massive increase in milk out put in the country, there has not been any improvement in per capita consumption of milk over years. Consumption of vegetables and fruits also continues to be very low. In rural areas there has not been any significant increase in percapita consumption of fats and oils and sugar and jaggery. However in urban areas –even among slum dwellers there has been an increase in oil consumption and some increase in sugar consumption. Data from NNMB surveys suggest that dietary intake

has not under gone any major shift towards increase in consumption of fat/oils, sugar and processed food. There has not been any increase in energy intake. These data are confirmed by t
he consumer expenditure on food items reported by the NSSO.

4.2 Nutrient intake

Table 4.2 Nutrient Intake in Rural and Urban (consumption unit /day)

	RDA (Sedentary man)	NNMB								INP (1995-96)	
		Rural					Urban Slums			Rural	Urban
		1975-79	1988-90	1996-97	2000-01	percent Δ^1	1975-79	1993-94	percent Δ^2		
Energy (Kcal)	2425	2340	2283	2108	2255	-4	2008	1896	-6	2321	2259
Protein (g)	60	62.9	61.8	53.7	58.7	-7	53.4	46.75	-12	70	70
Calcium (mg)	400	590	556	521	523	-11	492	*		631	673.4
Iron (mg)	28	30.2	28.4	24.9	17.5@	-42	24.9	18.96	-24	23.2	22.3
Vitamin A (mcg)	600	257	294	300	242	-6	248	352.5	42	355	356.0
Thiamin (mg)	1.2	1.6	1.5	1.2	1.4	-13	1.27	*		1.9	1.9
Riboflavin (mg)	1.4	0.9	0.9	0.9	0.8	-11	0.81	0.79	-2	1.0	1.0
Niacin (mg)	16	15.7	15.5	12.7	17.1	9	14.6	*		19.7	18.8
Vitamin C (mg)	40	37	37	40	51	38	40	42	5	55.2	62.4
Folic acid (mcg)	100	*	*	153	62		*	*		*	*

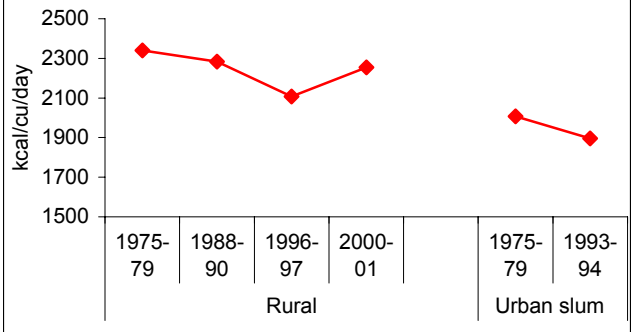
Source: National Nutrition Monitoring Bureau, India Nutrition Profile @method of estimation different *data not available
Survey Population: Urban and Rural
Sample Size: Rural, 33048 (1975-79), 14391 (1996-97), 30968 (2000-01), 32500 (1975-80), 5447 (1993-94), INP (46457)
1 Changes in intake From 1975-79 to 2000-01; 2 Changes in intake from 1975-79 to 1993-94; @method of estimation different

India Nutrition Profile (INP) provides data on nutrient intake in all states of the country in urban and rural areas (Table 4.2). The reported intake of nutrients is higher in INP as compared to National Nutrition Monitoring Bureau (NNMB) data because of higher intake in states not covered by NNMB. At the aggregate national level, total energy intake is less than 2,300 kcal/ cu/ day, even in the mid-nineties. There are substantial interstate differences in energy as well as other nutrient intake.

4.2.1 Time trends in of nutrient intake

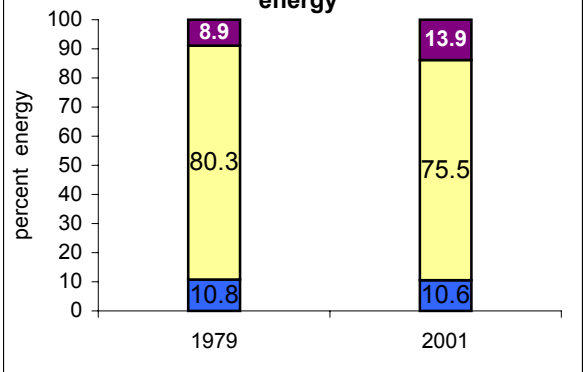
Data on time trends in nutrient intake is available from repeat surveys conducted by the National Nutrition Monitoring Bureau (Table 4.2). Data from NNMB surveys shows that over the last three decades there has been a small decline in energy intake Figure 4.2.

Figure 4.2 Time trends in energy intake



Source: NNMB reports

Figure 4.3 Nutrient intake as percent of energy



Source: NNMB reports

There has been some decline in intake of most of the nutrients both in urban and rural areas over the last three decades. A reduction in percent of total energy intake from carbohydrates and some increase in percent dietary energy from fats have occurred over the past three decades (Figure 4.3). In spite of this, the proportion of dietary energy from fat remains lower than 15 percent. However, these aggregate measures mask large disparities between intakes of urban and rural populations and different socio-economic groups. Dietary intake of iron in Indian dietaries has always been low**.** The steep decline in iron intake reported in the last NNMB survey can be attributed to different estimation methods, which showed that absorbable iron was 50percent less as compared to earlier values.

4.2.2 Urban rural differences in nutrient intake

Energy intake is lower in urban areas in spite of higher intake of fats and oils because of lower cereal consumption (Table 4.2). Data from NNMB suggests that the consumption of all nutrients is lower in urban slums as compared to rural areas. INP survey, which covered most of the major states, did not show any significant difference in nutrient intake between urban and rural areas. Interstate differences in nutrient consumption and the fact that NNMB repeat survey data was available only from urban slums are some of the factors responsible for the apparent differences between NNMB and the INP survey data.

4.2.3 Source of dietary energy

Table 4.3 Source of dietary energy

	Total Dietary Energy Intake (Kcal)				Percent Dietary energy from fat				Percent Dietary energy from protein				Percent Dietary energy from Carbohydrates			
	NNMB			INP	NNMB			INP	NNMB			INP	NNMB			INP
	'79	'96	'01	'96	'79	'96	'01	'96	'79	'96	'01	'96	'79	'96	'01	'96
Males & Females*																
1-3	834	807	706	926	14.8	14.3	12.1	15.1	10.9	10.4	10.1	13.2	74.3	75.3	77.7	71.7
4-6	1118	1213	1029	1299	12.9	13.6	10.8	13.2	10.8	10.3	10.2	12.7	76.3	76.4	79.1	74.1
7-9**		1467	1251	1520		12.3	10.1	13.9		10.6	10.1	13.1		77.1	79.8	73.1
Males																
10-12	1439	1738	1524	1847	8.8	12.7	11.8	12.1	10.9	10.5	10.6	12.3	80.3	76.7	77.6	75.6
13-15	1618	2004	1856	2185	9.3	12.4	11.9	11.9	10.7	10.5	10.5	12.3	80	77.1	77.6	75.8
16-17	1926	2369	2114	2514	8	12.6	11	11.3	10.4	10.4	10.4	12.6	81.6	77	78.7	76.1
<18#	2065	2488	2225	2592	8.9	12.4	13.9	12.2	10.8	10.2	10.6	12.3	80.3	74.8	75.5	75.5
Females																
10-12	1394	1635	1500	1482	9	12.2	11.3	12.3	11.2	10.4	10.5	12.3	79.8	77.4	78.1	75.4
13-15	1566	1848	1689	2097	9.1	11.7	11.2	12.2	10.5	10.4	10.3	12.5	80.4	77.9	78.5	75.3
16-17	1704	2030	1856	2327	8.8	12.9	11.7	12.3	10.3	10.2	10.1	12.8	80.9	76.6	77.7	74.9
<18#	1698	2106	1878	2293	9.1	13.9	13.9	12.6	10.7	9.9	10.6	12.4	80.2	76.2	75.5	75

**, No sex wise dis-aggregation of data age wise upto 10 years of age; **, Data not available; #, No dis-aggregation of data age-wise after 18 years of age*

Source: National Nutrition Monitoring Bureau, 1979, 2002; India Nutrition Profile, 1996.Survey Population: Rural (NNMB), Rural & Urban (INP) Sample size: NNMB, 33048 (1975-79), 14391 (1996-97), 22945 (2000-01); INP (46457)

Data on time trends in total energy intake, percent of energy intake from fat, carbohydrate and protein from NNMB and data on in total energy intake, percent of energy intake from fat, carbohydrate and protein from all the major states from India Nutrition Profile in different age groups is given in Table 4.3. Carbohydrates remain the

major source of energy in Indian diets. There has been some reduction in percent of total energy intake from carbohydrates and some increase in percent dietary energy from fats over the past three decades.

4.3 Dietary diversity

National Family Health Survey-2 (NFHS-2, IIPS, 1998-99) collected data on frequency of consumption of various types of foods (other than cereals which are consumed everyday by everyone) from these women (daily, weekly or occasionally) to assess dietary diversity among 90,000 ever-married women in the age group 15–49 living in 26 states; however details regarding quantity of intake were not obtained from these women. Data from the survey is presented in Table 4.4 and Table4.5. All adult women in India consume cereals every day; their diets tend to be monotonous and there is very little dietary diversity. Fruits are eaten daily by only 8 per cent of women and only one-third of women eat fruits at least once a week. Almost one-third of women in India never eat chicken, meat, or fish and very few women (only 6 percent) eat chicken, meat, or fish every day. Eggs are consumed less often than chicken, meat, or fish.

Table 4.4 Frequency of consumption of specific foods

Type of food	Daily	Weekly	Occasionally	Never
Milk or curd	37.5	17.4	34.1	10.9
Pulses or beans	46.9	40.8	11.6	0.6
Green leafy Vegetables	41.8	43.4	14.3	0.4
Other vegetables	65.1	28	6.6	0.2
Fruits	8.1	24.9	62.3	4.7
Eggs	2.8	25.0	37.9	34.2
Chicken, meat or fish	5.8	26.1	37.3	30.8

Source: NFHS-2, 1998-99

There were substantial differentials in food consumption patterns by selected background characteristics (Table 4.5). Age does not play an important role in women's consumption patterns. Women in urban areas are more likely than women in rural areas to include every type of food in their diet, particularly fruits and milk or curd. Illiterate women have less varied diets than literate women, and seldom eat fruits. Poverty has a strong negative effect on dietary diversity. Women in households belonging to low

Table 4.5 Women's food consumption by background characteristics

Background characteristic	Type of food consumed at least once a week							
	Milk or curd	Pulses or beans	Green leafy vegetables	Other vegetables	Fruits	Eggs	Chicken,meat or fish	Number of women
Residence								
Urban	65.3	92.8	88.4	95.0	53.9	39.7	41.7	23,370
Rural	51.3	86.0	84.1	92.4	25.6	23.6	28.5	65,829
Economic status								
Low	35.0	81.4	82.1	91.6	17.0	23.8	29.1	29,033
Medium	58.1	89.4	85.3	93.1	31.5	28.6	33.1	41,289
High	80.0	94.3	90.0	95.7	62.0	32.3	33.6	17,845
Total	55.0	87.8	85.2	93.1	33.0	27.8	31.9	89,199

Source: NFHS-2, 1998-99

socio-economic group are less likely than other women to eat items from each type of food group listed, and their diet is particularly deficient in fruits and milk or curd. There are substantial inter state differences in consumption of different types of food.

4.4.To sum up

During the past three decades there has been

- reduction in energy intake though cereals except among the poor ; over all there has been a small decrease in total energy intake in both urban and rural areas.
- some increase in dietary energy derived from fat and a reciprocal reduction in percentage of dietary energy derived from carbohydrate.
- some increase in consumption of fats and oils, in urban population even in urban slum population.
- increasing dietary diversity among upper income groups both in urban and rural areas – more so in urban areas.
- diets are cereal based and monotonous among the rural poor
- Intakes of most micronutrients continue to be low.
- Iron intake is low; this coupled with poor bio-availability of iron from Indian diets is responsible for high prevalence of anaemia

References:

4.1 NNMB National Nutrition Monitoring Bureau. 1979-2002. *NNMB Reports*. National Institute Of Nutrition, Hyderabad.

4.2 Department of Women and Child Development. 1995-96. *Indian Nutrition Profile*. Government of India, New Delhi.

4.3 Indian Council of Medical Research. 1989. *Nutrient Requirements and Recommended Dietary allowances for Indians.* New Delhi

4.4 National Institute of Nutrition. 2004. *Nutritive Value of Indian Foods.* Hyderabad.

4.5 NSSO National Sample Survey Organization. 1975-2000. *Reports of NSSO.* Department of Statistics. Government of India.

4.6 International Institute of Population Sciences. 1992-93. *National Family Health Survey 1.* Mumbai.

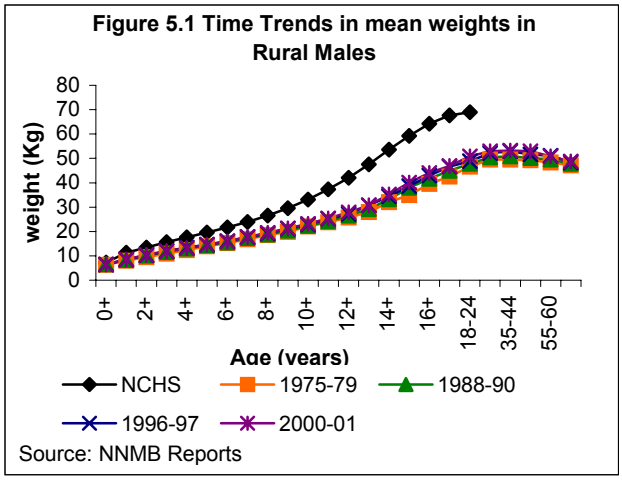
4.7 International Institute of Population Sciences. 1998-99. *National Family Health Survey 2.* Mumbai.

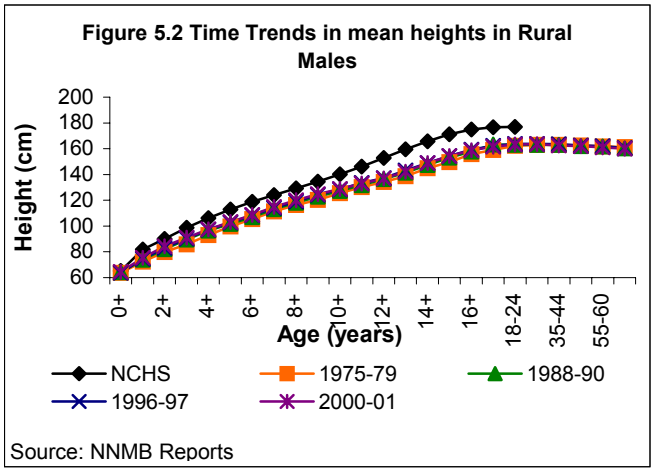
5. Dietary intake and Nutritional Status in different age groups

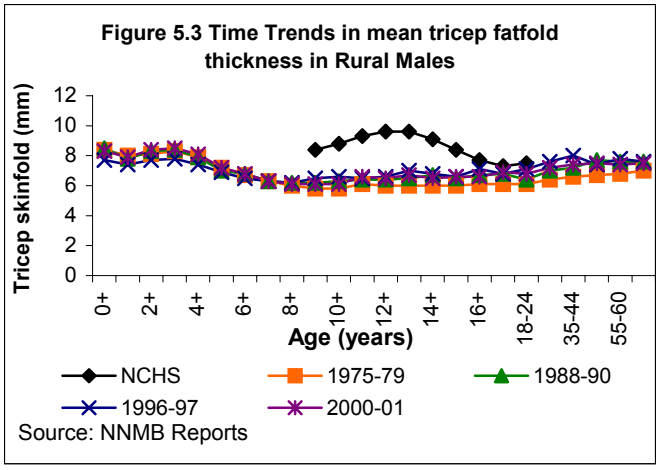
Nutritional status of Indian population has been extensively investigated over the past three decades. NNMB (NNMB, 1979-2002) and INP (Department of Women and Child Development, 1995-96) provide information on nutritional status of different age groups of the population in relation to their dietary intake. NNMB provides information on time trends in nutritional status in all age group population. The National Family Health Survey 1 (IIPS, 1992-93) & 2 (IIPS, 1998-99) provide state level estimates of time trends in nutritional status of women and preschool children during the nineties in all major state. The District Level Household Survey 2002-03 (Ministry of Family and Health Welfare, 2004) provides district level estimates on nutritional status preschool children. In addition there are several smaller cohort studies providing follow up data on nutritional status of specific groups over decades. In this section data on time trends in dietary intake and nutritional status of different age group of population is reviewed.

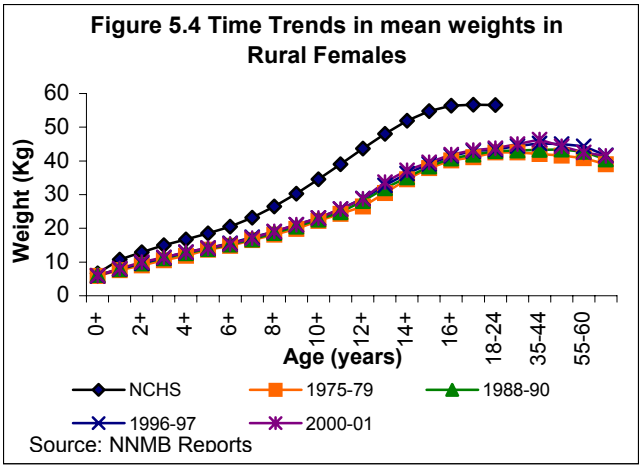
5.1.Time trends in anthropometric indices

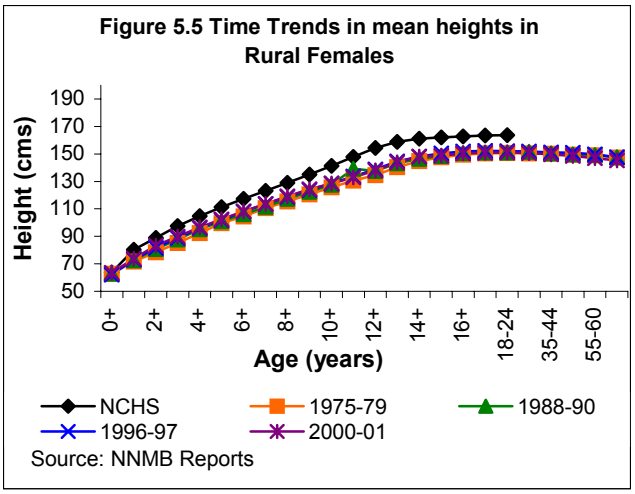
Data NNMB (NNMB, 1979-2002) rural surveys on time trends in weight, height, mid-arm circumference and triceps fat fold thickness in all age groups in both males and females

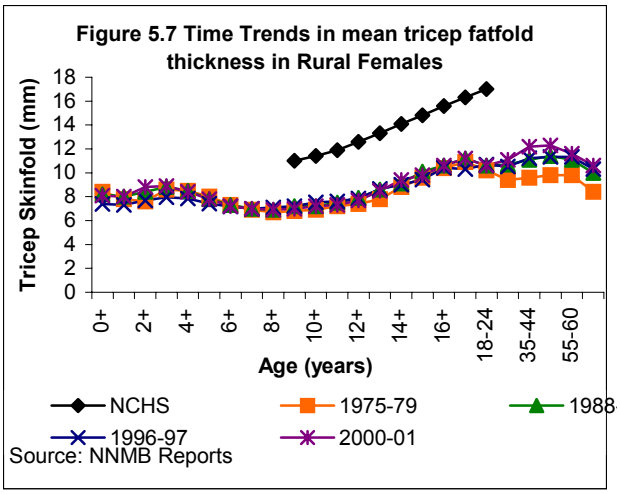






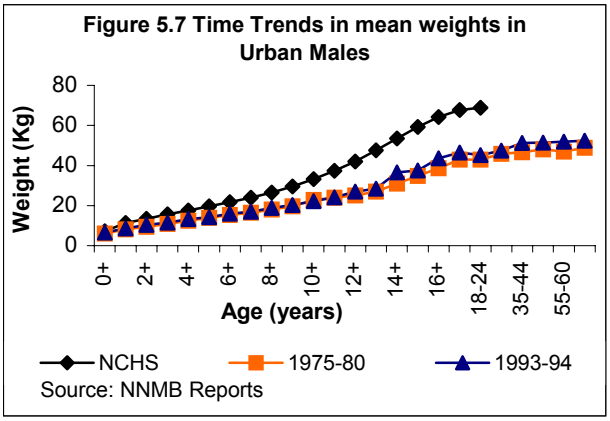


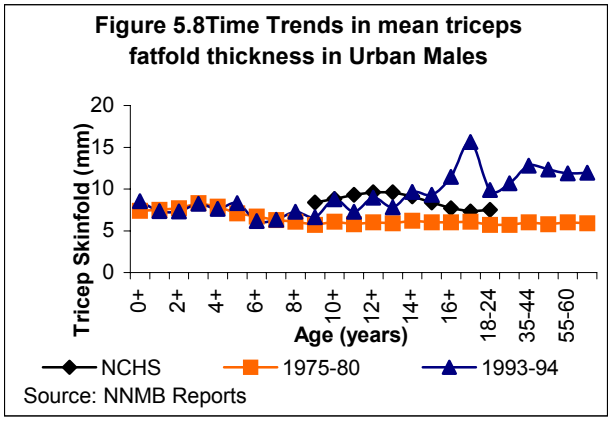


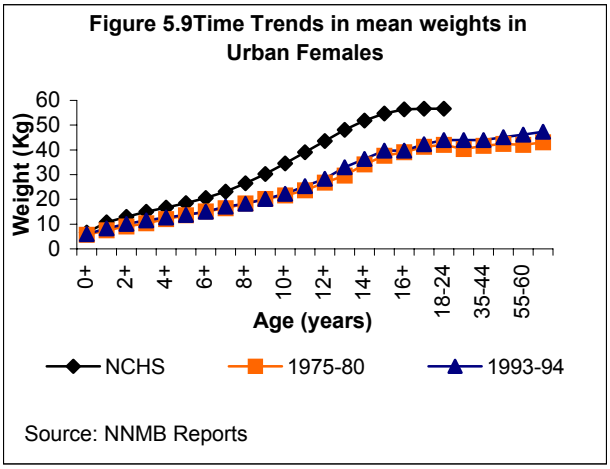


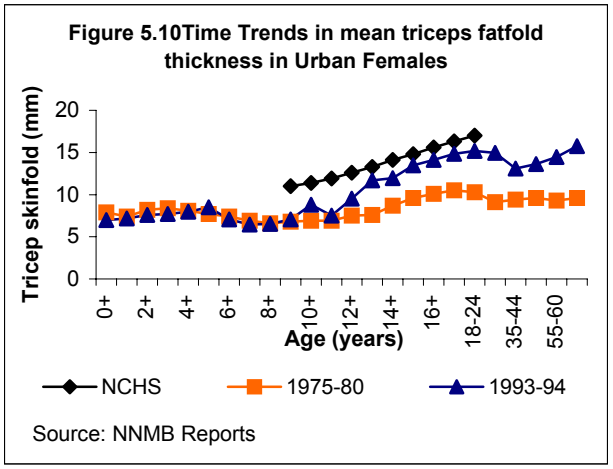
is shown in Figures 5.1, 5.2, 5.3, 5.4, 5.5 and 5.6, respectively. Even in rural population there is an increase of about four cms in adult height; the increase in body weight over the period is greater. This is mainly due to fat deposition as shown by progressive increase in the fat fold thickness over this period. The increase in fat fold thickness begins in childhood and increases with age in both males and females. The increase is more in women.

Data from NNMB surveys in urban slums on time trends in weight; mid-upper arm circumference and fat fold thickness at triceps are shown in Figure 5.7, 5.8, 5.9 and







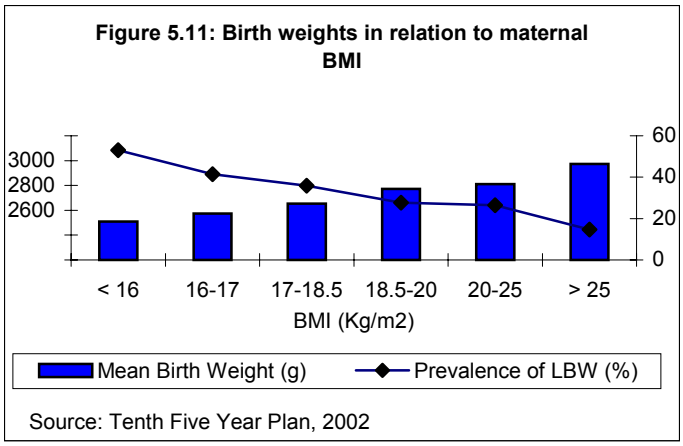


5.10. Mean body weight, mid upper arm circumference and fat fold thickness at triceps are higher in all age groups in 1993 - 94. The increase in body weight is mainly due to increase fat as shown by rising fat fold thickness.

5.2. Low birth weight

Nearly one-third of all Indian infants weigh less than 2.5 kg at birth. Incidence of low birth rate is the highest among the low-income groups (Table-5.11) (Prema, 1989). There is a good correlation between birth weights and maternal body weight (Figure- 5.12); low birth weight rate doubles when Hb levels fall below 8 gms/dl.

Low birth weight incidence has remained unaltered over the last three decades (Figure 5.16) (Nutrition Foundation of India, 2004).



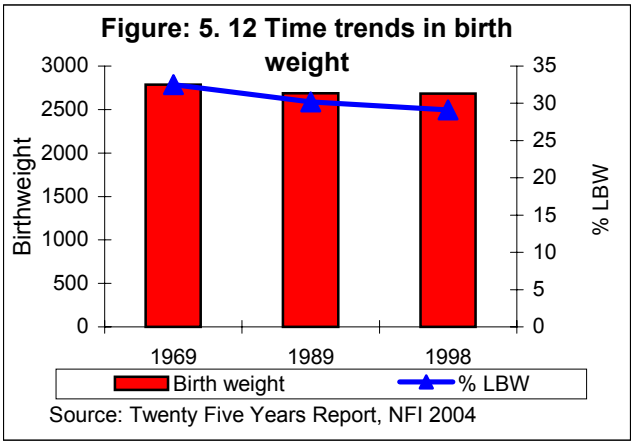


Table 5.1 Birth Weight and Socio-economic Status

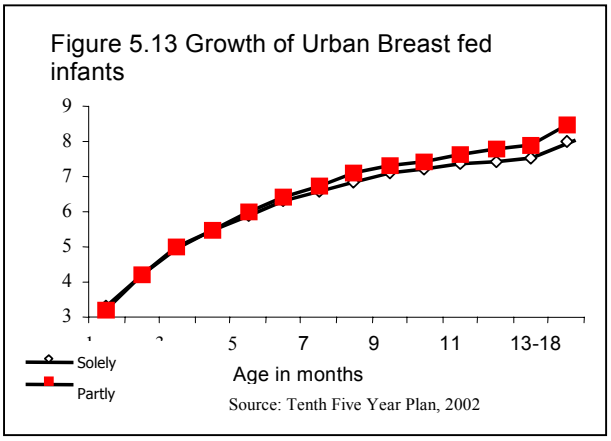
	Poor Income	Middle Income	High Income
Age (years)	24.1	24.3	27.8
Parity	2.41	1.96	1.61
Height (cm)	151.5	154.2	156.3
Weight (kg)	45.7	49.9	56.2
Hb (g/dl)	10.9	11.1	12.4
Birh weight (kg)	2.70	2.90	3.13

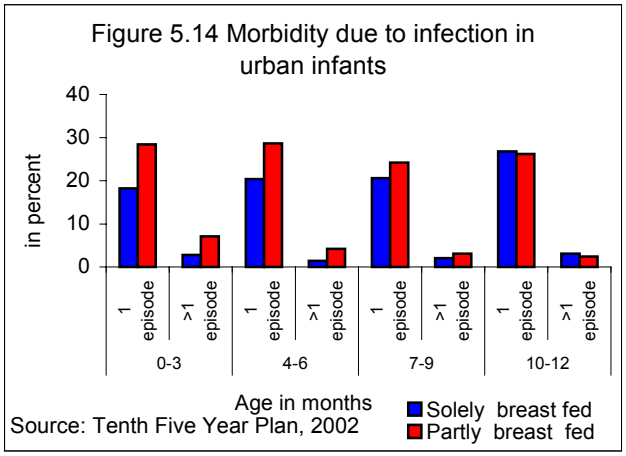
Source: Prema 1989

In spite of the fact that there has been no decline in the prevalence of low birth weight, India has achieved substantial decline in IMR (Registrar General of India, 2002). With the increase in survival of the low birth weight neonate, there is growing concern regarding the relationship between low birth weight and poor growth during childhood adolescence as well as increased risk of chronic degenerative diseases in later life.

Under the Reproductive and Child Health Programme 1 (Ministry of Family and Health Welfare, 1998-99) and 2 (Ministry of Family and Health Welfare, 2002) efforts are under way to provide effective antenatal care and achieve reduction in low birth weight. Factors such as maternal height, which has significant influence on birth weight, are not amenable to short term corrective interventions. On the other hand, anaemia, pregnancy induced hypertension and low maternal weight gain during pregnancy can be detected and treated. Effective management of these could result in substantial reduction both in pre-term births and birth of small for date neonates.

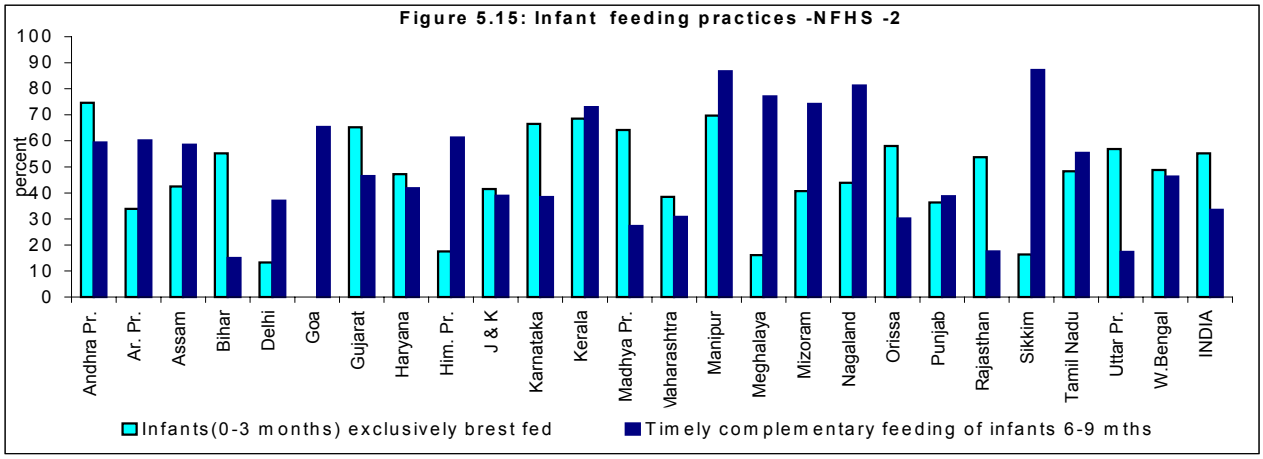
5.3. Growth during infancy and early childhood





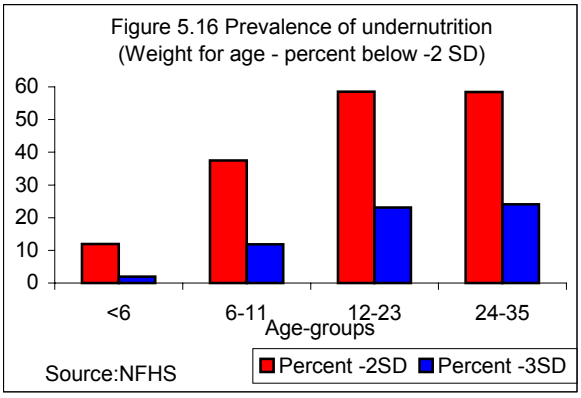
Growth during infancy and childhood depend upon birth weight, adequacy of infant feeding and absence of infection. Available data clearly indicate that in India exclusively breast-fed infants thrive normally during the first six months of life (Figure 5.13) and have lower morbidity episodes (diarrhoea, respiratory tract infection and fever) than those receiving supplements in addition to breast milk (Figure 5.14). In India, steps taken for the protection and promotion of the practice of breast-feeding have been effective and breast-feeding is almost universal (Planning Commission, 2002). However, the message that exclusive breast feeding up to six months and gradual introduction of semisolids after that are critical for the prevention of under-nutrition in infancy has not been as effectively communicated. Data from NFHS 2 (IIPS, 1998-99) indicated that though breastfeeding was nearly universal and mean duration of lactation is over 2 years, exclusive breast-feeding among infants in the age group of 0-3 months was only 55.2 percent. In spite of the emphasis on the need for timely introduction of complementary food only 33.5 per cent of the infants in the age group of 6-9 months received breast milk and semi-solid food.

There are substantial inter-state differences in exclusive breastfeeding and timely introduction of semi-solid food (Figure 5.15). Too early introduction of supplements is a major problem in states like Delhi, Himachal Pradesh and Punjab and too late introduction of supplements is a big problem in Bihar, Uttar Pradesh, Madhya Pradesh,



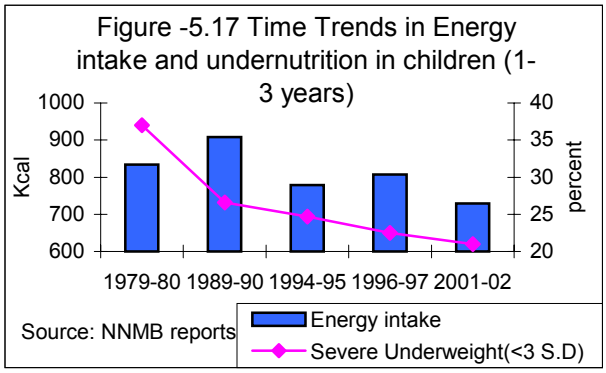
Rajasthan, and Orissa. Kerala fares well in terms of appropriate infant feeding practices and this might be one of the reasons for the relatively low under nutrition rates in the state (IIPS, 1998-99)

Too early introduction of milk substitutes and too late introduction of complimentary food are associated with increased risk of under-nutrition and infection. As a result of faulty infant feeding practices there is a steep increase in the prevalence of under-nutrition from 11.9 per cent at less than 6 months to 58.5 per cent in the 12- 23 months age group (Figure 5.16). A major thrust during the Tenth five Year plan is aimed at prevention of onset of under-nutrition in infancy and early child hood through nutrition education so that by 2007 more than 80% of women exclusive breast feeding upto six month and complementary feeding rate at six month goes up to 75 per cent (IIPS, 1998-99).



5.4. Time trends in the dietary intake and nutritional status of pre-school children

Data from NNMB (NNMB 1979-2002) on energy intake and prevalence of under nutrition in under three children is shown in Figure 5.17. There has been a steady decline in under-nutrition in children even though the dietary intake has not shown a major change over years. The decline in under nutrition is most probably attributable to the better access to health care and effective management of infections.



Pre-school children constitute one of the most nutritionally vulnerable segments of the population and their nutritional status is considered to be a sensitive indicator of community health and nutrition. There has not been a substantial improvement in their dietary intake over the last two decades (Table 5.2).

Table-5.2 Average Nutrient Intakes Among Pre-school Children

	1-3 years			4-6 years		
	1975-79	88-90	96-97	75-79	88-90	96-97
Protein (g)	22.8	23.7	20.9	30.2	33.9	31.2
Energy (Kcal)	834	908	807	1118	1260	1213
Vitamin A (μg)	136	117	133	159	153	205
Thiamin (mg)	0.50	0.52	0.40	0.76	0.83	0.70
Riboflavin (mg)	0.38	0.37	0.40	0.48	0.52	0.60
Niacin (mg)	5.08	5.56	4.60	7.09	8.40	7.40
Vitamin C (mg)	15	14	15	20	23	25

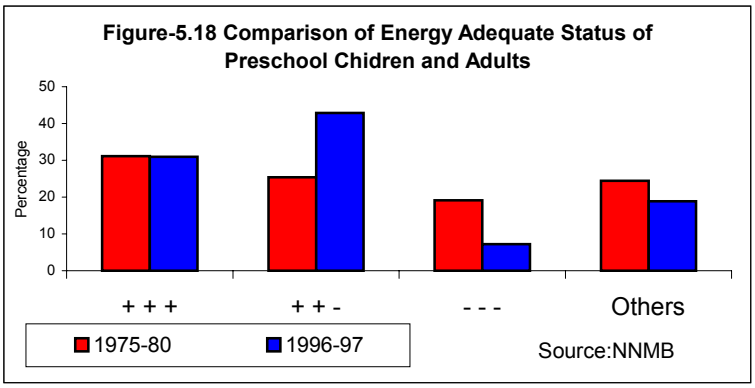
Source: NNMB (2000)

Table 5.3. Mean Energy Intake- Children / Adolescents and Adults

	Males			Females		
Age Group	Kcals	RDA	% RDA	Kcals	RDA	% RDIA
Pre-school	889	1357	65.5	897	1351	66.4
School Age	1464	1929	75.9	1409	1876	75.1
Adolescents	2065	2441	84.6	1670	1823	91.6
Adults	2226	2425	91.8	1923	1874	102.6

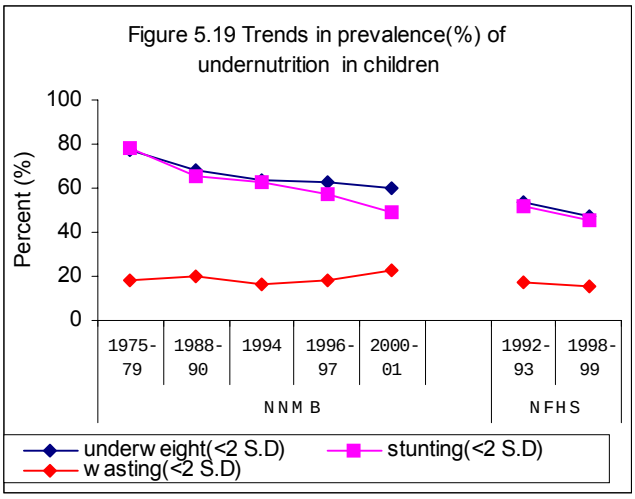
Source: NNMB 2000

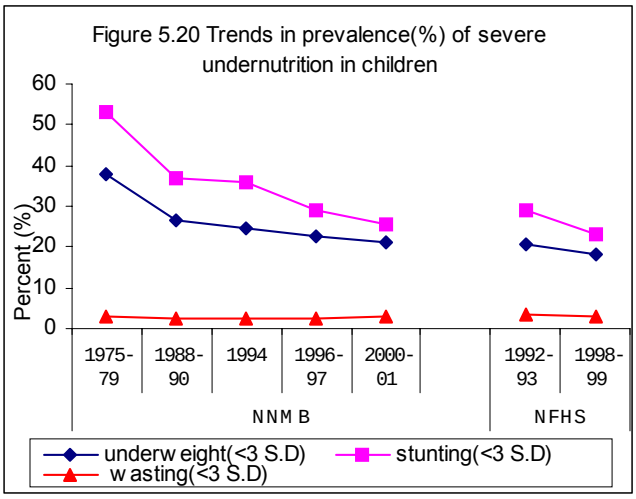
Data on energy intake in children, adolescents and adults from NNMB 2000 (NNMB, 2000) is shown in Table 5.3. Mean energy consumption, as percentage of RDA is the least among the preschool children. Time trends in intra familial distribution of food (Figure - 5.18) indicate that while the proportion of families where both the adults and preschool children have adequate food has remained at about 30% over the last 20 years, the proportion of families with inadequate intake has come down substantially. However, the proportion of families where the pre-school children receive inadequate intake in all while adults have adequate intake has nearly doubled. This is in spite of the fact that the RDA for preschool children forms a very small proportion (on an average 1300 Kcal/day) of the family's total intake of around 11000 Kcal/day (assuming a family size of 5). It would, therefore, appear that poor young child feeding and caring practices and not poverty is factor responsible for inadequate dietary intake. Tenth Five Year Plan (Planning Commission, 2002) has emphasised the importance of health and nutrition education to ensure proper intrafamily distribution of food based on needs.



Dietary Intake	Adult Male	Adult Female	Preschool Children
+++	Adequate	Adequate	Adequate
++ -	Adequate	Adequate	Inadequate
- - -	Inadequate	Inadequate	Inadequate

5.5. Time trends in prevalence of under nutrition in preschool children

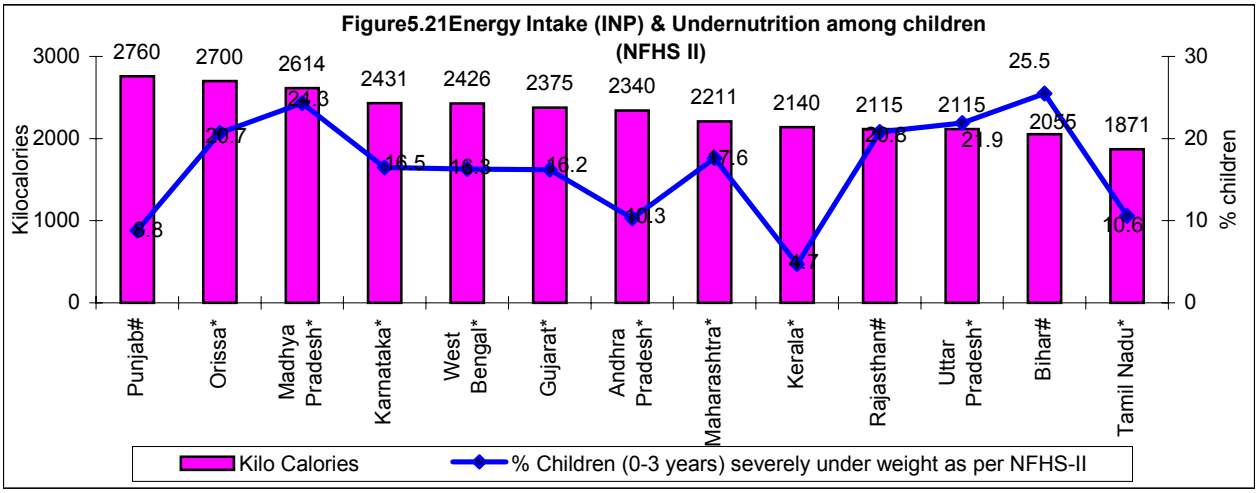




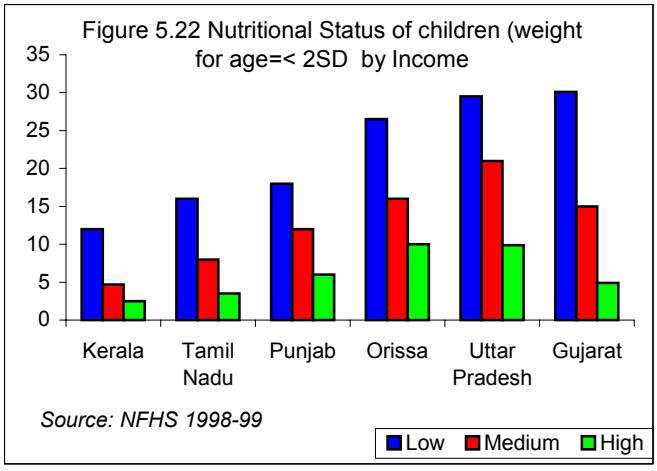
Source: National Nutrition Monitoring Bureau, 1975-80,1988-90, 1996-97, 2000-01; India Nutrition Profile, 1995-96; National family Health Survey, 1992-93, 1998-99. Age 0-6 in NNMB&INP surveys; -3 years in NFHS 1&2 Survey Population: Rural (NNMB), Rural & Urban (INP), Rural & Urban (NFHS) *Sample size: NNMB, 1975-80 (6428); 1988-90 (13432); 1996-97 (8654); 2000-01(6646); INP (46457); NFHS, 1998-99 (24600); 1992-93 (25584)*

Over the last three decades there has been a steep decline in the prevalence of moderate and severe under nutrition as assessed by weight for age and height for age (Figure 5.19 & 5.20). There has been relatively no change in the prevalence of wasting. In spite of the steep decline in the prevalence of stunting over the last three decades, the change in the mean height of children is very low. The increase in adult height is also modest 2-4 cms in three decades.

Indian children are short as compared to the NCHS norms; even when they have appropriate weight for their height they get classified as undernourished by NCHS norms. The so-called South Asian paradox (high under nutrition rates but comparatively good health status) will disappear if BMI for age is used as criteria for defining under



nutrition. Early detection and correction of wasting will have to be taken up on priority basis so that there is reduction in wasting; this will inturn enable Indian children to achieve their growth potential. In India there are considerable interstate difference in the dietary intake and nutritional status of children (Figure 5.21). Though dietary intake is a major determinant of nutritional status in children, it is not the only determinant. Energy intake is low and under nutrition is high in Uttar Pradesh, Bihar and Rajasthan. However in spite of low energy intake prevalence of under nutrition is low in Kerala and Tamil Nadu, most probably because of more equitable intra-familial distribution of food based on needs and better access to health care. In spite of high energy intake prevalence of under nutrition is high in Madhya Pradesh and Orissa perhaps due to inequitable distribution of food and poor access to health care (IIPS, 1998-99).

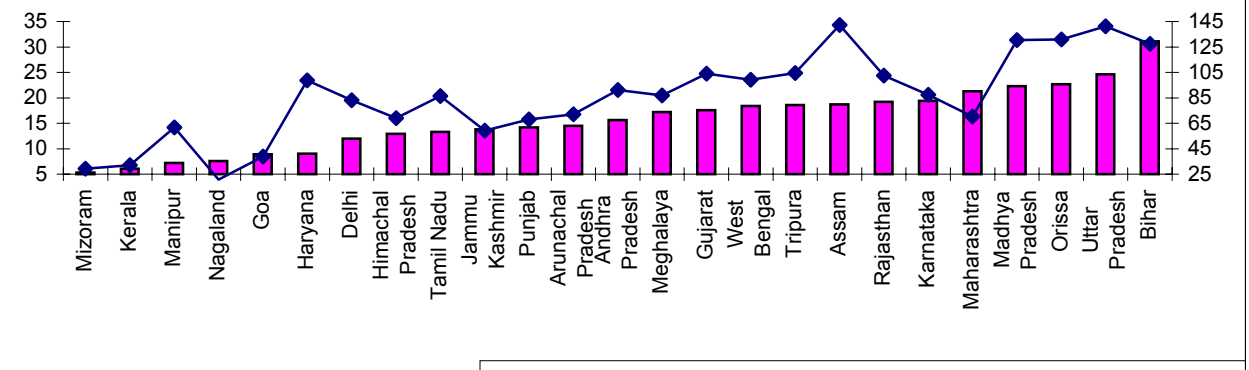


Nutritional status of poor children in Kerala is similar to the nutritional status of the rich in Uttar Pradesh and Orissa (Figure 5.22). This is probably

attributable to better access to health care and equitable distribution of food between members of the family in Kerala and lack of these in Uttar Pradesh. These data clearly indicates that lack of access to health care is a major factor responsible for under nutrition in preschool children. The decline in fertility and reduction in the higher order births may also have contributed to this because prevalence of severe forms of under-nutrition is higher among higher order births (IIPS, 1998-99).

Poor dietary intake, poor caring practices and poor access to health care are some of the major factors responsible for under-nutrition and under five mortality (U5MR). In

Figure 5.23 % of severe underweight(<4yrs) and under-5 mortality rate

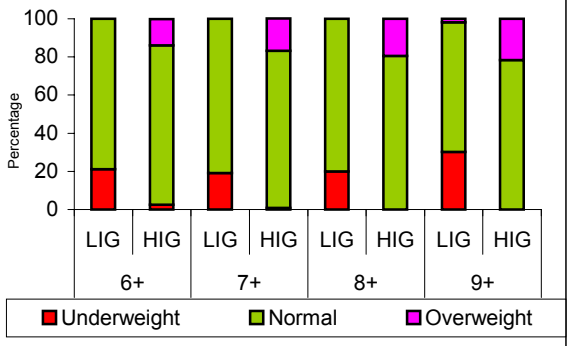


Source: NFHS 1992-93

most of the states eg Orissa where under-nutrition is high, under five mortality rate is also high; in states like Kerala where under-nutrition is low, U5MR is also low (Figure 5.23). However there are exceptions to this. In Maharashtra U5MR is relatively low inspite of relatively high undernutrition rates, perhaps because access to health care is better. In Punjab, inspite of high per capita income, high dietary intake and good access to health care, both under-nutrition and IMR are relatively high. These data indicate the importance of health care in reducing both under nutrition and under five mortality (IIPS, 1992-93).

5.6. Nutritional status of affluent school children

Figure 5.24 Comparison of weight-for-age (NCHS) in LIG & HIG school boys in Delhi

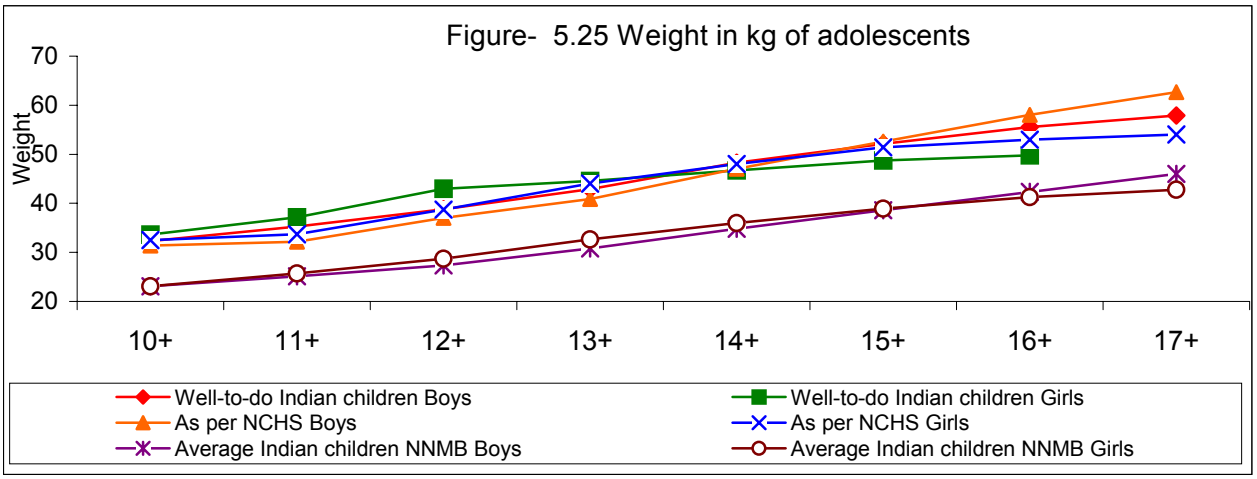


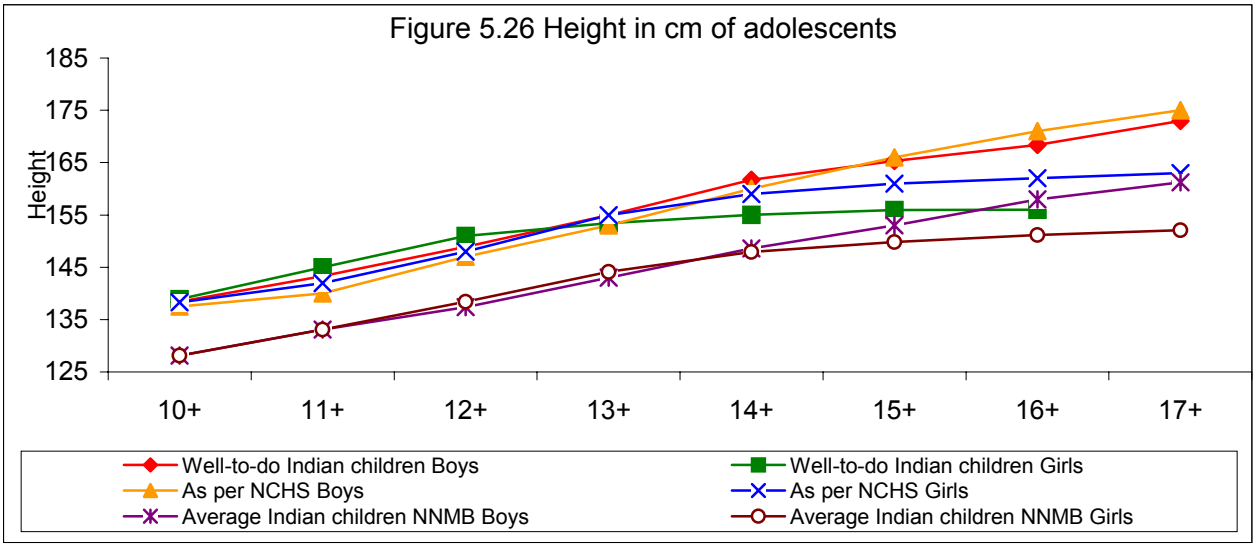
Source: Twenty Five Year Report, NFI 2004

LIG-Low income group, MIG-Middle income group, HIG-High income group

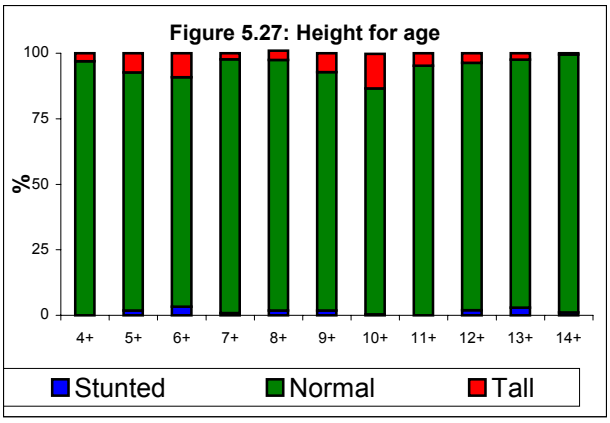
Studies carried out by Nutrition Foundation of India (1991) (Nutrition Foundation of India, 2004) showed that growth of affluent children in 0-6 years of age was similar to the NCHS-WHO norm. Data from studies carried out by NFI in Delhi between 2000-2004 (Nutrition Foundation of India, 2004) showed that while under nutrition is the problem in children from low income group (LIG) who are studying in Government schools, over nutrition is the cause for worry in high income group (HIG) children in public schools right from six years of age (Figure 5.24).

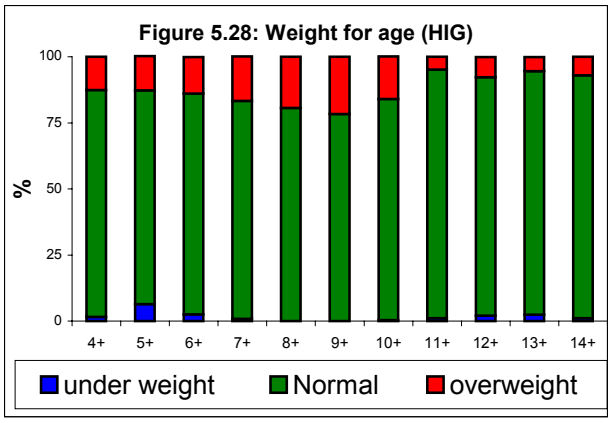
5.7. Growth of adolescents from urban affluent families





Comparison between the heights and weights of adolescent girls and boys from affluent segments show that their heights and weights are comparable to NCHS norms (Figure 5.25 & 5.26) and are higher than adolescents surveyed by NNMB (NNMB 1979-2002) Data on height and weight distribution (as compared to NCHS norms) in Delhi school children from affluent segments of the population investigated by Nutrition Foundation of India (1998-2005) is shown in Figures 5.27 and 5.28. Even among affluent segments there are some children who are stunted (-2SD height for age). There are overweight children in all classes right from play school. After the age of ten there is a reduction in overweight children because they are conscious of being overweight and try to lose weight either through exercise or through skipping meals (Nutrition Foundation of India, 2004). However consistent habits in eating and exercise often elude these adolescents; as a result they have cyclical weight gain and loss and incur all the health hazards associated with it.





5.8. Nutritional status of adults

Data from NNMB and INP shows that prevalence of under-nutrition in adults is higher in rural areas as compared to urban areas (Table 5.5). Prevalence of over nutrition is higher in urban areas. Over the last three decades there has been a progressive decline in under nutrition and some increase in over-nutrition both in urban and in rural areas. Prevalence of both under nutrition and over nutrition are higher in women as compared to men.

Table 5.5 Prevalence of Under-nutrition and over nutrition among adults

	Underweight						**Overweight**					
	NNMB					**INP***	NNMB					INP
	'75-79	'89-90	'96-97	'00-01	'93-94	'95-96	'75-79	'89-90	'96-97	'00-01	'93-94	'95-96
Rural	53.2	49	48.5	38.6		34.6	2.9	3.1	46.5	6.6		4.1
Urban					20.3	27.7					8.8	6.0
Male	55.6	49	45.5	37.4	22.2	28.6	2.3	2.6	4.1	5.7	5.0	4.3
Female	51.8	49.3	47.7	39.3	19.4	36.3	3.4	4.1	6.0	8.2	10.6	4.6

Source: NNMB -90, 1996-97, 2000-01INP,1995-96; NFHS, 1998-99.

Survey Population: NNMB Rural (1975-79, 1988-90, 1995-96, 2000-01) &Urban (1993-94); INP (1995-96)both urban and rural (U+R)Sample size: NNMB, 11973 (1975-79), 21398 (1989-90), 30773 (1996-97), 11074 (2000-01); NNMB 2772 (1993-94); INP, 177841 (1995-96),

5.9. Nutritional status of women

Data from National Family Health Survey indicates that as of 1998-99 prevalence of under nutrition in urban areas is half of the prevalence of under nutrition in rural areas (Table 5.6). Prevalence of over nutrition is four folds higher in urban as compared to rural areas. There is a progressive decline in the prevalence of under nutrition and progressive increase in the prevalence of over nutrition in adult women with increase in age.

Data from NFHS –2 show that while

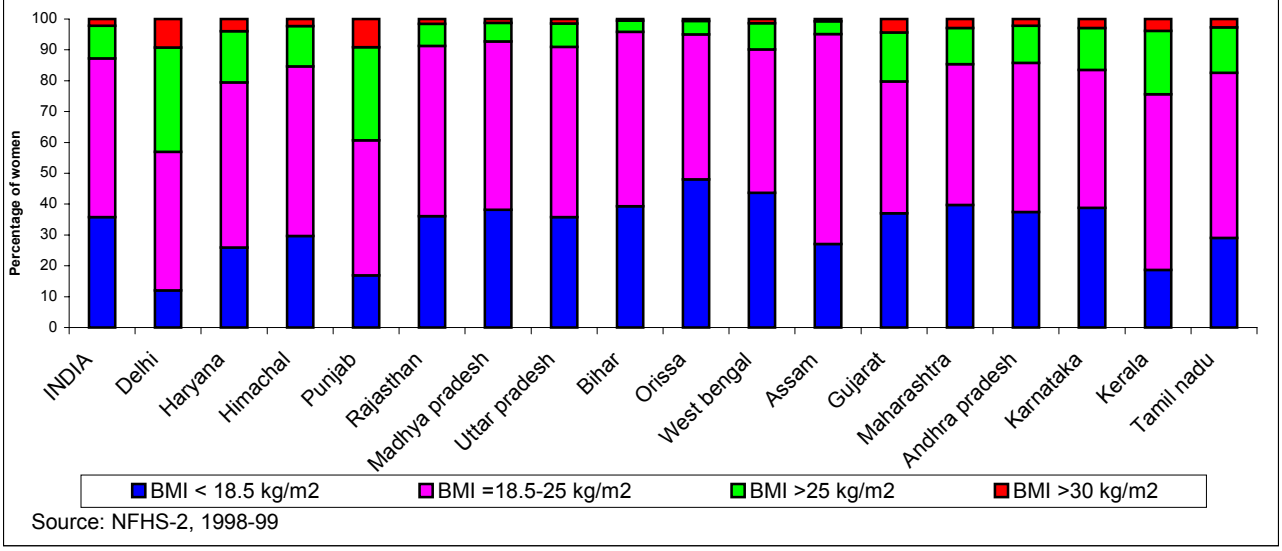
Table 5.6 Prevalence of Under-nutrition and over nutrition among women(15-45)

Characteristic	**Mean BMI**	**BMI<18.5**	**BMI≥25**
	1998-99	**1998-99**	**1998-99**
Rural	19.6	40.6	5.9
Urban	21.1	22.6	23.5
Age			
15-19	19.3	38.8	1.7
20-24	19.3	41.8	3.6
25-29	19.8	39.1	7.3
30-34	20.4	35.0	11.7
35-49	21.1	31.1	16.8
All	20.3	35.8	10.6

Source: NFHS, India, 1998-99. Survey Population: Rural & Urban; Sample Size: 77119 (1998-99)

prevalence of undernutrition is continuing to be high among women poorer segment of the population, overnutrition and obesity are emerging as major problems in all the states. There are substantial differences in the prevalence of under and over nutrition between states but all states have to gear up for detection and management of these dual nutrition problems in women (Figure 5.29)

Figure 5.29 Comparison of the BMI of women (state-wise)



Source: NFHS-2, 1998-99

5.10. To sum up

During the past three decades there has been

- a very small (2-4 cm) increase in adult height over the last three decades
- significant increase in the mean body weight ; this is mostly due to increase in body fat as shown by increase fat fold thickness; increase in fat fold thickness is more urban areas

Increase in fat deposition in the absence of increase in energy consumption is attributed to the reduction in physical activity. There are very few studies documenting the physical activity pattern over the last three decades. However it is well documented that over this period there has been

- reduction in the number of the persons engaged in manual work
- substantial improvement in mechanical aids in agriculture, industry and allied activities
- improvement in access to water and fuel near households both in urban and rural areas
- availability of urban mass transport at affordable cost has resulted in less number of people walking or cycling to work place, school or market
- mechanical aids have reduced physical activity during cooking and household chores
- among urban affluent class TV and computers contributed to steep reduction in physical activity .

As a result of these life style changes, there has been a reduction in energy requirements. Unchanged energy intake and reduced energy requirement is associated with positive energy balance and fat deposition.

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6.0 MICRONUTRIENT DEFICIENCIES

Goitre due to iodine deficiency, blindness due to Vitamin A deficiency, and anaemia due to iron and folate deficiency are major public health problems in India. Over the last three decades there has been a steep decline in keratomalacia due to severe Vitamin A deficiency. However, there has not been any decline in the prevalence of anaemia due to iron and folic acid deficiency; the decline in Vitamin A deficiency and iodine deficiency disorders has been very slow. Data from NNMB surveys, NFHS and DLHS provide valuable insights for assessing the progress achieved so far in combating these deficiencies, help in formulating the future interventions and provide baseline information to assess the impact of future interventions.

6.1 Anaemia

In India, the prevalence of anaemia is high because of

- Low dietary intake of iron (less than 20 mg /day NNMB 2000) and folate (less than 70 micrograms/day);
- Poor bio-availability of iron (3-4 percent only) in phytate fibre-rich Indian diet; and
- Chronic blood loss due to infection such as malaria and hookworm infestations.

Data from DLHS (all states 1100 households/district, 2002-03) (Ministry of Family and Health Welfare, 2002-03) and NNMB survey (data from 8 states, NNMB 2002) have shown that prevalence of anaemia is very high (ranging between 80->90 percent) in preschool children, pregnant and lactating women and adolescent girls (Figure 6.1). Criteria used for assessing anemia in DLHS survey is given in Table 6.1.

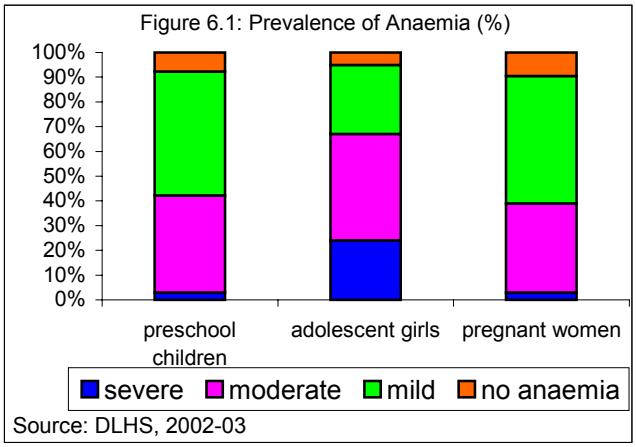
Table 6.1 Criteria used for anaemia in DLHS survey

		Anaemia (g/dl)		
	Normal	Mild	Moderate	Severe
Pregnant women & Preschool children	≥11	8.0-10.9	5.0-7.9	≤5
Adolescent girls	≥12	10.0-11.9	8.0-9.9	≤8

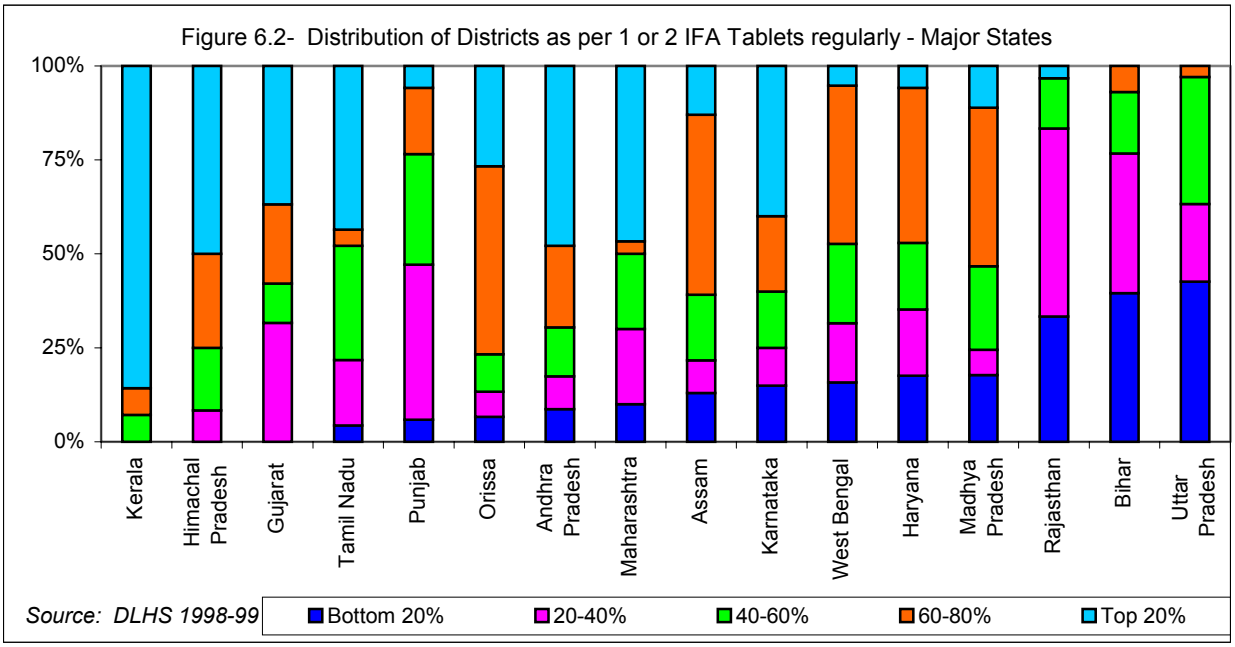
Source: DLHS, 2002-03

Moderate and severe anaemia is seen even among the upper income group educated families. There are interstate differences in prevalence of anaemia, which is perhaps attributable partly to differences in dietary intake and partly to access to health care.

Anaemia is associated with increased susceptibility to infections, reduction in work capacity and poor concentration. Anaemia remains to be major cause of maternal mortality in India accounting for over 20percent of all maternal deaths. In view of the low dietary intake of iron and folate, high prevalence of anaemia and its adverse health consequences, India became the first developing country to take up a National Nutritional Anaemia Prophylaxis Programme (NNAP) to prevent anaemia among pregnant women



and children. Screening for anaemia and iron-folate therapy in appropriate doses and route of administration for the prevention and management of anaemia has been an essential component of antenatal care and paediatric practice for the last three decades; however, coverage under these programme are very low. (Figure 2). As a result of this, very high rates of anaemia in pregnant women persist and the impact of



severe anaemia on birth weight and maternal mortality remain unaltered. Anaemia continues to be a major problem affecting all segments of the population and there has not been any substantial decline in the adverse health consequences associated of anaemia.

6.2 Strategies for the Prevention, Detection and Management of Anaemia in Tenth Plan (Planning Commission, 2002)

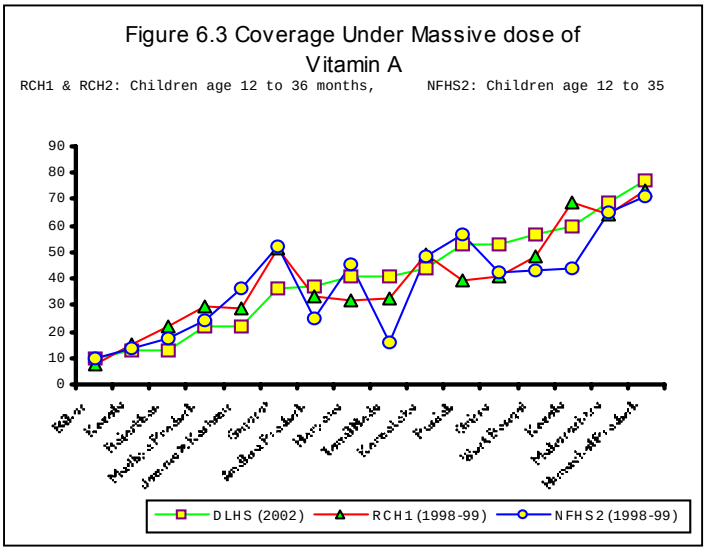
The entire Indian population of over one billion will have to double their iron and folate intake and sustain it life long. The major intervention strategies required for the prevention and management of anaemia are:

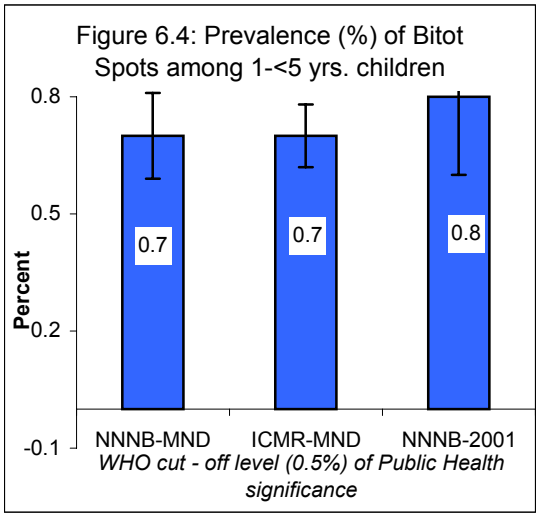
- Dietary diversification inclusion of iron folate rich foods as well as food items that promote iron absorption;
- Health and nutrition education to improve consumption of iron and folate-rich foodstuffs;
- Food fortification, especially introduction of iron and iodine-fortified salt to all at affordable cost to ensure sustainable improvement in iron intake of billion plus population.
- Screening for early detection of anaemia among vulnerable groups (such as pregnant women and children).
- Management of anaemia depending upon its severity/ chronicity, physiological status of the individual and the time available for correction of anaemia.

The Tenth Plan has set the goal of reduction in prevalence of anaemia by 25 percent and reduction in prevalence of moderate/severe anaemia by 50 percent by 2007.

6.3 Vitamin A Deficiency

Vitamin A is an important micronutrient for maintaining normal growth, regulating





cellular proliferation and differentiation, controlling development, and maintaining visual and reproductive functions. Diet surveys have shown that the intake of Vitamin A is significantly lower than the recommended daily allowance in all and over decades there has not been any improvement in intake (NNMB 1979-2002). NFHS, RCH-1 and DLHS surveys have shown that coverage under Massive Dose Vitamin A programme has been poor (Figure 6.3). However over years there has been a steep decline in severe forms of Vitamin A deficiency in children. Blindness due to vitamin A deficiency is now very rare. All the large national surveys (NNMB-MND, ICMR-MND and NNMB 2001) have clearly shown that the, in clinical Vitamin A deficiency in under-five children in the country is currently below 1 percent (Figure 6.4). The decline in Vitamin A deficiency signs in children appears to be due to better access to health care, consequent reduction in severity and duration of common childhood morbidity due to infections especially measles.

6.4 Strategies for management of Vitamin A deficiency during the Tenth Plan (Planning Commission, 2002)

Clinical Vitamin A deficiency often coexists with other micronutrient deficiencies and hence, there is a need for broad-based dietary diversification programmes aimed at improving the overall micronutrient nutritional status of the population. In addition, the ongoing Massive Dose Vitamin A supplementation programme in children in the 9-36 month age group will be continued and its implementation strengthened.

Goals for the Tenth Plan

- Achieve universal coverage for each of the five doses of Vitamin A;

- Reduce prevalence of night blindness to below 1 per cent and that of Bitot's Spots to below 0.5 per cent in children between six months to six years of age; and
- Eliminate Vitamin A deficiency as a public health problem.

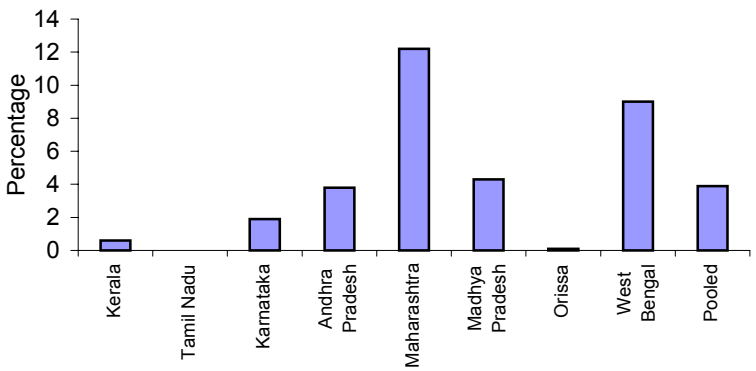
6.5 IODINE DEFICIENCY DISORDERS

Iodine deficiency disorders (IDD) have been recognised as a public health problem in India since the 1920s. IDD is due to deficiency of iodine in water, soil and foodstuffs and affect all socio-economic groups living in defined geographic areas. Surveys carried by Central and State Health Directorates, Indian Council of Medical Research and various Medical Colleges have shown that no State or Union Territory is free from the problem of IDD. An estimated 167 million people are at risk of Iodine Deficiency Disorders (IDD) in India of which 54 million have goitre and over 8 million have neurological handicaps. Universal use of iodised salt is a simple, inexpensive method of preventing iodine deficiency disorders.

6.6 Ongoing Interventions to reduce IDD

The Government of India launched National Goitre Control Programme (NGCP) in 1962. Initially the programme aimed at providing iodised salt to the well-recognized Sub-Himalayan 'goitre' belt. However due to erratic availability of salt, availability of cheaper non-iodised salt, lack of awareness regarding need to use iodised salt, there was no substantial reduction in IDD. As no state is free of IDD, a decision was taken for universal iodisation of salt for human consumption. This was implemented in a phased manner from 1986. There was a major effort to increase the production and promoting access of iodised salt (Salt Department, 2003-04). In August 1992, the NGCP was renamed as National Iodine Deficiency Disorders Control Programme (NIDDCP) taking into its ambit control of the entire wide spectrum of IDD. The Government took a policy decision to iodise the entire edible salt in the country. India became the second largest producer of iodised salt in the world today after China. In 1997 the storage and sale of non-iodised salt was banned by the Central Government; but In October 2000, the central government lifted the ban because "matters of public health should be left to informed choice and not enforced.

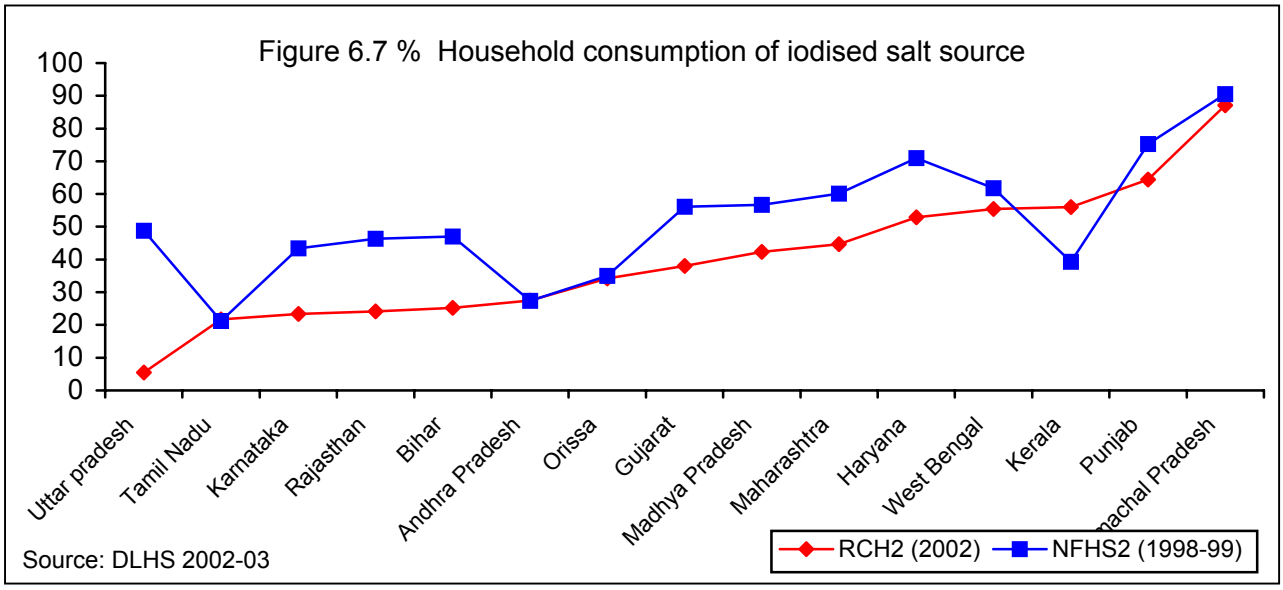
Figure -6.5 Prevalence of goitre (children 6-12yrs)



Source: NNMB 2002

Data on prevalence of goitre in 6-12 year old children in the NNMB states (NNMB, 2002) is shown in Figure 6.5. The relatively high prevalence of goitre in these non-endemic states is a source of concern. The data from the District Level Household Survey 2002-03, which under took spot test for iodisation in the salt consumed in 3,05,106 households is presented in

Figure 6.7. There has been some decline in the consumption of iodised salt after the lifting of the National ban on use of non-iodised salt.



6.7 Strategies For The Prevention Of Iodine Deficiency Disorders During The Tenth Plan (Planning Commission, 2002-2007)

On 25.6.2005 the Union Minister for Health and Family Welfare announced the decision of the Government of India to reimpose the ban on sale of non iodised salt for human consumption It is expected that this announcement ensure universal access to iodised salt, so that the time lost since 2000 is made up and the goals set in the Tenth Plan are achieved.

The Tenth Plan goals are to:

- Achieve universal access to iodised salt;
- Generate district-wise data on iodised salt consumption; and
- Reduction in the prevalence of iodine deficiency disorders in the country to less than 10 per cent by 2010.

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6.2 NNMB National Nutrition Monitoring Bureau. 1979-2002. *NNMB Reports*. National Institute Of Nutrition, Hyderabad.

6.3 NNMB National Nutrition Monitoring Bureau. 2002. *NNMB Micronutrient Survey*. National Institute Of Nutrition, Hyderabad.

6.4 NNMB National Nutrition Monitoring Bureau. 2001. *NNMB Report-2001.* National Institute Of Nutrition, Hyderabad

6.5 Indian Council of medical Research.2004. *Micronutrient Profile of Indian Population*. New Delhi .

6.6 Ministry of Family and Health Welfare. 2002. *Reproductive and Child Health-1*. Government of India, New Delhi.

6.7 NNMB National Nutrition Monitoring Bureau. 2000. *NNMB Reports*. National Institute Of Nutrition, Hyderabad.

6.8 International Institute of Population Sciences. 1992-93. *National Family Health Survey 1.* Mumbai.

6.9 International Institute of Population Sciences. 1998-99. *National Family Health Survey 2.* Mumbai.

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7.0 Over nutrition and non-communicable diseases

Soon after independence, India established systems for assessment of per-capita income, purchasing power, poverty, under nutrition and micronutrient deficiencies. Data from these were used to assess interstate differences and time trends in these indices. However a similar system for tracking over nutrition and risk of non-communicable diseases (NCD) was not established till nineties; even now the coverage under these are not as extensive as the coverage under the nutrition surveys. In view of this, for documenting time trends in prevalence of non-communicable diseases related to over-nutrition, the country has to depend on research studies carried out in different parts of the country. The differences in methodology of data collection, criteria used for case definition and parameters reported make the task of comparison between studies and drawing conclusions regarding time trends a rather difficult exercise. However from the existing data, it is clear that there has been an increase in prevalence of diabetes, hypertension and cardiovascular diseases over the last two decades especially in urban affluent segments of population. These diseases appear a decade earlier, often in association with abdominal obesity as a part of metabolic syndrome. Prevalence of these diseases is lower in poorer segments and in rural areas, but case fatality rates may be higher in them because of poor access to health care.

National Cancer Registry Programme (NCRP) (Indian Council of Medical Research, 1983) established hospitals based and population based cancer registries in mid eighties and has been generating data on time trends and regional differences in cancer incidence, prevalence and mortality. Data from NCRP shows that India has the lowest cancer rates in the world in spite of relatively high tobacco use (nearly half of the cancers in men are tobacco related). In spite of the increasing longevity there has not been any increase in over all cancer incidence over the last two decades. However, there have been changes in incidence of cancers in different sites eg decrease in prevalence of cancer cervix and increase in cancer breast.

As NCDs are emerging as major public health problems in India, Indian Council of Medical Research (ICMR) under took an assessment of disease burden due to NCD in 2004 using DISMOD II model (ICMR, 2004). The major data sources utilised for this exercise were

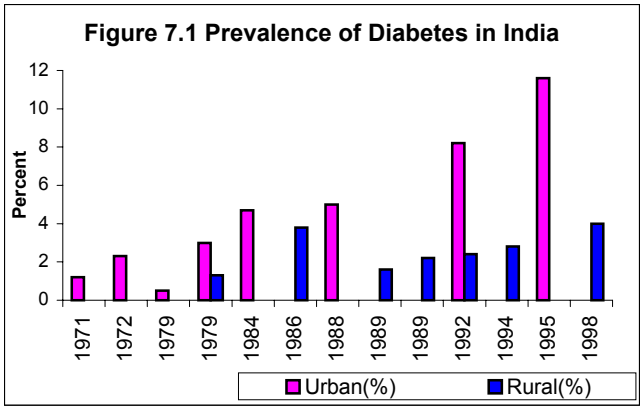
- medical certification of causes of disease (MCCD)
- survey of causes of death (rural)
- cancer registry data
- review of 180 published articles,10 published reports, five unpublished reports and one personal communication dealing with diabetes, hypertension, ischemic heart disease, stroke and cancers

This publication provides the national level estimates of disease burden due to NCD in the first five years of the new millennium.

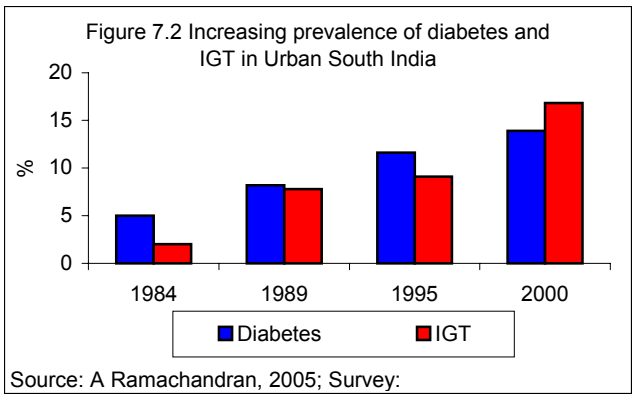
Available data on time trends in prevalence of hypertension, diabetes, ischemic heart disease, stroke and cancers over the last two decades, ICMR estimates of the diseases burden due to NCD and the relationship between nutritional status and NCD are reviewed in this section.

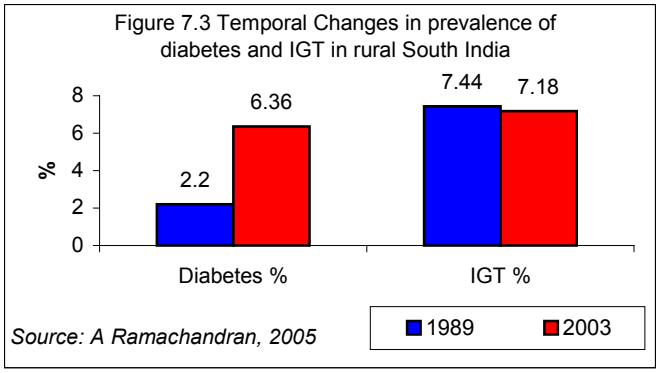
7.1 Diabetes and impaired glucose tolerance

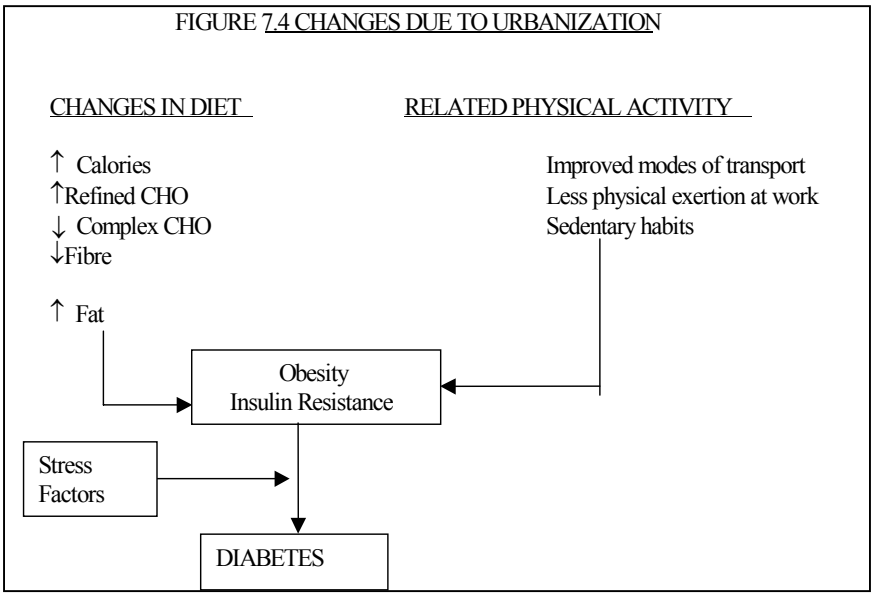
Community based studies on prevalence of diabetes in urban and rural areas have been conducted in all regions of the country (Figure 7.1); all these studies show that over the last three decades there has been progressive increase in prevalence of diabetes both in urban and rural areas.



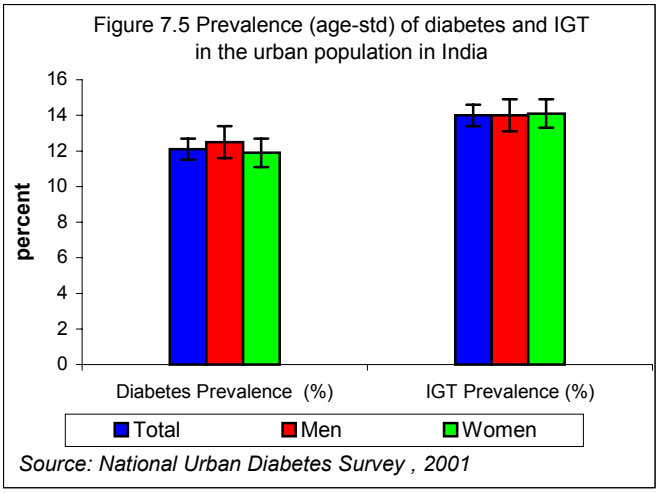
Data from the Chennai on time trends in prevalence of diabetes and impaired glucose tolerance (IGT) in urban and rural urban population (Figure 7.2, 7.3) shows that over the last two decades there has been a progressive steep increase in prevalence of diabetes and IGT in urban and rural areas (Ramachandran A, 2005). Prevalence is higher in urban areas. Potential factors associated with higher urban prevalence of diabetes are shown in Figure 7.4.



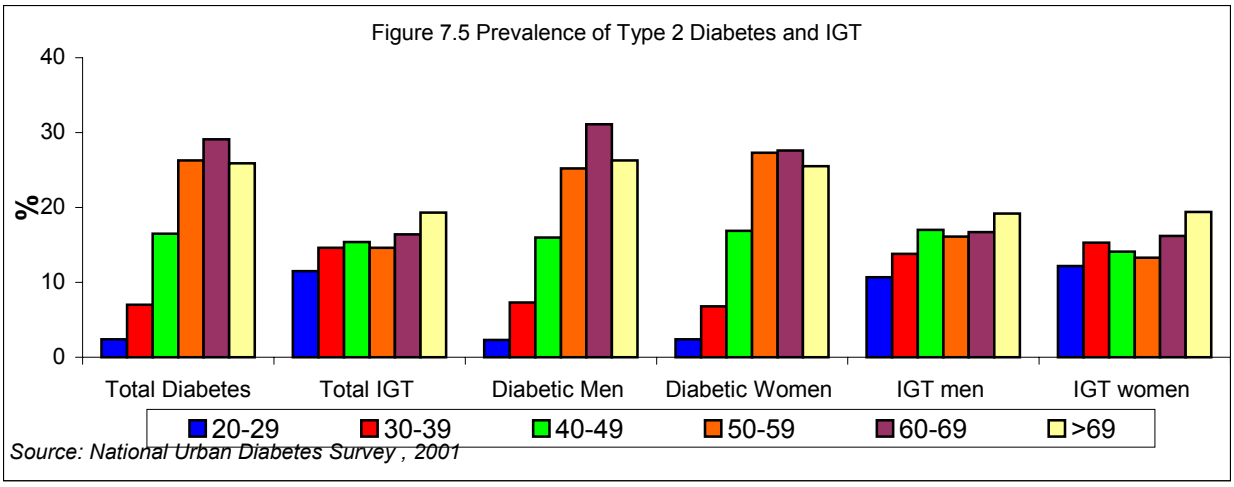




In 2000 Diabetes Epidemiology Study group in India initiated, a multicentre community based study using stratified



random sampling method in Bangalore, Chennai, Mumbai, Delhi, Kolkata and Hyderabad to assess the prevalence of diabetes and IGT. Oral Glucose Tolerance Test (OGTT) was done in 11216 (5288 men; 5928 women) persons aged 20 years or above (representative sample drawn from all socio-economic strata). Information on socio-economic status, physical activity and anthropometric data were collected in all (National Urban Diabetes Survey, 2001). Age-standardized prevalence of diabetes and impaired glucose tolerance is shown in Figure 7.5. There was progressive increase



in prevalence of diabetes and IGT with age (Figure 7.6). Subjects under 40 years of age had a higher prevalence of impaired glucose tolerance than diabetes (12.8 percent vs 4.6 percent, $p<0.0001$). In India diabetes is usually not listed as predisposing cause of death in death certificates; data from hospital-based studies suggest that major causes of death in patients with diabetes are infections, renal failure, IHD and stroke.

Summary results of ICMR's estimates of disease burden due to diabetes in 1998 and 2004 are presented in Table 7.1. Number of cases will increase from 58.34 million in

Table 7.1 Projections of disease burden due to diabetes

	1998			2004		
	Urban	Rural	Total	Urban	Rural	Total
Population(in000)	262,152	708,781	970,933	319,727	746,031	1,065,758
No. of cases of diabetes(000)	30,939	27,409,	58,348	37,734	28,849	66,583
No. of deaths due to diabetes	51,251	44,299	95,550	62,506	46,627	109,133
No. of YLL	529,959	484,983	1,014,942	646,351	510,471	1,156,822
No. of DALY	1,016,866	971,890	1,988,756	1,240,195	1,022,968	2,263,163
Source: Assessment of burden of non-communicable diseases, ICMR 2004						

1996 to 66.58 million in 2004 (37.73 million in urban and 28.85 million in rural). By 2004, diabetes accounts for 100 thousand deaths in a year, is responsible for 1.15 million Years Of Life Lost (YLL) due to disease and 2.26 million Disability Adjusted Life Years (DALYs) (ICMR, 2004)

WHO burden of disease study (2000) estimated that DALY attributable to diabetes is 2.7 million; ICMR estimates for 2004 correspond closely to this estimate (ICMR, 2004).

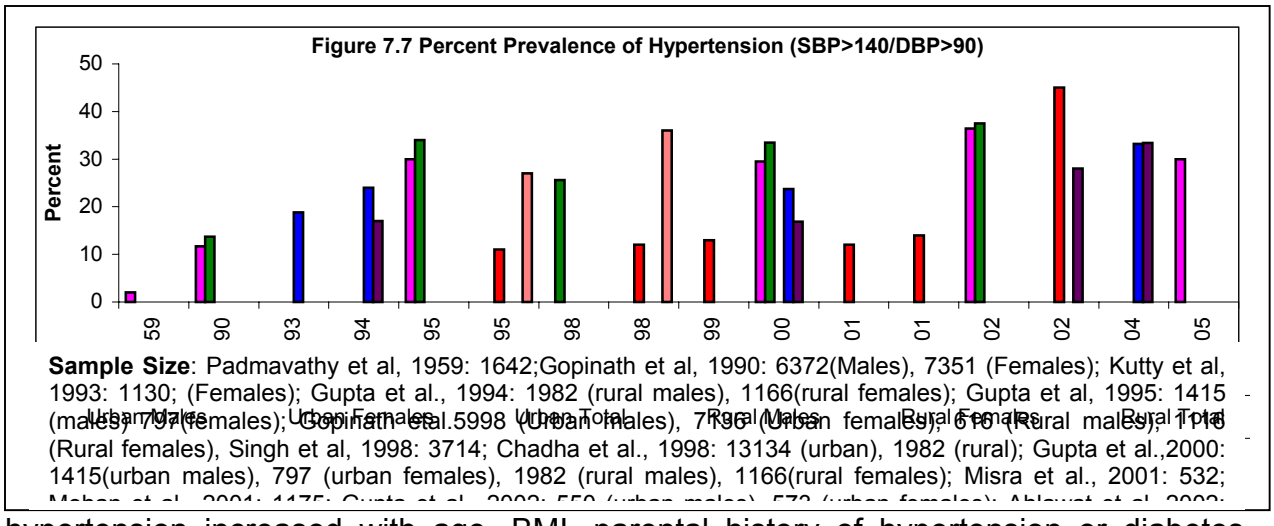
7.2 HYPERTENSION

Hypertension is probably the most common non-communicable disease. It is the most common factor responsible for Ischemic Heart Diseases (IHD) and cerebro-vascular accidents. In early seventies reported prevalence of hypertension was low ranging between 2-5 percent of adult population. However over years reported hypertension rates have increased and currently in urban adults range between 5-15 percent. Yagnik et al (Yagnik CS. 1998) have shown that even from early childhood some Indian children are prone to develop hypertension. Gopinath et al (Gopinath et al., 1994) investigated in 10200 Delhi school children (male 5709 and female 4506) aged between 5-14 years and showed that hypertension existed even among them. Prevalence of hypertension increased with age, BMI, parental history of hypertension or diabetes. Community based study of hypertension (systolic BP >140 and diastolic BP more than 85) in 6543 persons in 15-25 age group in Delhi in 1985-87 showed over all prevalence of hypertension was 3.9/1000 (Reddy KS. 1998) (Table 7.2).

Table 7.2 Age and sex-wise prevalence rate of hypertension /1000

	Male			Female			Total		
Age (in Yr)	No examined	Hypertensives	PR±SE	No examined	Hypertensives	PR±SE	No examined	Hypertensives	PR±SE
15-19	1744	47	26.9±4.0	1874	27	14.4±3.7	3618	74	20.5±2.0
20-24	1342	80	59.6±8.2	1583	48	30.3±6.7	2925	128	43.8±6.6
Total	3086	127	41.2±5.0	3457	75	21.7±4.0	6543	202	30.9±3.6

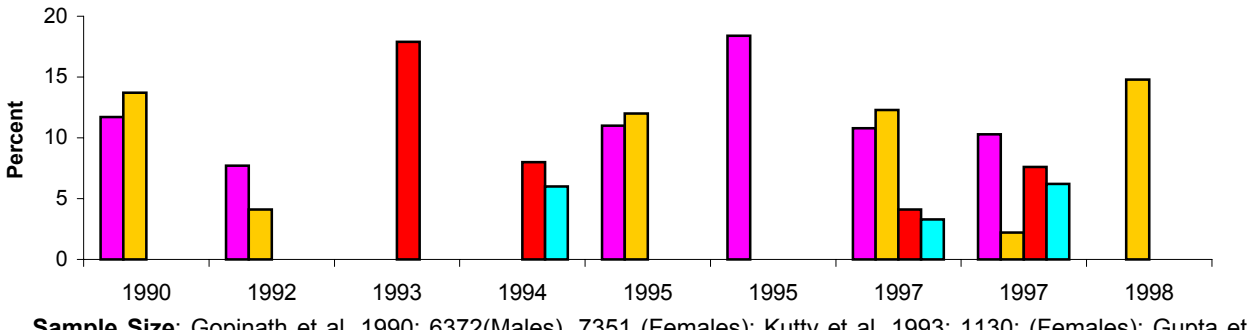
PR, Prevalence rate /1000, SE, Standard Error;Source: Gopinath et al, 1994
Survey: Urban Delhi;Sample Size: 6543



Sample Size: Padmavathy et al, 1959: 1642;Gopinath et al, 1990: 6372(Males), 7351 (Females); Kutty et al, 1993: 1130; (Females); Gupta et al., 1994: 1982 (rural males), 1166(rural females); Gupta et al, 1995: 1415 (males) 797(females); Gopinath etal.5998 (Urban males), 7196 (Urban females), 616 (Rural males), 1116 (Rural females), Singh et al, 1998: 3714; Chadha et al., 1998: 13134 (urban), 1982 (rural); Gupta et al.,2000: 1415(urban males), 797 (urban females), 1982 (rural males), 1166(rural females); Misra et al., 2001: 532;

Some of the major community based studies on hypertension over the last two decades is shown in Figure 7.7 and 7.8. It is obvious that over the past two decades there has been an increase in the prevalence of hypertension among men and women living in urban and rural areas. Prevalence in rural areas is lower than urban areas.
ICMR undertook an assessment of burden of disease due to hypertension (systolic BP> 140 mmHg and / or diastolic BP >90 mmHg) based on studies carried out between 1995 and 2002 in different regions in urban and rural areas (Figure 7.7) Meta analysis of data indicated that for the country prevalence rate of hypertension was 157.4/1000 (ICMR, 2004).

Figure 7.8 Percent Prevalence of Hypertension (SBP>160/DBP>90)

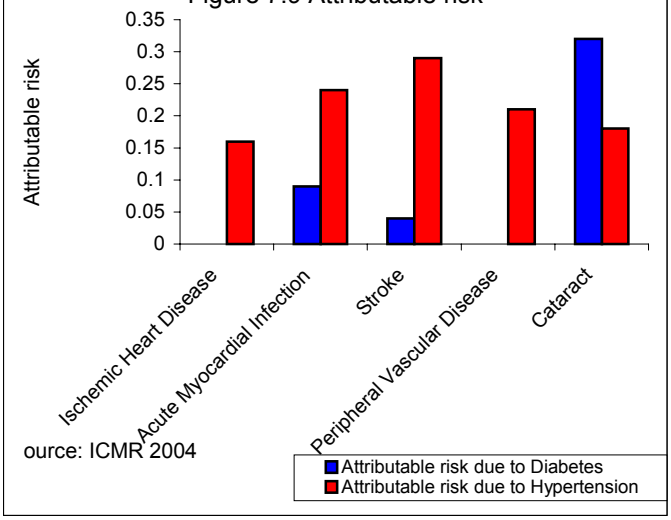


Sample Size: Gopinath et al, 1990: 6372(Males), 7351 (Females); Kutty et al, 1993: 1130; (Females); Gupta et al., 1994: 1982 (rural males), 1166(rural females); Gupta et al, 1995: 1415 (males) 797(females); Gopinath etal 5998 (Urban males), 7136 (Urban females), 616 (Rural males), 1116 (Rural females), Singh et al, 1998: 3714;

7.2.2 Health Consequences of Hypertension

ICMR estimated the data on odds ratio/risk ratio of NCDs associated with hypertension; 16percent of ischaemic heart disease, 21 percent of peripheral vascular diseases, 24 percent of Acute Myocardial Infarctions (AMI) and 29 percent strokes could be attributed to hypertension (ICMR, 2004). ICMR computed population attributable risk due to diabetes and hypertension for a range of non-communicable diseases (Figure 7.9). Since both hypertension and diabetes often coexist the actual risk of various non-communicable diseases due to both these might be higher than the risk for either individually.

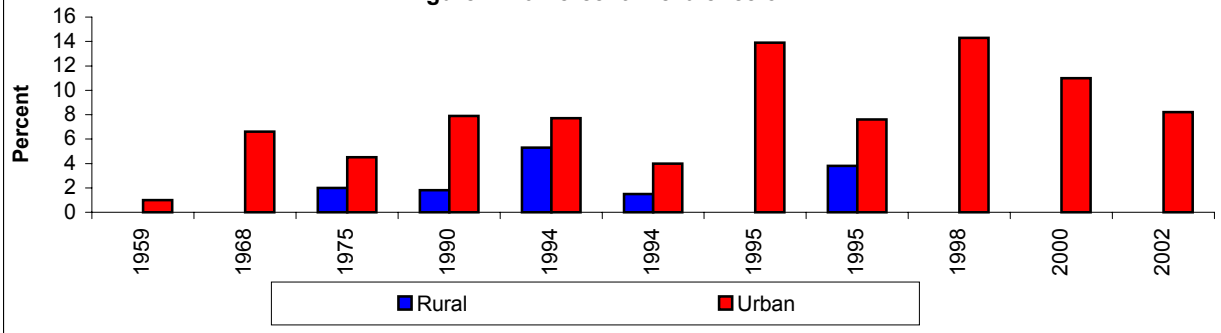
Figure 7.9 Attributable risk



7.3 Ischaemic Heart Diseases

Ischaemic heart diseases (IHD) are becoming an important cause of death in India. Some of the major studies on prevalence of IHD in urban and rural areas from different parts of India and from the studies used in the meta-analysis are shown in Figure 7.10.

Figure 7. 10 Percent Prevalence of IHD



Sample Size: Padmavathy et al, 1959: 1642; Sarvotham et al, 1968: 1331; Gupta et al,1975: 1504; Chaddha et al, 1990: 13,723; Begon et al, 1995: 460; ICMR, New Delhi: 3019; ICMR, Vellore: 2649; Gupta et al, 1995: 2212; Ramachandran et al, 1998: 953; Mohan et al, 2000: 1175; Gupta et al, 2002: 1123.

Over the last three decades there has been a progressive increase in prevalence of IHD; the increase has been steeper during the last decade especially in urban areas. This has been mainly attributed to life style changes, which have affected people in urban areas more than in rural areas (ICMR, 2004).

The ICMR (ICMR, 2004) undertook a meta- analysis of the results of studies carried out in 1990s and upto 2000 in which IHD was diagnosed on the basis of

- history of documented angina or infarction and previous diagnosed CHD
- affirmative response to Rose Questionnaire,
- ECG changes namely Minnesota codes 1-1,4-1,5-9,5-2 or 9-2.

Table 7.3 Age specific prevalence rate derived from the studies selected for I.H.D

	Urban						Rural					
	Male			Female			Male			Female		
Age Group	Sample Size	No. Of cases	PR/ 1000	Sample Size	No. of cases	PR /1000	Sample Size	No. of cases	PR/ 1000	Sample Size	No. of cases	PR/ 1000
20-24	125	1	8.0	147	1	6.8	285	5	17.5	191	2	10.5
25-29	1374	27	19.6	1677	44	26.2	512	7	13.7	624	9	14.4
30-34	1584	27	17.1	2091	48	22.9	888	11	12.4	1302	14	10.8
35-39	1459	63	43.2	1796	87	48.4	1011	19	18.8	1376	22	15.9
40-44	1418	67	47.3	1549	102	65.8	836	15	17.9	1033	24	23.2
45-49	1093	91	83.2	1234	130	105.4	724	15	20.7	954	37	38.8
50-54	1053	98	93.1	1162	130	111.9	675	21	31.11	722	36	49.9
55-59	985	160	162.4	1054	161	152.8	937	25	26.7	825	42	50.9
60+	835	145	173.6	941	165	175.4	591	42	71.1	519	35	67.4

Source: Assessment of burden of non-communicable diseases, ICMR 2004. PR/1000-Prevalence Rate per 1000

Age specific prevalence rates of IHD among males and females obtained by pooling the data of these five studies (separately for urban and rural areas) is given in the Table 7.3. There is a steep increase in prevalence of IHD in both sexes in forties. Prevalence rates in women are comparable to or higher than prevalence rates in men.

Indices of burden of diseases for IHD in India are presented in Table 7.4. Estimated prevalence rates were 64.4/1000 in urban and 25.3/1000 in rural population. The projections of burden of disease due to IHD in India for the years 1998 and 2004 are given in Table 7.5. Number of cases of IHD is estimated to increase from 34.78 million in 1998 to about 39.43 million (20.58 million cases in urban areas and 18.85 million in rural areas) by 2004. In 2004 , the total number of DALYs attributable to IHD is estimated to be 16 million (ICMR, 2004).

Table 7.4 Indices of Burden of Diseases for IHD

	Ischemic Heart Disease	
	Urban	Rural
Prevalence rate/1000	64.4	25.3
Death rate/1000	0.8	0.4
YLL per 100,000	728.7	351.5
DALY per 100,000	2703.4	986.2

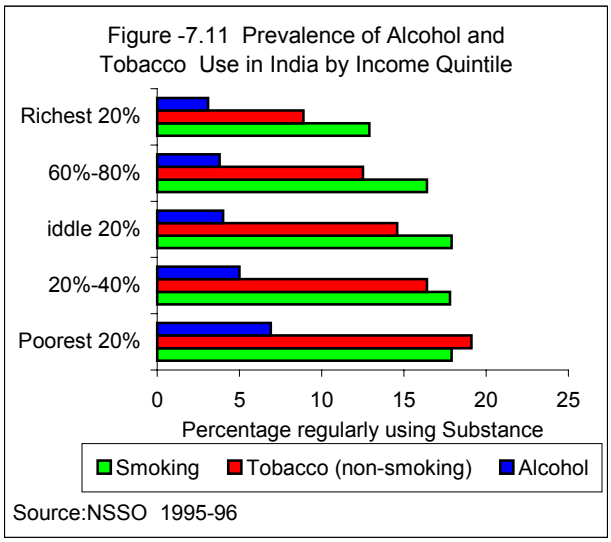
Source: Assessment of burden of non-communicable diseases, ICMR 2004

Table 7.5 Projections of disease burden due to I.H.D

	1998			2004		
	Urban	Rural	Total	Urban	Rural	Total
Population (in thousands)	262,152	708,781	970,933	319,727	746,031	1,065,758
No. of cases of IHD	16,874,724	17,910,896	34,785,620	20,580,827	18,852,203	39,433,030
No. of deaths due to IHD	207,548	256,014	463,562	255,782	298,412	554,194
No. of YLL	1,991,451	2,470,149,	4,461,600	2,329,851	2,622,299	4,952,150
No. of DALY	7,388,453	6,930,974	14,319,427	8,643,450	7,357,358	16,000,808

Source: Assessment of burden of non-communicable diseases, ICMR 2004

It is often assumed that ischemic heart disease affects mainly the well to do. However there are several studies, which suggest that, poor are vulnerable for IHD. A community based cross sectional survey looked at prevalence of coronary heart disease and coronary risk factors in Rajasthan in relation to educational level in 3148 residents aged over 20 (1982 men, 1166 women) residing in three villages (Gupta etal., 1994). The prevalence of coronary heart disease (diagnosed by electrocardiography) showed an inverse relation with education in both sexes; prevalence of coronary risk factors smoking and hypertension was higher among uneducated. NSSO (NSSO, 1975-2000) surveys have documented higher prevalence of prevalence of tobacco use among the poorer segments of the



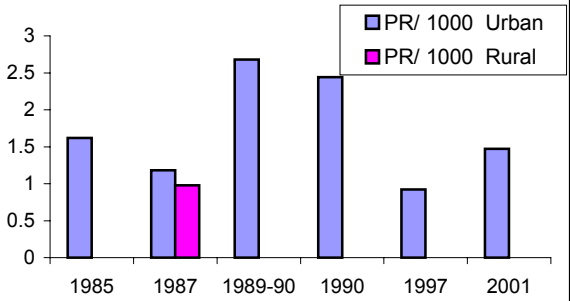
population (Figure- 7.11). Lack of physical exercise and stress of life are common among the urban poor with sedentary jobs. It is there fore not surprising that there is a high prevalence of hypertension and IHD among poor also. Results of some of the studies carried out in Delhi show that that prevalence of hypertension and IHD is high among poorer segments of population in urban areas Some of the data indicate that untreated / poorly controlled severe of hypertension and IHD was higher among low income groups perhaps because of poor access to health care; some of the data also indicate that IHD associated with morality rates are higher among the poor (Srinath Reddy-personal communication). It is therefore important to recognize that in the Indian context it is not the urban affluent alone that is at risk of hypertension, and IHD. Programmes aimed at life style modification of all segments of population are of critical importance for prevention of IHD. Simultaneously facilities for screening population groups for detection of IHD and for management of those with IHD have to be built up.

7.4 STROKE

WHO defined stroke as ‘ rapidly developed clinical signs of focal disturbances of cerebral function, lasting more than 24 hours or leading to death, with no apparent cause other than vascular origin. The 24 hours threshold in the definition excludes Transient Ischaemic Attacks (TIA). Stroke is the acute severe manifestation of cerebro-vascular disease and is one of the leading causes of mortality and morbidity in developed countries.

ICMR under took a meta analysis of stroke from well-designed studies with adequate sample size (Figure 7.12). Weighted average of stroke prevalence rate was 1.54/1000. Estimated prevalence of stroke is lower in India as compared to developed countries. However with increasing longevity it may increase proportionally .The prevalence rates, stroke specific mortality rates, case fatality rates, all cause mortality rates, and age distribution of population (1998) were given as an input for DISMOD analysis of data for stroke.

Figure 7.12 Prevalence of Stroke



Source: Assessment of burden of non-communicable diseases, ICMR 2004, Sample Size: Kapoor et al, 1985: 26450; Gauri Devi et al, 1987: 18618 (Urban), 8160 (Rural); Das et al, 1989-90: 17526; Koul et al, 1990: 37226; Dhamija et al, 1997: 24949; Banerjee et al, 2001: 50293

Table 7.6 Indices of Burden of Diseases for Stroke	
Prevalence rate/1000	1.54
Death rate/1000	0.6
YLL per 100,000	496.3
DALY per 100,000	597.6

The figures for YLL per hundred thousand are 496.3, and DALY per hundred thousand is 597.6 (Table 7.6)

Table 7.7 Projections of disease burden due to Stroke		
	1998	2004
Population (in thousands)	970,933	1,065,758
No. of cases of stroke	14,95,237	16,41,267
No.of deaths due to stroke	5,93,362	6,39,455
No. of YLL	48,18,740	52,89,357
No. of DALY	58,02,295	63,68,970
Source: Assessment of burden of non-communicable diseases, ICMR 2004		

Projections of burden of disease due to stroke in India for the years 1998 and 2004 are given in Table 7.7. The total number of stroke cases in India in year 2004 is expected to be 1.64 million. The total number of DALYs attributable to stroke are estimated to be 6.37 million for the year 2004 in India.

7.5 Cancers

National Cancer Registry Programme (NCRP) (ICMR, 1990-2005) of India estimated that annually there are 7,00,000 new cases of cancer and that there are about 2 million

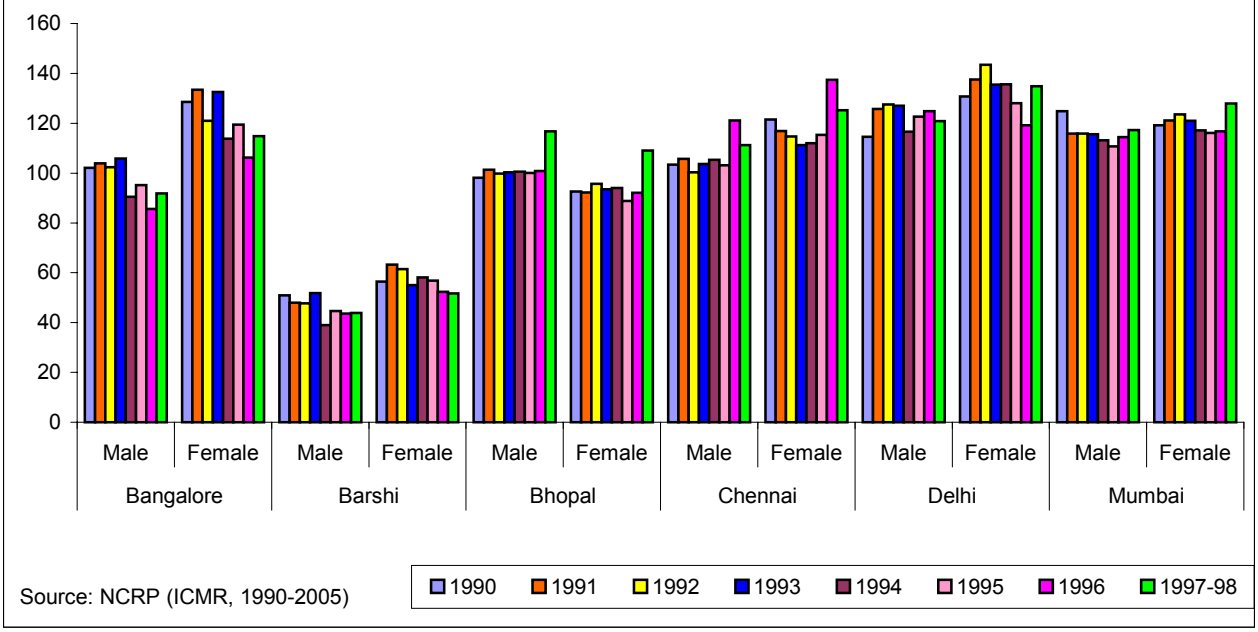
Table7.8 Cumulative incidence rate, cumulative risk and possibility of one in number of persons developing cancer of all sites (ICD9: 140-208); Calculation based on age specific rates from 0-64 and 0-74 years of age

Registry	**Cumulative rate (percent)**		**Cumulative risk (percent)**		**Possibility of one in no. of persons developing cancer**	
	Males	**Females**	**Males**	**Females**	**Males**	**Females**
0-64 yrs						
Bangalore	8.06	10.80	7.75	10.24	13	10
Barshi	4.05	5.04	3.97	4.91	25	20
Bhopal	10.49	10.80	9.96	10.24	10	10
Chennai	10.11	11.69	9.62	11.03	10	9
Delhi	10.45	12.21	9.92	11.49	10	9
Mumbai	9.37	11.17	8.94	10.57	11	9
0-74 yrs						
Bangalore	11.08	13.39	10.49	12.53	10	8
Barshi	5.10	5.86	4.97	5.69	20	18
Bhopal	15.34	12.50	14.22	11.75	7	9
Chennai	13.19	14.35	12.35	13.37	8	7
Delhi	13.97	15.23	13.04	14.13	8	7
Mumbai	13.98	14.82	13.04	13.77	8	7
Source: NCRP 2005						

cases of cancer in the country. In India age adjusted cancer incidence varies between 91.9-120.9/ 100,000 in urban males and 108.7-134.8/100,000 in urban females. Cumulative incidence rate in selected population based cancer registries in India is given in Table 7.8. Over all cancer incidence in India is among the lowest in the world. Incidence of cancers reported by the urban cancer registries are similar to cancer incidence among Indians in Singapore and are substantially lower than cancer rates reported in other countries. Cancer epidemiologists have been exploring the protective role of habitual Indian diet with high fiber, phytate and spices including turmeric in the observed low prevalence of malignancies in India. Cancer associated with tobacco use account for 36-55percent of all of cancers in men and 10-16percent of cancers in women. Anti tobacco education and reduction in tobacco use can result in further substantial reduction in cancer rates in India. Data on time trends in prevalence of cancers (all sites) from the six population based cancer registries is shown in Figure

7.13. It is obvious that unlike CVD and diabetes, there has not been any increase in over all cancer prevalence over time.

Figure 7.13 Time trends in Percent Prevalence of Cancer rates per 100,000 population



Source: NCRP (ICMR, 1990-2005)

Bombay cancer registry has population based data on incidence of cancer from sixties (Yeole, 2001). Analysis of time trends from sixties till 1999 confirm that though there has been massive changes in prevalence of some cancers (reduction in cancer cervix, increase in cancer breast) there has been no increase in overall prevalence of cancers over the last five decades.

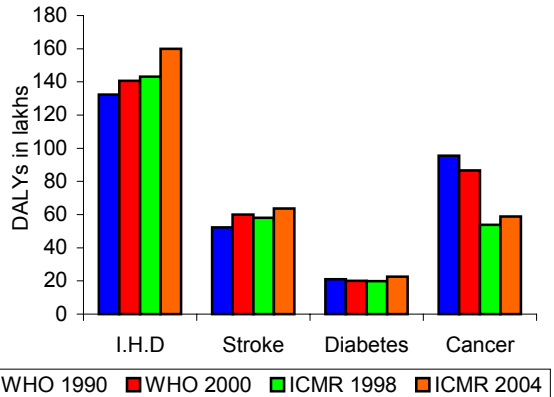
ICMR estimate of burden of disease due to cancer (all sites) based on data from population based cancer registries of NCRP are given in Table 7.9. The number of cases of cancer in 2004 is expected to be 820,000. The total number of DALYs due to cancer in India in the year 2004 is estimated as 5.9 million. This estimate is low as compared to the estimate of 8.6 million DALY reported by WHO Burden of Disease Study (2000) (Figure 7.14). For obtaining

Table 7.9 Projection of Burden of disease due to Cancer in 2004

	Male	Female
Population (in thousands)	550,404	515,354
No. of cases of cancer	390,809	428,545
No. of death	138,622	121,192
No. of YLL	13,96,508	16,17,787
No. of DALY	25,48,392	33,48,444

Source: Assessment of burden of non-communicable diseases, ICMR 2004

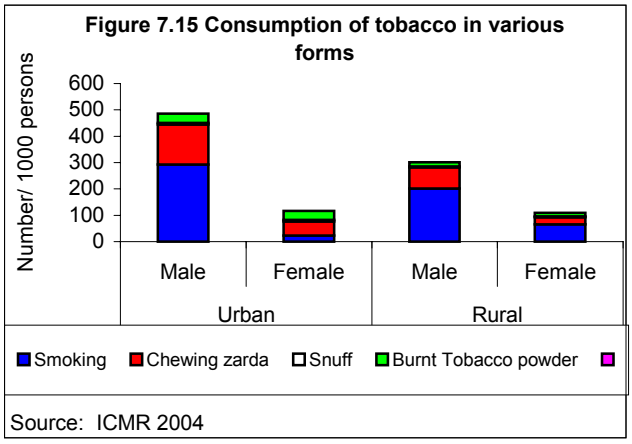
Figure 7.14 WHO and ICMR estimates/projections of Burden of Disease



Source: ICMR 2004

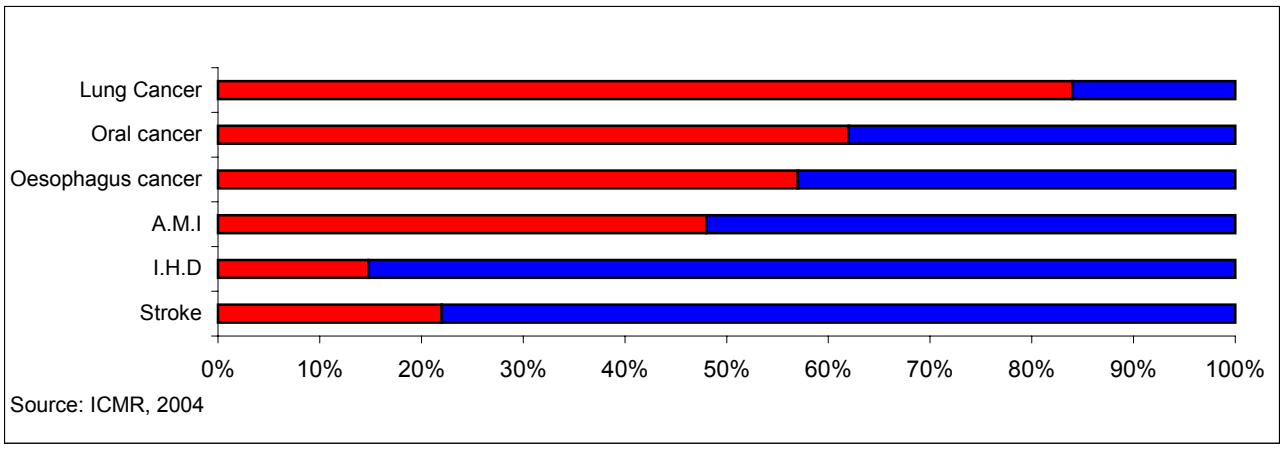
cancer disease burden estimates ICMR has used the mortality rates obtained by pooling the data of all six population based registries. However, if cancer mortality rates reported by Chennai Registry (which are highest cancer mortality) were used the figures become comparable to the figures reported by WHO Burden of disease study.

7.5.1 Tobacco as a risk factor for NCD in India



Data on Tobacco use in the country is available from 50th round NSSO (NSSO, 1975-2000) survey is shown in Figure 7.15. Prevalence rates of tobacco use in urban areas are 43 percent among males and 7 percent among females. In rural areas the prevalence rates for tobacco use are 64.4 percent among males and 15.5 percent among females. The overall prevalence rates of tobacco use in the country (rural+ urban) are 35.5 percent.

Risk ratio associated with tobacco use for non-communicable diseases are presented in Figure 7.16; 15percent of IHD cases, 48percentof AMI, 22percent of stroke cases, are



attributable to use of tobacco.. Tobacco use is the major factor responsible for Lung cancer, oral cancers and cancer oesophagus. Tobacco control a strategy is therefore will result in significant reduction of these NCD.

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8.0 Factors responsible for emerging problem of over-nutrition

Data presented in the section on survey on food and nutrient intake indicate that over the last three decades there has not been any significant change in energy intake of Indian population except in affluent families, especially in urban areas; even in this segment the increase in consumption of energy dense fast foods is mainly among adolescents and youth. It is therefore obvious that increase in dietary intake of fats, oils and sugar is not a major factor responsible for over-nutrition in India. Over this period there has been a progressive reduction in physical activity in all segments of population. Reduction in energy expenditure and unchanged dietary intake results in positive energy balance and could be one of the major factors responsible for the rising prevalence of over-nutrition in adults in India. Available evidence to support this are reviewed in the next few paragraphs.

Cross sectional studies undertaken among affluent housewives (PhD dissertation - 2003) in the age group 30 - 60 years in Delhi showed that their dietary intake remained unaltered between 2100 - 2300 Kcal/ day (Wasuja M and Siddhu A, 2003.). In each age group the energy expenditure was lower by about 70 - 100 Kcal/ day. This was associated with a weight gain of about five Kg per decade (Table 8.1). These women did not make any conscious effort to increase physical activity or take up regular exercise regime. It is possible that similar situation exists among men in these segments of population. Small but persistent positive energy balance accounts for the slow but steady weight gain in adults among affluent segments of population

Table 8.1 Energy intake and expenditure in urban affluent housewives

Groups	Weight (Kg)	BMI (kg/m^2)	BFpercent	TDEI (kcal)	TDEE (Kcal/d)	Energy Balance (Kcal)	Measured RMR (kcal/d)	PAR_{RMR} (TDEE/ measured RMR)
D3 (30-39y) [n=22]	59	24.8	32.8	2,134	2056±238.7 (1724.5-2665.5)	+78	1562± 260 (1166-2059)	1.33±0.14 (1.12-1.59)
D4 (40-49y) [n=20]	64	26.4	36.5	2,264	2191±306.6 (1785.4-2817.3)	+73	1779± 273 (1267-2304)	1.24±0.10 (1.10-1.49)
D5 (50-59y) [n=20]	69	28.6	40.3	2,195	2146±173.1 (1849.4-2494.0)	+49	1752± 274 (1224-2203)	1.24±0.12 (1.06-1.51)

Source: Wasuja M. and Siddhu A. 2003

During the last three decades there has been a progressive decline in poverty ratio and a steep increase in per capita income. Economic improvement inevitably results in improved purchasing power, ability to purchase food items and consume many of them. This in turn can lead to some increase in energy intake from fats, sugar, refined carbohydrates, and reduction in energy intake from complex carbohydrates and reduction in dietary fiber. Simultaneously there is a reduction in physical activity and perhaps increase in work related stress because of change in occupation. The combination of factors might be responsible to extent for the rapid increase in over nutrition, and hypertension in segments of population who have just emerged from

poverty. This situation would also apply to rural migrants who settle down in urban areas.

It is well documented that Indians have higher body fat for the same BMI as compared to the Caucasians. Prevalence of abdominal obesity is higher in Indians. Both over-nutrition and abdominal obesity are associated with increased risk of hypertension, diabetes and CVD.

It is however important to remember that the seeds for obesity in adult life might be sown decades earlier. The thrifty gene hypothesis proposes that populations who had faced energy scarcity over millennia may evolve so that majority have thrifty gene, which conserves energy. If this population gets adequate or excess energy intake, they lay down fat, develop abdominal obesity, increase insulin resistance, which may progress to diabetes, and incur risk of hypertension and CVD. Barker's thrifty phenotype hypothesis shifts the evolution of thriftiness to intrauterine period; Indians with one-third low birth weight rate can be deemed to have acquired the risk of metabolic syndrome in utero.

Yagnik and coworkers in Pune explored the relationship between low birth weight and glucose investigated was insulin metabolism (OGTT) in 477 children born in KEM hospital, Pune (Yagnik CS, 1998). They found that Indian neonates were small because they had poor muscles and small abdominal viscera. These neonates however had conserved their subcutaneous fat. At 4 years of age plasma glucose and insulin concentrations 30 minutes after glucose were inversely related to birth weight (Table-8.2) but directly related to current weight and skinfold thicknesses. The relationship between glucose/insulin and birth weight was independent of current weight. Thus poor intra-uterine growth, but relatively excess growth later ('obesity') was associated with metabolic endocrine abnormalities, which could lead to diabetes in adult life. Adolescent obesity is a well-documented entity in both urban and rural areas and may be the stepping-stone for adult obesity.

Table-8.2: Birth weight, plasma glucose and insulin concentrations in 4-year old urban children

Birth weight (kg)	Number of children	Plasma glucose (mmol/l) at 30 min	Plasma insulin (pmol/l) at 30 min
=< 2.4	36	8.1	321
-2.6	36	8.3	337
-2.8	44	7.8	309
-3.0	42	7.9	298
=>3.0	43	7.5	289
All	201	7.9	310
P for trend		0.01	0.04

Source: Yagnik et al, 1998

Bhargava and co-workers (Bhargava etal., 2004) have shown that urban Delhi in the nineties makes even low middle-income adults who were undernourished in infancy, childhood and adolescence, develop obesity-both general and abdominal- hypertension and diabetes by the time they are thirty (Table 8.3 and 8.4)

.

Table- 8.3: Time Trends in nutritional status of Delhi cohort

	Male		Female	
Age	No.	Weight (Kg)	No.	Weight (Kg)
At birth	803	2.89±0.44	561	2.79±0.38
2 yrs	834	10.3±1.3	609	9.8±1.2
12 yrs	867	30.9±5.9	625	32.2±6.7
30 yrs	886	71.8±14.0	640	59.2±13.4

Source: Bhargava et al, 2004

Table –8.4: Current Status of Delhi cohort				
Characteristic	Men		Women	
	No.	Value	No.	Value
Weight (Kg.)	886	71.8±14.0	640	59.2±13.4
Height (m)	886	1.70±0.06	638	1.55±0.06
BMI	886	24.9±4.3	638	24.6±5.1
Waist:Hip ratio	886	0.92±0.06	639	0.82±0.07
BMI>_25 BMI>_23	886 886	47.4 66.0	638 638	45.5 61.8
Central Obesity (percent)	886	65.5	639	31
Impaired GTT	849	16	539	14
Source: Bhargava et al, 2004				

The lesson to be learnt from these data is that it is never too early for Indians to start practicing healthy lifestyle and dietary habits. Early detection and correction of under-nutrition until children attain appropriate weight for their height is essential to promote linear growth. Adolescents and adults should ensure balanced diet with just adequate energy intake. Exercise has to become a part of daily routine to promote muscle and bone health as well as prevent development of adiposity in all age groups. The lesson to be learnt from these data is that it is never too early for Indians to start practicing healthy lifestyle and dietary habits.

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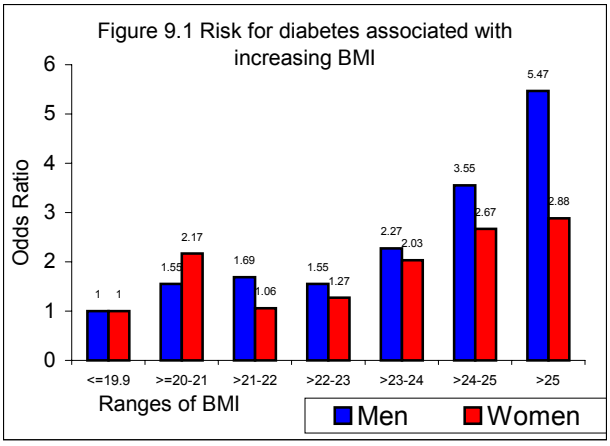
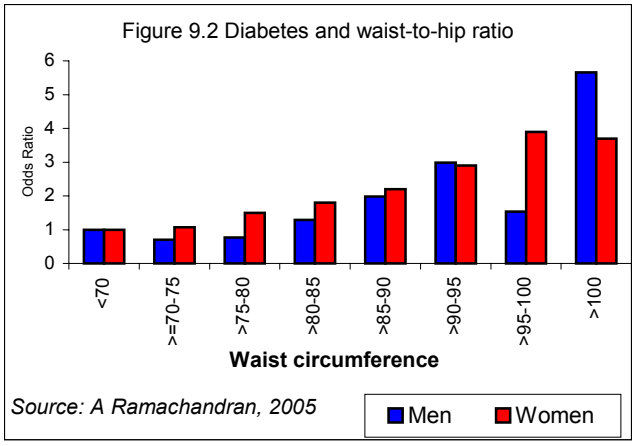
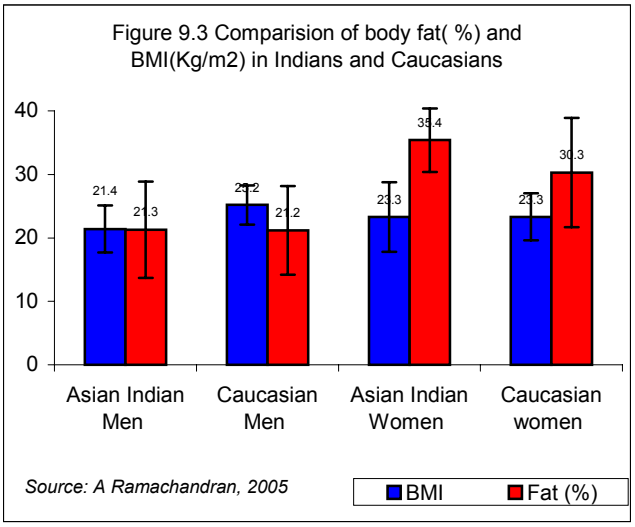
9. Over nutrition NCD linkages

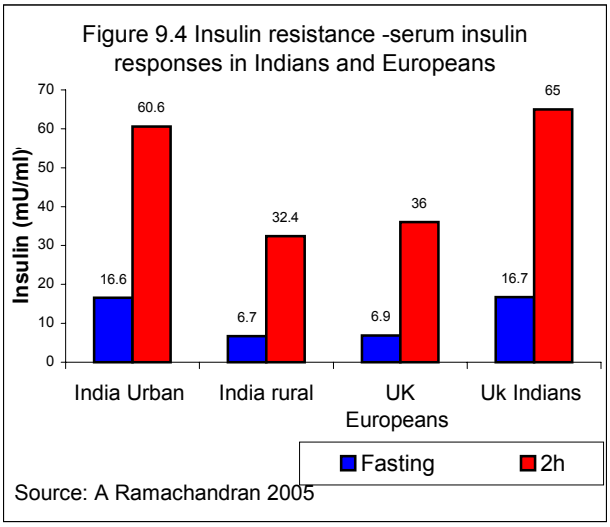
9.1 Linkages between over nutrition and diabetes





Studies from Chennai (Ramachandran A, 2005) have shown that with increasing BMI there is increase in risk of diabetes both in men and women. There is a steep increase in risk of diabetes when BMI increase beyond 23 (Figure 9.1). There was. a progressive increase in prevalence of diabetes with increasing waist-hip-ratio both in men and women (Figure 9.2). Indians have higher body fat for given BMI as compared to

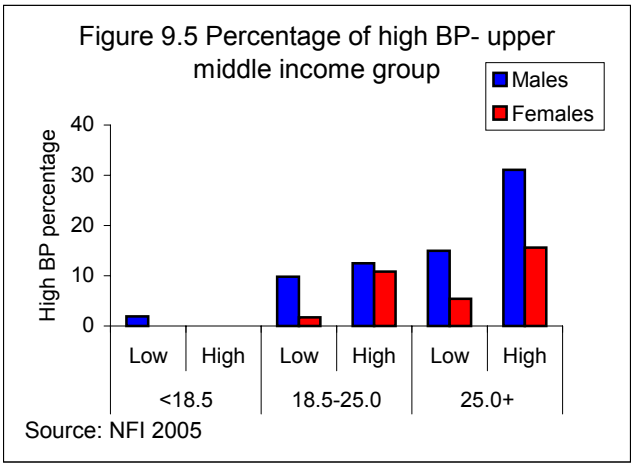




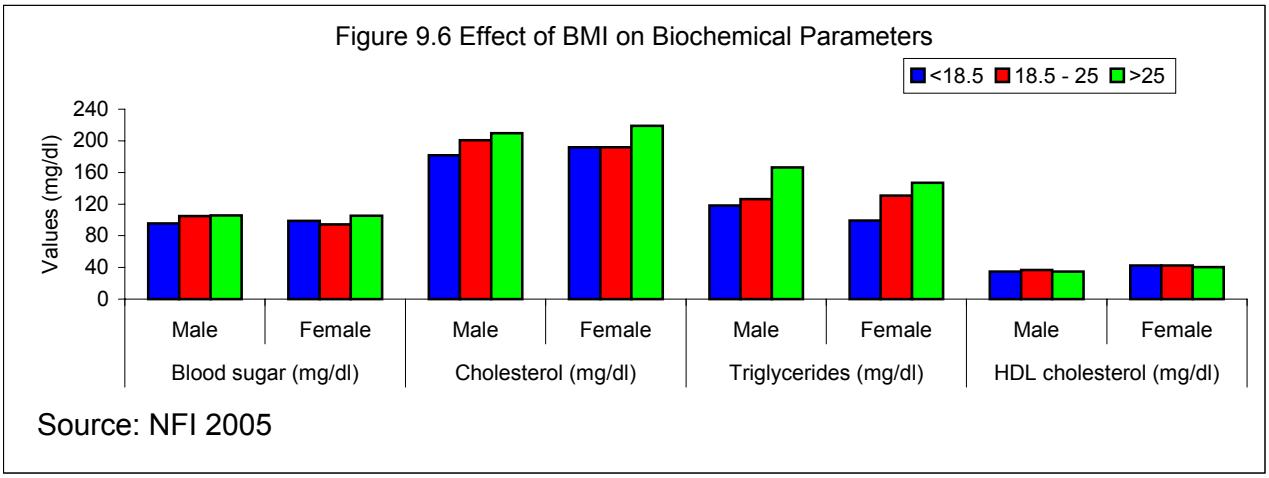
Caucasians (Figure 9.3). Association between abdominal obesity and the metabolic syndrome of hypertension, dyslipedemia, insulin resistance and diabetes have been well documented. Comparison of insulin resistance and insulin response between Indians and UK citizens showed that both fasting and 2 hour insulin levels are lower in Indians in rural areas and Europeans in UK; urban Indians and Indians residing UK have substantially higher fasting and 2 hour insulin levels indicating insulin resistance (Figure 9.4). Data from urban affluent population show that prevalence of insulin resistance is high not only in adults but also in children and young adults REF (Yagnik CS, 1998).

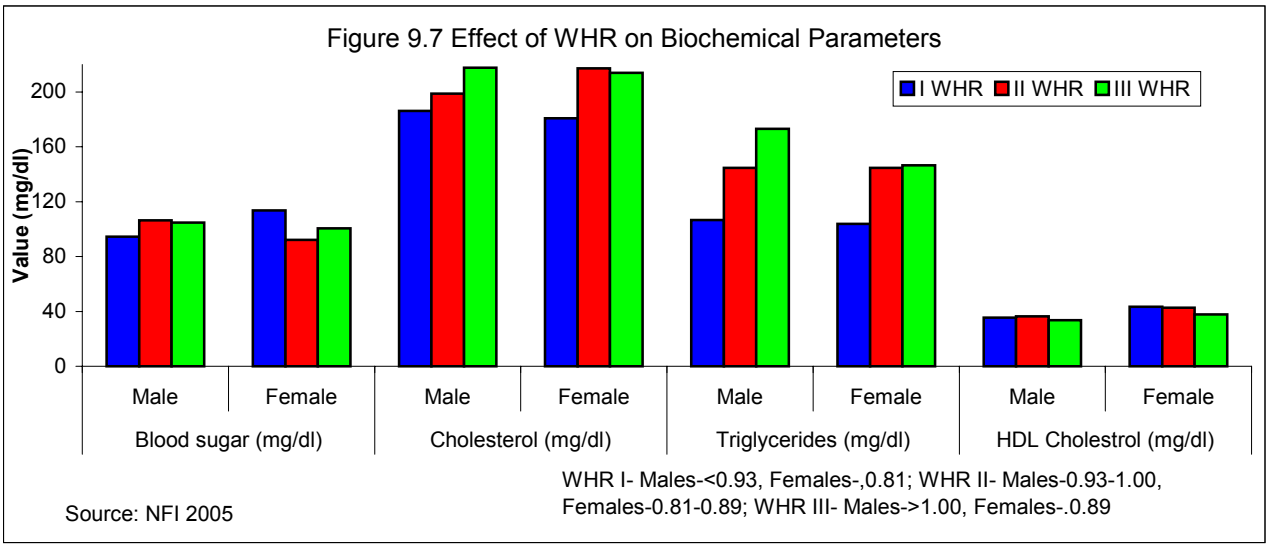
9.2. Linkages between over-nutrition and hypertension

Nutrition Foundation of India carried out studies exploring relationship between over nutrition and cardiovascular diseases in - persons belonging to different income groups working in a Government Institution (Nutrition Foundation of India, 2004). There were a larger proportion of subjects having higher WHR (50.3percent) compared with the population with BMI>25 (30.8percent). The higher the BMI and WHR, the higher were the prevalence rates of hypertension both in men and women. The prevalence of high blood pressure in the normal and overweight subjects was higher when WHR was high. Overweight/obese subjects of both sexes with abdominal adiposity had higher systolic and diastolic blood pressure as compared to those without abdominal obesity (Figure 9.5).



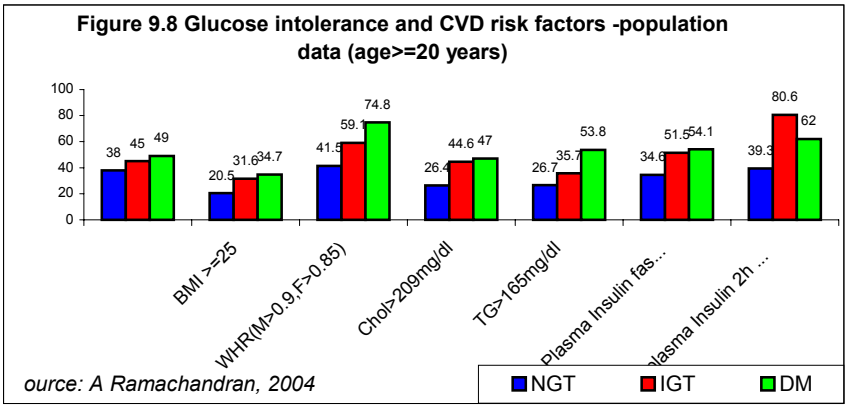
Serum cholesterol and triglycerides in men were significantly higher in subjects with BMI>25. There was a positive trend of increase in blood sugar with increasing values of BMI both in men and women. Serum cholesterol and triglycerides increased significantly with increasing BMI and WHR both in men and women. A similar trend was seen in the ratio of total cholesterol and HDL cholesterol (Figure 9.6). Cholesterol levels greater than 180 mg percent and blood sugar levels of 140 mg percent were mostly seen in subjects with high BMI, and those with greater WHR (Figure 9.7).





9.3. Linkages between obesity, diabetes and cardiovascular diseases

Indians have higher body fat for any BMI as compared to Caucasians. The susceptibility of the urban Indians to central adiposity has been highlighted by all studies. All studies in India have shown that central obesity was more strongly associated with glucose intolerance than generalized obesity. A cluster of risk factors has been demonstrated to be associated with central obesity. These include glucose intolerance, obesity, hyperinsulinameia, hypertriglyceridaemia, and hypertension, all-important risk factors for ischaemic heart disease. Recent studies comparing body fat topography in migrant Asian subjects with those of white Caucasians have also reported a higher waist-hip ratio with hyperglycemia, elevated plasma insulin concentrations, altered blood lipids and increased risk of coronary heart disease in Indians.



Indians are at higher risk of metabolic syndrome with Type 2 diabetes, dyslipedemia, hypertension and cardiovascular disease for example at BMI> 25 the Cardio vascular risk is least if the person has normal glucose tolerance and highest if he has diabetes (Figure 9.8) (Ramachandran et al., 2004). Risk of glucose intolerance, insulin resistance and hypertension increases with age, BMI. Waist-to-hip ratio, blood cholesterol (> 209mg/dl) and triglyceride level (>165 mg/dl).

Comparison of newly diagnosed NIDDM patients in KEM hospital, Pune compared with migrant Indian and white Caucasian NIDDM patients in UKPDS (Yagnik CS, 1998) showed that

- At diagnosis diabetic patients in India are about a decade younger (20percent < 35 years, and 50percent <40 years of age).
- Obesity (using body mass index, as criterion) is less common, but central obesity (increased waist-hip ratio, WHR) is a very striking feature in Indian patients. Highest glucose concentration was found in subjects who were thin but centrally obese.
- Hypercholesterolemia is uncommon (5percent), but plasma triglycerides and non-esterified fatty acids (NEFA) are significantly elevated in both IGT and diabetic Indian patients, compared to those with normal glucose tolerance (NGT).
- Both IGT and diabetic patients show fasting hyperinsulinameia compared to NGT subjects but post-glucose plasma immunoreactive insulin (IRI) concentrations are diminished in diabetic patients. Plasma IRI concentrations show an inverted U-shaped distribution in relation to plasma glucose concentration suggesting that insulin resistance and compensatory hyperinsulinaemia precede diabetes. Even NGT Indians are substantially more hyperinsulinaemic and insulin resistant than white Caucasians.

In Indians the cardio vascular risk factors (obesity, central obesity, hypertension, high plasma triglycerides and elevated NEFAs) are increased not only in diabetic patients but also in those with IGT, a stage, which precedes diabetes by many years. Electrocardiographic changes suggestive of CHD were associated with older age, higher blood pressure, higher plasma triglycerides and Immuno Reactive Insulin (IRI) concentrations. Cardio-vascular risk factors were all related to plasma insulin levels and can be thought of as occurring as a part of the complex metabolic profile called the 'insulin resistance syndrome', metabolic syndrome or Syndrome X.

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10.National Nutrition Policy and Plan of Action - Response to Nutrition Transition

In 1950 India faced two major nutritional problems. One was the threat of famine and the resultant acute starvation due to low agricultural production and the lack of an appropriate food distribution system. The other was chronic energy deficiency due to:

- low dietary intake because of poverty and low purchasing power;
- high prevalence of infection because of poor access to safe-drinking water, sanitation and health care;
- poor utilisation of available facilities due to low literacy and lack of awareness.

Initiatives to improve nutritional status of the population between 1950-1990 include:

- Increasing food production- building buffer stocks
- Improving food distribution- building up the Public Distribution System (PDS)
- Improving household food security through
  - Improving purchasing power
  - Food for work programme
  - Direct or indirect food subsidy
- Food supplementation to address special needs of the vulnerable groups-Integrated Child Development Services (ICDS), Mid-Day Meals
- Nutrition education especially through Food and Nutrition Board (FNB) and ICDS
- Efforts of the health sector to tackle
  - Adverse health consequences of undernutrition
  - Adverse effects of infection and unwanted fertility on the nutritional status
  - Micronutrient deficiencies and their health consequence

Source: Planning Commission, 2002

The country adopted multi-sectoral, multi-pronged strategy to combat these problems and to improve the nutritional status of the population. Article 47 of the Constitution of India states that "the State shall regard raising the level of nutrition and standard of living of its people and improvement in public health among its primary duties". Successive Five-Year Plans laid down the policies and strategies for achieving these goals.

Progress achieved in seven five year plan was reviewed in 1991-92. It was obvious that threat of famine has disappeared. There was a significant decline in severe forms of under nutrition. However mild and moderate under nutrition and micronutrient deficiencies were widely prevalent. India prepared and adopted the National Nutrition Policy in 1993 (DWCD 1993). The Policy advocated a comprehensive inter-sectoral strategy between 14 sectors (which directly or indirectly affect dietary intake and nutritional status of the population) for combating multi-faceted problem of under nutrition and improving nutritional status for all sections of the society. The Policy sought to strike a balance between the short-term direct nutrition interventions and long-term institutional/structural changes to create an enabling environment and necessary conditions for improving nutritional and health status. The Policy also set goals to be achieved by each sector by 2000. A National Plan of Action (DWCD 1995) was drawn up and approved in 1995. In order to achieve inter-sectoral coordination at the highest level, a National Nutrition Council was formed under the chairmanship of the Prime Minister with Planning Commission as the secretariat for the Council. The Council was to act as the national forum for policy and strategy formulation, review of performance and mid course corrections. A similar set up was envisaged at the state level. Inter-departmental coordination committee under the

Department of Women and Child Development was to coordinate and review the implementation of the nutrition programmes.

Review of the situation in 2000-01 prior to the formulation of the Tenth Five Year Plan (Planning Commission, 2002) showed that while under-nutrition and micronutrient deficiencies continued to be major public health problems, over nutrition and obesity are also emerging as a major problem in many states. Taking cognizance of this Tenth Plan envisaged a **paradigm shift from:**

- household food security and freedom from hunger to nutrition security for the family and the individual;
- untargeted food supplementation to screening of all the persons from vulnerable groups, identification of those with various grades of under-nutrition and appropriate management;
- lack of focused interventions on the prevention of over-nutrition to the promotion of appropriate lifestyles and dietary intakes for the prevention and management of over-nutrition and obesity.

Effective implementation of focused and comprehensive interventions aimed at improving the nutritional and health status of the individuals was given the highest priority. It was emphasized that the increased outlays to combat the dual nutrition burden should result in improved outcomes and outputs in terms of reduction in both under and over nutrition. In view of the massive interstate differences the Tenth Five Year Plan laid down state specific goals based on the current nutritional status and investment provided for the sector in the state plan (Planning Commission). The National Goals are essentially in conformity with the Millennium Development Goals; though ambitious, it will be possible to achieve the goals through improvement in coverage quality and content of the nutrition related services. The details of the goals set for different programmes have been reviewed in the relevant sections of the report. A National Nutrition Mission with Prime Minister as the Chairman has been constituted Department of Women and Child Development as the secretariat to oversee the policy, strategy and programmes being implemented by different departments.

References

10.1 Planning Commission. *2002*. *Tenth Five-Year Plan.* New Delhi.
10.2 Department of Women and Child Development. *1993***.** National Nutrition Policy Government of India. New Delhi
10.3 Department of Women and Child Development. *1995***.** National Plan of Action. Government of India. New Delhi

11.0. Summary and Conclusions

Data reviewed so far suggest that in India there has not been much change in the predominantly cereal based dietary intakes over the last three decades except among affluent segments of population. In spite of increasing per capita income and reduction in poverty, dietary diversity is seen mainly among affluent. Under-nutrition rates remained high. The high under-nutrition rate begins in-utero, gets aggravated in infancy due to poor infant feeding practices and is perpetuated in childhood due to poor intra-family distribution of food and poor access to health care. There has been substantial reduction in severe under-nutrition, which is mainly due to improved access to health care. The country can achieve substantial improvement in nutritional status through health and nutritional education and improved access to health and nutrition services.

Prevention of intrauterine growth retardation through antenatal care, early detection and correction of under-nutrition so that children attain appropriate weight for their height are essential to promote linear growth; this can be achieved through effective implementation of ongoing intervention programmes utilizing the available infrastructure.

Low intake of vegetables and fruits, poor bioavailability of iron, and lack of universal use of iodised salt are responsible for micronutrient deficiencies being major public health problems even to day. Dietary diversification, better coverage under the national anaemia control programme, massive dose vitamin A administration, universal access to iodised and later iron and iodine fortified salt are some of the interventions that could help the country to achieve rapid reduction in micronutrient deficiencies.

Over the last decade there has been a progressive increase in over nutrition. Reduction of physical activity is the major factor behind the progressive increase in over-nutrition. In the urban affluent segments an increase in energy intake form fats, refined cereals and sugar and simultaneous reduction in physical activity have contributed to steep increase in over nutrition in all age groups. Nutrition education that children, adolescents and adults should eat balanced diet with just adequate energy intake and lots of vegetables and health education that exercise has to become a part of daily routine to promote muscle and bone health as well as prevent development of adiposity in all age groups have to be beamed regularly through all channels of communication. As this segment accesses information and services readily, they can be persuaded to change their life styles so that they regain their normal weight and health. The fact that they have changed could stimulate the other segments to follow suit.

Indians appears to have a predisposition for adiposity especially abdominal, insulin resistance and diabetes, hyper-triglyceridaemia and cardiovascular diseases. This predisposition could be genetic or environmental; it can manifest itself at birth, in childhood, during adolescence and in adult life. It is never too early for Indians to start practicing healthy lifestyle and dietary habits.

It would therefore appear that India could combat the dual nutrition burden through efficient implementation of time tested, effective and inexpensive interventions to achieve significant reduction in both over and under nutrition and their adverse health consequences within the next two decades.