

DIETARY INTAKES AND NUTRITIONAL STATUS OF ADULTS

Introduction

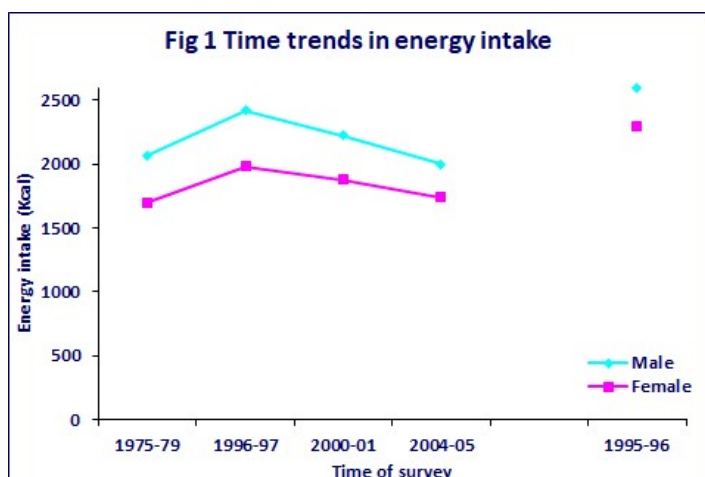
Over the last six decades India has undergone a slow but sustained demographic, social, economic, agricultural, nutrition and health transition. There has been a steady if slow economic growth, which is accompanied by reduction in poverty through out the second half of last century. During the last decade the Gross Domestic Product (GDP) growth rate has accelerated, but there has not been commensurate decline in poverty ratio. In spite of increasing per capita income and reduction in poverty, Indian diets remain predominantly cereal based; dietary diversity is seen mainly among the affluent. Though there has been reduction in poverty and improved access to food at subsidized cost under-nutrition rates continue to be high.

Over the last decade there has been a progressive increase in over-nutrition. In the urban affluent segments, there has been an increase in energy intake from fats, refined cereals and sugar; simultaneously, there has been a reduction in physical activity. As a result, there has been a rapid increase in over-nutrition in adults from the affluent segments of the population. Reduction of physical activity rather than increase in energy intake appears to be the major factor behind the progressive increase in over-nutrition in other segments of population. Currently, over-nutrition rates are low in rural population and among poorer segments of the population in urban areas. The changing pattern of dietary intake and physical activity in adults and the impact of these on nutritional status of adults are reviewed in this paper.

Dietary Intake

Table 1: Average Intake of food among adult men and women (g/day)											
			Cereals & Millets	Dairy products	Pulses & Legumes	Vegetables	Green leafy vegetables	Others (includes tubers)	Fruits	Fats & oil	Sugar & jaggery
NNMB	Men	75-79	495	66	37	59	13	55	14	11	18
		88-92	531	86	32	51	9	53	23	16	23
		96-97	541	74	35	56	17	54	31	15	21
		00-01	457	85	34	75	18	57	28	14	17
		05-06	418	94	31	68	17	63	27	16	15
	Women	75-79	386	56	31	51	11	47	11	9	16
		88-92	445	92	32	40	8	45	30	14	23
		96-97	434	72	29	53	16	49	24	13	21
		00-01	389	67	26	69	18	50	20	12	16
		05-06	365	80	27	63	18	52	26	13	14
INP (1995-96)	Men		543	119	41	112	41	81	20	17	19
	Women		468	113	37	101	37	72	19	26	18
RDI	Men		460	150	40	50	40	60	*	20	30
	Women		410	100	40	50	100	40	*	20	35

Source: Reference 1 & 2. * data not available.



National Nutrition Monitoring Bureau (NNMB)¹ surveys provide data on time trends in dietary intake (by 24 hours dietary recall) and nutritional status of the adult population in eight states from 1975 to 2005. India Nutrition Profile (INP)² survey provides data on dietary intake (by 24 hours dietary recall) and nutritional status of adults in non-NNMB states in mid nineties.

Data from NNMB and INP surveys show that in the mid nineties average intake of cereals was near recommended dietary allowance (RDA). The reported intake of foodstuffs is higher in INP states as compared to NNMB states (Table 1 and Fig 1); this is attributable to higher intake of cereals and pulses in the non-NNMB states, which were covered in the INP. Intake of pulses, vegetables and fruits are low among both men and women in all states (Table 1). NNMB data showed that over time there has been an increase in fats and oil intake; there has been a reduction in average intake of cereals among both men and women, especially, since mid-nineties (Table 1).

Nutrient intake

Data on time trends in nutrient intake from available NNMB surveys are shown in Table 2. Data from NNMB surveys shows that energy intake was high in mid nineties and subsequently there has been a small decline in energy intake. There has been some decline in intake of most of the nutrients among both men and women over the last three decades. In spite of increasing oil and fat intake the proportion of dietary energy from fat remains lower than 15%. Dietary intake of iron in Indian dietaries has always been low. The steep

			Protein (g)	Total Fat (g)	Energy (Kcal)	Calcium (mg)	Iron (mg)	Vit A (ug)	Thiamine (mg)	Ribo (mg)	Niacin (mg)	Vit. C (mg)
NNMB	Adult Men	1975-79	55.7	20.3	2065	98	26	142	1.3	0.8	13	28
		1996-97	60.1	27.4	2418	421	27	172	1.1	1	14	36
		2000-01	58.7	34.4	2225	523	17.5	242	1.4	0.8	17.1	51
		2004-05	54.8	26.9	2000	511	16.9	267	1.3	0.7	16.1	50
	Adult Women (NPNL)	1975-79	45.4	17.1	1698	330	21	118	1	0.7	11	24
		1996-97	49.9	24.5	1983	382	22	148	0.9	0.8	12	32
		2000-01	48.2	27.6	1878	445	14.1	220	1.2	0.6	14.9	44.7
		2004-05	46.5	21.8	1738	443	13.8	254	1.1	0.6	14.2	47
INP	Men	1995-96	79.7	35.2	2592	716	26.1	397	2.12	1.2	22.6	66.8
	Women	1995-96	70.8	32.1	2293	659	23	376	1.84	1	20.3	62.6

Source: Reference 1 & 2

decline in iron intake reported in the last NNMB survey can be attributed to different

estimation methods, which showed that absorbable iron was 50% less as compared to earlier values.

Source of dietary energy

Table 3 Source of dietary intake				
	Survey	Year	Men	Women
			>18 [#]	
Total Dietary Energy Intake (Kcals)	NNMB	1975-79	2065	1698
		1996-97	2488	2106
		2000-01	2225	1878
		2004-05	2000	1738
	INP	1995-96	2592	2293
% Dietary energy from fat	NNMB	1975-79	8.9	9.1
		1996-97	12.4	13.9
		2000-01	13.9	13.9
		2004-05	12.1	11.3
	INP	1995-96	12.2	12.6
% Dietary energy from protein	NNMB	1975-79	10.8	10.7
		1996-97	10.2	9.9
		2000-01	10.6	10.6
		2004-05	11	10.7
	INP	1995-96	12.3	12.4
% Dietary energy from Carbohydrates	NNMB	1975-79	80.3	80.2
		1996-97	74.8	76.2
		2000-01	75.5	75.5
		2004-05	76.9	78
	INP	1995-96	75.5	75

#, No disaggregation of data age-wise after 18 years of age Source: Reference 1 & 2 Survey Population: Rural (NNMB), Rural & Urban (INP)

Data on time trends on total energy intake, percent of energy intake from fat, carbohydrate and protein from NNMB (9 states) and data on total energy intake, percent energy intake from fat, carbohydrate and protein from all the major states from INP for adult men and women is given in Table 3. Carbohydrates remain the major source of energy in the Indian diet. Data from NNMB surveys suggest that dietary intake has not undergone any major shift towards increase in the consumption of fat/oils, sugar and processed food; neither has there been any increase in energy intake. Since mid-nineties there was a reduction in the percent of energy from cereals. There was increase in percentage of energy from fat till 2001, but subsequently there was a reduction in percent energy from fat. However, even in 2001 the percent energy from fat was below 15% (WHO/FAO /UNO)³

Nutritional status of adults

NNMB surveys provide data on time trends in nutritional status of adults in rural areas and

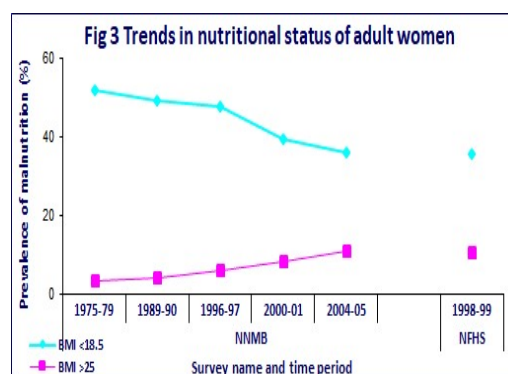
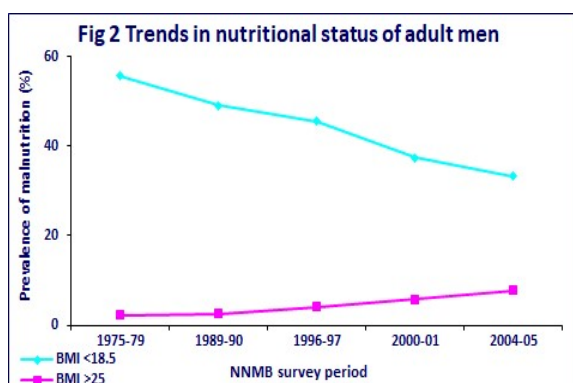


Table 4 Prevalence of under-nutrition and over-nutrition among adults				Rural	Urban	Men	Women
Under-nutrition	NNMB	Rural	1975-79	53.2		55.6	51.8
			1989-90	49		49	49.3
			1996-97	48.5		45.5	47.7
			2000-01	38.6		37.4	39.3
			2004-05	34.8		33.2	36
	INP	U+R	1993-94		20.3	22.2	19.4
			1995-96	34.6	27.7	28.6	36.3
	NFHS-3	Men	2005-06	33.1	17.5	28.1	
	NFHS-2	Women	1998-99	40.6	22.6		35.8
	NFHS-3		2005-06	38.8	19.8		33
Over-nutrition	NNMB	Rural	1975-79	2.9		2.3	3.4
			1989-90	3.1		2.6	4.1
			1996-97	4.5		4.1	6
			2000-01	6.6		5.7	8.2
			2004-05	9.6		7.8	10.9
	INP	U+R	1993-94		8.8	5	10.6
			1995-96	4.1	6	4.3	4.6
	NFHS 3	Men	2005-06	7.3	22.2	12.1	
	NFHS 2	Women	1998-99	5.9	23.5		10.6
	NFHS 3		2005-06	8.6	28.9		14.8

Source: Reference 1,2 & 4. Survey Population: NNMB Rural (1975-79, 1988-90, 195-96, 2000-01) & Urban (1993-94); INP (1995-96) Sample size: NNMB, 11973 (1975-79), 21398 (1989-90), 30773 (1996-97), 11074 (2000-01); INP, 177841 (1995-96), 2772 (1993-94)

urban slums (Table 4). National Family Health Surveys (NFHS) 2⁴ and 3⁵ provide data on nutritional status of women in reproductive age and NFHS-3 provide data on nutritional status of men and women in all major states. All these surveys show that the prevalence of under-nutrition in adults is higher in rural areas as compared to urban areas. Prevalence of over-nutrition is higher in urban areas. Over the last three decades,

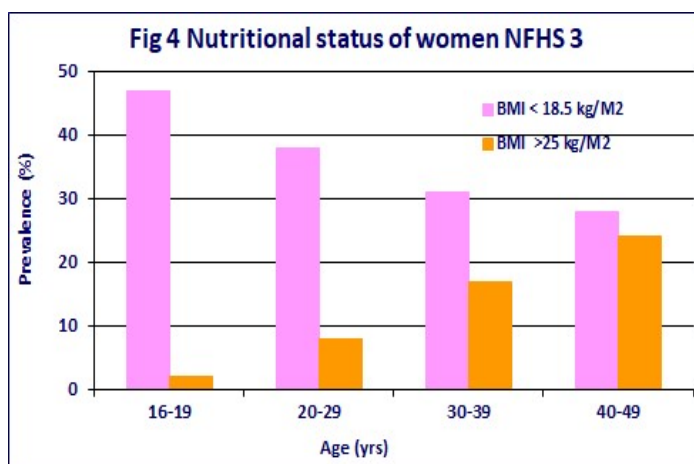
there has been a progressive decline in undernutrition and some increase in overnutrition both in urban and in rural areas. Prevalence of both under-nutrition and over-nutrition are higher in women as compared to men (Figs 2 and 3).

All the available data from National Sample Survey Organization (NSSO) and NNMB surveys show that from mid-nineties there has been a progressive reduction in the energy intake. In spite of this there has been a progressive increase in overnutrition rates. This is most probably due to changes in life style, reduction in physical activity and consequently, reduction in energy requirement.

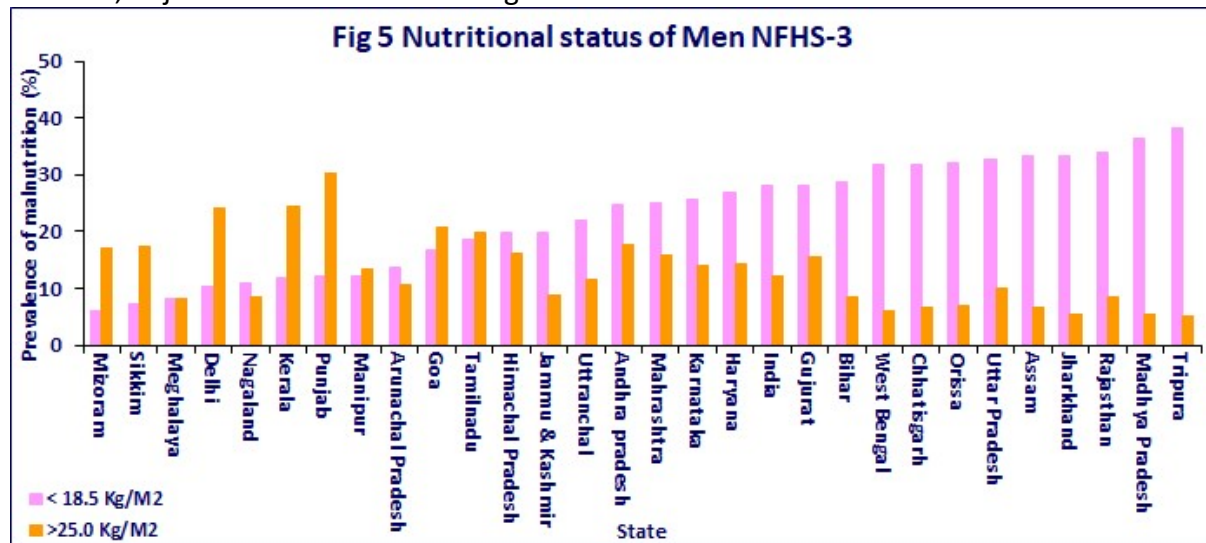
NFHS-3 data showed that the prevalence of overnutrition is four-fold higher in urban as compared to rural areas. There is a progressive decline in the prevalence of under-nutrition and progressive increase in the prevalence of overnutrition in adult women with increase in age (Fig 4)

Interstate differences in adult nutritional status

Data from NFHS showed that all the states in India have entered the dual

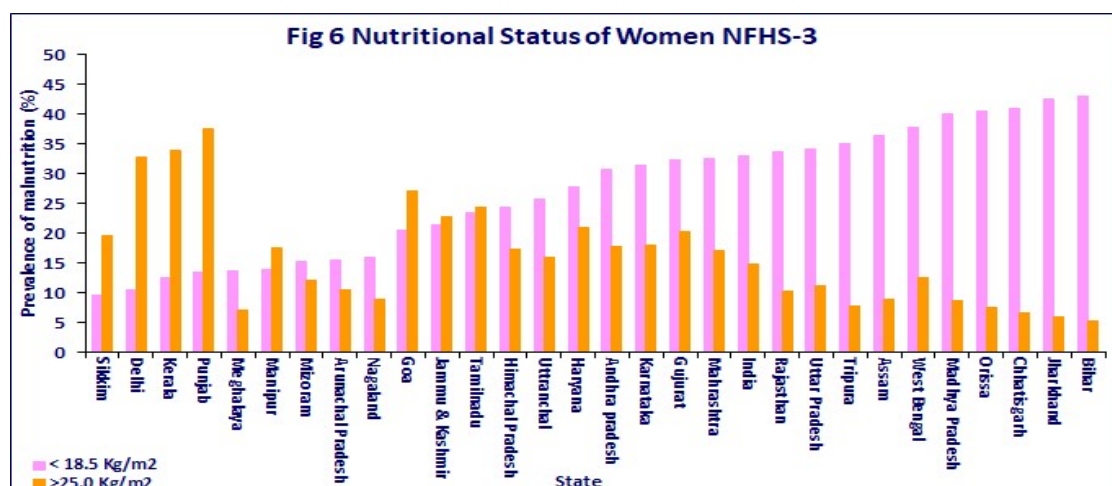


nutrition burden era (Figs 5 and 6). Prevalence of both under- and over-nutrition in women is higher than men (Figs 5 and 6). Populous states like Uttar Pradesh, Bihar, Madhya Pradesh, Rajasthan and Orissa have high under-nutrition and low over-nutrition rates. States



like Delhi, Punjab has low under-nutrition and high over-nutrition rates. However, there are states like Goa, Tamil Nadu, Himachal Pradesh have relatively high under-nutrition and over-nutrition rates.

Data on energy intakes in different states from NSSO survey (2004-05)⁶ and under-nutrition in women in different states from NFHS –3 were plotted and is shown Fig 7. There are substantial interstate differences in the energy intake and prevalence of undernutrition in women (Fig 7). In states with low energy intake (e.g Bihar), under-nutrition rates are high. In states with high-energy intake eg Punjab, under-nutrition rates in women are lower. However, there are exceptions to this. In Orissa in spite of high energy intake under-nutrition rates are high. In Tamil Nadu in spite of low energy intake, under-nutrition rates are low. Kerala with relatively low energy intake has under-nutrition rates comparable to



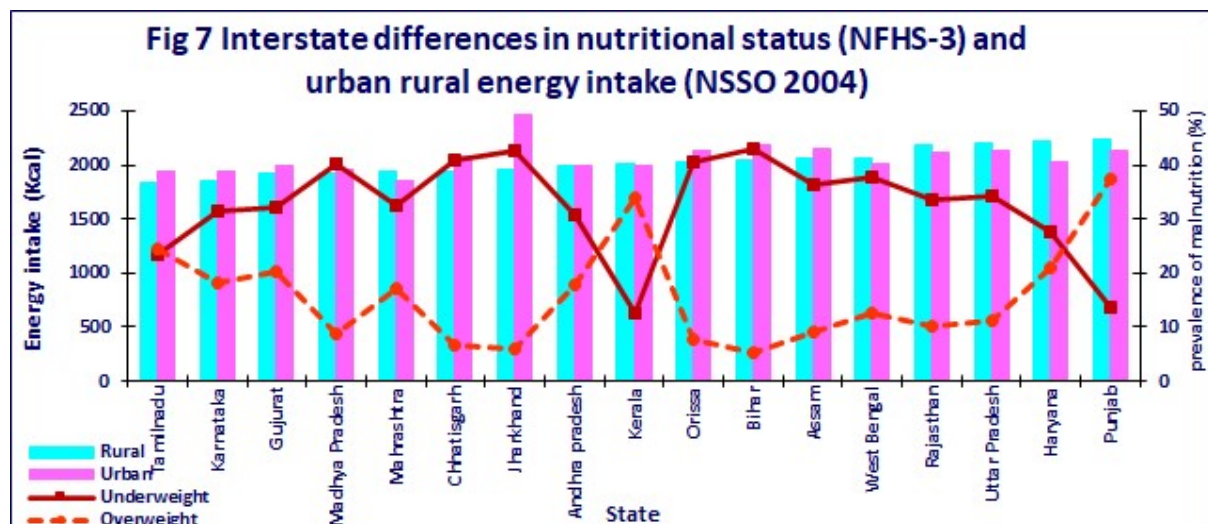
Punjab. Lower physical activity due to levels in occupational and household activities, better availability of transport, fuel and mechanization in Kerala and Tamil Nadu may account for the low under-nutrition rates in adults in spite of low energy intake.

Physical activity

Physical activity is one of the major determinants of energy requirement. Physiologists recognize four domains of physical activity; work, domestic transport and discretionary time. Until two decades ago in most developing countries including India, physical activity in work, domestic and transport domains were very high. As a result, majority of the population expended very little energy in discretionary physical activity. Because of the high physical activity level in daily chores, majority of the population were moderately active and hence their energy requirements were that of moderately active

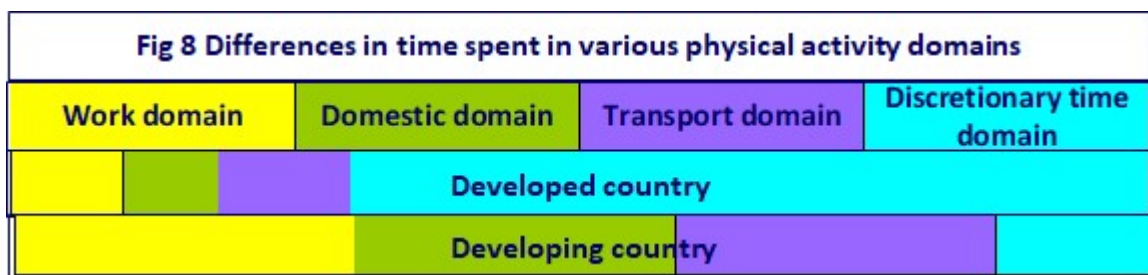
	Rural	Urban
Monthly Household income (Rs)	1860	12674
Transport		
Motorized two-wheelers	7.9	78.2
Car	0.2	12.2
Household appliances		
Washing machine	0.1	41.4
Kitchen mixer / blender	4.5	95.2
Leisure		
Television	24.9	98.2

Source: Reference 8

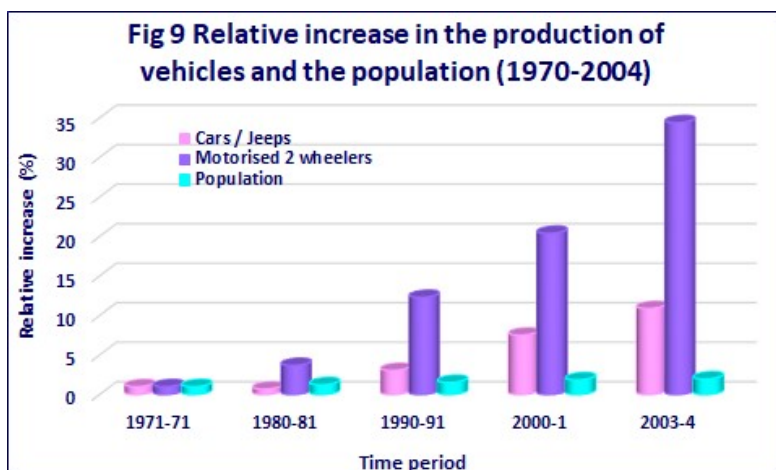


population. They enjoyed the health benefits of moderate physical activity without any discretionary physical activity (Fig 8).

The last two decades witnessed tremendous change in lifestyle. The availability of transport both personal and public has improved several fold (Fig 9)⁷ and energy expenditure in reaching places of study/work has become a fraction of what it was two decades ago. This is also reflected in the consumption expenditure pattern. The NSSO surveys have shown steep



increase in expenditure on transport. Better access to water and fuel both in urban and rural has resulted in substantial reduction in energy spent by women on collecting water and fuel.



During the last decade some well-planned studies have been initiated for investigating physical activity pattern in urban and rural areas and in different income groups. The Prospective Urban and Rural Epidemiological (PURE) India study documented level of mechanization for transport and domestic activities in urban and rural areas (Table

5)⁸. It is obvious that in urban areas, transport as well as household activity is highly mechanized. Majority of urban population are working in white or blue-collar jobs, where occupation related physical activity levels are low. As a result, even though urban men and women spend time in domestic and occupation related activities, their energy expenditure for these activities is low (Fig 10). Their discretionary activities are (TV watching, computer games etc) associated with very low energy expenditure. Unlike people in the developed countries Indians do not undertake energy intensive discretionary activities; and as a result, there has been a steep reduction in their energy requirement. Unchanged dietary intake reduced physical activity and consequent reduction in energy requirement appears to be responsible for increase in over-nutrition.

Energy balance

Table 6: Energy intake and expenditure in urban affluent housewives

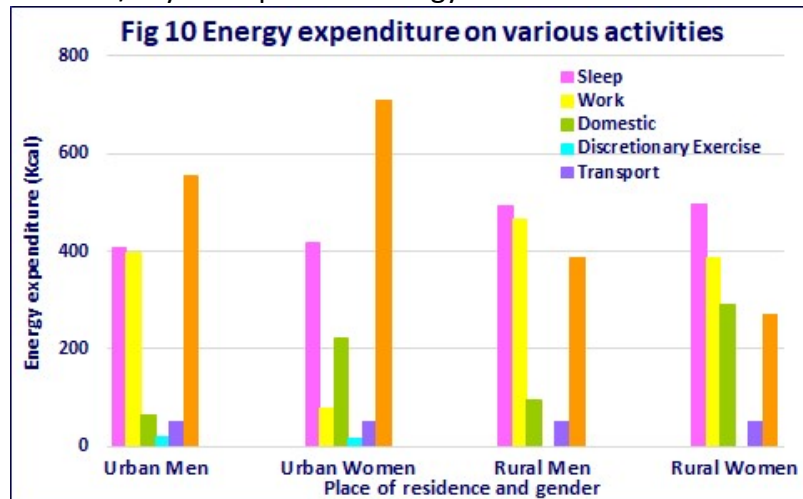
Groups	Weight (Kg)	BMI (Kg/m ²)	BF%	TDEI (Kcal)	TDEE (Kcal/day)	Energy Balance (Kcal)	Measured RMR (kcal/day)	PAR _{RMR} (TDEE/measured RMR)
D3 (30-39y) [n=22]	59	24.8	32.8	2,134	2056±238.7 (1724.5-2665.5)	+78	1562±260 (1166-2059)	1.33±0.14 (1.12-1.59)
D4 (40-49y) [n=20]	64	26.4	36.5	2,264	2191±306.6 (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)
D6 (60-69y) [n=14]	66	29.3	44.0	2,065	1971±118.4 (1770.0-2144.3)	+94	1457±154 (1224-1742)	1.36±0.14 (1.16-1.69)
D7 (70-88y) [n=07]	56	24.5	38.5	1562	1736±162.8 (1553.0-2012.0)	-174	1292±108 (1152-1454)	1.35±0.14 (1.15-1.52)

Source: Reference 9

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 a variety of food items and consume many of them. This, in turn, can lead to some increase in energy intake. Simultaneously, there is a reduction in physical activity. The combination of all these factors might be responsible for the rapid increase in over-nutrition in segments of the population who have just emerged

from poverty. This situation might also apply to rural migrants who had settled down in urban areas.

A cross sectional study on energy intake and expenditure in affluent housewives in the age group of 30-70 years in Delhi showed that their energy intake was between 2100-2300 kcal/day. In each age group, the energy expenditure was lower than the intake by about 70-100 kcal/day. This positive energy balance was associated with a weight gain of about five



kg per decade (Table 6). These women did not make any conscious effort to increase physical activity or take up regular exercise regime until they were over sixty years of age or had health problems. It is possible that similar situation exists among men in these segments of population. Small but persistent positive energy

balance appears to be the major factor responsible for the slow but steady weight gain in adults among affluent segments of population.

Policy and programme implications

Over the years, there has been a reduction in poverty; food grains are available at subsidised cost to the poorer segments of population. Data so far presented indicate that over the last three decades there has not been much change in dietary intake of adults; while macronutrient intake nearly meets the RDA, micronutrient intake is very low because of low intake of vegetables. There has been a reduction in physical activity due to increased mechanisation of transport, agricultural and industrial tasks; improved access to water, cooking fuels and mechanisation of household chores has resulted in reduced physical activity in household chores in women.

Unchanged dietary intake with reduction in energy requirement has resulted in a slow but steady decline in under-nutrition and increase in over-nutrition both in men and women. Under-nutrition rates continue to be high among rural poor while overnutrition is emerging as a major problem in affluent segments of population, especially, in urban areas. Prevalence of both under-nutrition and over-nutrition are higher in women than men. Huge inter-state differences exist in terms of dietary intake, physical activity and nutritional status.

Nutrition education that adults should eat balanced diet with just adequate energy intake and lots of vegetables should be communicated to all. If they follow this advice there will be improvement in undernutrition and micronutrient deficiencies. 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 have to be beamed regularly through all channels of communication. As the urban affluent segments access information and services readily,

they can be persuaded to reverse their recently acquired unhealthy life style, and regain their normal nutrition and health status. The fact that they are trying to change their lifestyle will act as a powerful incentive to stimulate the other segments of the population to follow suit thereby combat the trend towards increasing over-nutrition in middle income group population. Emergence of dual nutrition burden should therefore be considered as an opportunity to improve nutritional status of the population by combating both under- and over-nutrition through nutrition and health education.

References

1. NNMB National Nutrition Monitoring Bureau. *NNMB Reports*: National Institute Of Nutrition, Hyderabad. 1979-2006.
2. Department of Women and Child Development. *India Nutrition Profile*. Government of India, New Delhi, 1995-96.
3. Human energy requirements, Report of a Joint FAO /WHO /UNU Expert Consultation, Rome 2004.
4. National Family Health Survey (NFHS-2): <http://www.nfhsindia.org/india2.html>; last accessed on 24/09/07
5. National Family Health Survey (NFHS-3): <http://mohfw.nic.in/nfhsfactsheet.html>; last accessed on 24/09/07
6. National Sample Survey Organization NSSO. 1975-2000; http://mospi.nic.in/mospi_nssso_rept_pubn.htm; last accessed on 24/09/07
7. Economic Survey of India 2003-04: <http://indiabudget.nic.in/es2006-07/esmain.htm>; last accessed on 24/09/07
8. PURE Prospective Urban and Rural Epidemiological Study: <http://www.ccc.mcmaster.ca/pure/index.html>; last accessed on 24/09/07
9. Vasuja M and Siddu A: Energy intake and expenditure in urban affluent housewives PhD Dissertation, Delhi University, 2003.