2 TRIPLE BURDEN OF MALNUTRITION IN INDIA: CHALLENGES AND OPPORTUNITIES

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India is home to one-sixth of the global population. When the country became independent in 1947, it was not self-sufficient in food production and did not have an appropriate food distribution system. There were pockets which faced threats of famine and starvation whenever monsoon failed or staple production was low. Over three-fourth of the population were poor, food insecure and suffered from chronic macro- and micro-nutrient deficiencies. High prevalence of infections due to poor access to safe drinking water and sanitation led to loss of nutrients. Lack of access to healthcare facilities and poor utilisation of even the available healthcare facilities due to low literacy and lack of awareness, prolonged illness and increased the nutrition toll of infection.

The rapid population growth due to fall in death rates and unaltered birth rates resulting in high population growth rates, imposed great strain on the country's efforts to reduce hunger, under nutrition, micro-nutrient deficiencies and associated health problems. The focus of interventions in the 1950s and 1960s was on improving agricultural production to meet the needs of the growing population, reducing population growth to sustainable levels, and improving access to healthcare to reduce adverse effect of infections on health and nutrition status.

Thanks to Green Revolution, India became self-sufficient in foodgrain production by 1970. However, mere self-sufficiency in foodgrain production could not reduce household food insecurity or improve nutritional status of Indians. Over 70 per cent families continued to be poor; even though their expenditure on food was 70 per cent of their total household expenditure, 70 per cent of children were still under-nourished. The Government of India, therefore, initiated several national multi-sectoral programmes to reduce poverty, food insecurity, under-nutrition and micro-nutrient deficiencies, especially among the vulnerable segments of the population. These included poverty alleviation programmes aimed at improving purchasing power, providing foodgrain subsidy to improve household food security, food supplementation programmes aimed at bridging the energy gap among the vulnerable segments of the population, and providing healthcare to reduce nutrition toll of infections.

Six decades later, a review of the situation shows that there has been a substantial increase in per capita income and reduction in poverty; relatively low cost of food especially subsidised grains supplied through the public distribution system (PDS) has resulted in improvement in the energy intake of the low income group. The Government of India's Integrated Child Development Services (ICDS) is the world's largest food supplementation programme and covers pre-school children, and pregnant and lactating women. The major objectives of the programme are prevention, early detection, and effective management of under-nutrition. The mid-day meal (MDM) scheme covering over a 100 million school children is the largest school meal programme in the world. Access to essential primary

healthcare is universal, though there are problems in content and quality of care. Despite all these, one-third of Indian infants have low birth weight (at birth weighing less than 2.5 kg) and 20 per cent are stunted at birth. Nearly half of the pre-school children are stunted and underweight though only a third are wasted (thin). A third of Indian adults are thin and under-nourished. A majority of Indians are anaemic and lack access to iodised salt.

The last two decades witnessed a progressive if relatively slow increase in prevalence of over-nutrition and associated health problems. Initially the rise in over-nutrition was seen in the urban affluent segments of the population. But recent data indicate that over-nutrition is emerging as a problem in all age groups, in all segments of population, in all states, both in urban and rural areas. Data indicate that under-nutrition in childhood can be a risk factor for over-nutrition and non-communicable diseases during adult life. Apprehensions that India may become the home for largest number of over-nourished persons and may face steep escalation in non-communicable diseases (NCDs) are widespread.

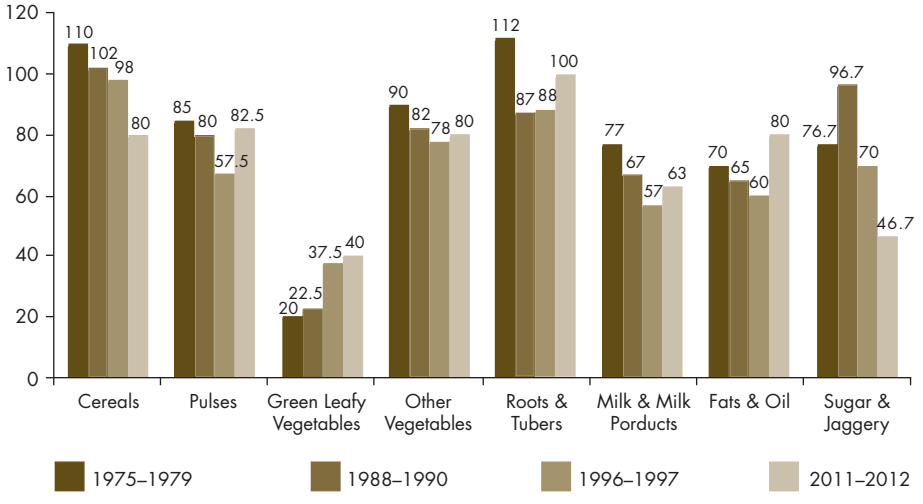
Triple burden of persistent under-nutrition, micro-nutrient deficiencies, and rising over-nutrition and their health consequences is but one manifestation of the ongoing economic, social, lifestyle, demographic, nutrition and health transitions. India is currently reaping the demographic dividend of having a young, literate, rational and healthy population. There are time-tested, simple, effective and inexpensive interventions for prevention and management of under-nutrition, micro-nutrient deficiencies and over-nutrition. The country has the infrastructure and human resources to implement these and combat triple nutrition burden. This manuscript will briefly review the causes, consequences of triple burden of malnutrition and India's efforts to combat them.

Factors Affecting Nutritional Status of Indians

Dietary Intake

Recognising the need for good quality data for monitoring nutritional status, the Indian Council of Medical Research (ICMR) in 1972 established the National Nutrition Monitoring Bureau (NNMB) in the National Institute of Nutrition (NIN), Hyderabad. Since 1973, NNMB has been conducting diet and nutrition surveys in 10 major states: Andhra Pradesh, Kerala, Karnataka, Gujarat, Maharashtra, Madhya Pradesh, Odisha, Tamil Nadu, Uttar Pradesh and West Bengal. NNMB had carried out surveys in the rural areas in 1975–79, 1980–85, 1988–90, 1996–97, 2000–01 and 2004–05 and in the urban areas in 1975–79 and 1993–94. Data from NNMB surveys on dietary intake in rural areas in terms of food items as percentage of the recommended dietary allowances (RDA) for Indians is shown in Figure 2.1. Over the last four decades there has been a substantial reduction in intake of cereals (137 gm) (NNMB 2012). A similar reduction in cereal intake was reported by the

Figure 2.1 Time Trends in Food Intake as Percentage of RDA (Rural)



Note: RDA: Recommended Dietary Allowances.
Source: NNMB (2012).

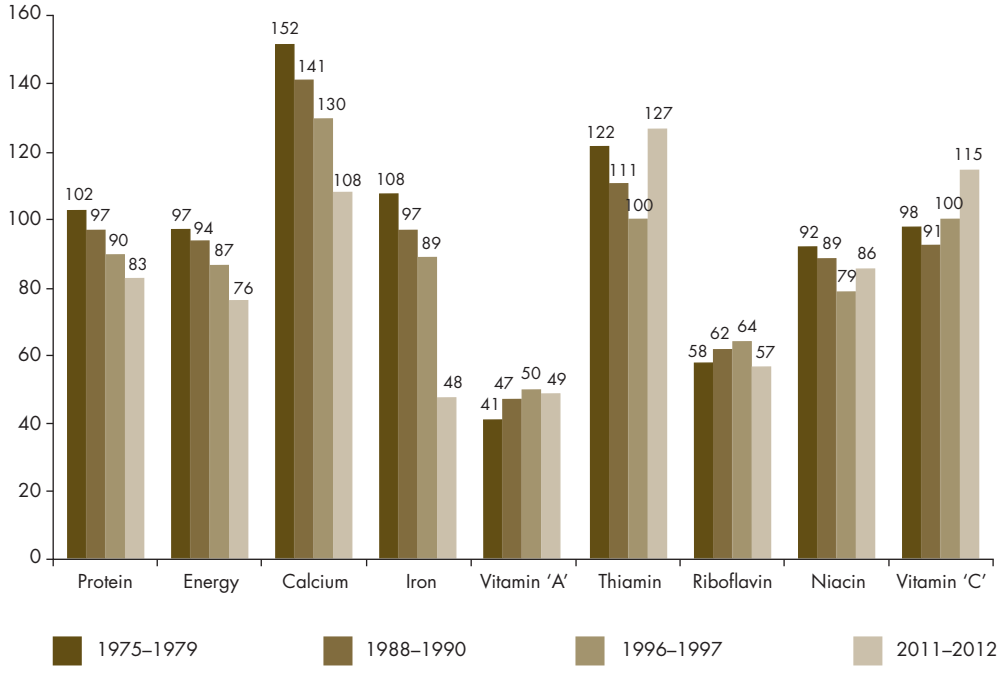
consumer expenditure surveys conducted by the National Sample Survey Organisation (NSSO). There has been some reduction in intake of roots and tubers (6 gm), milk and milk products (21 ml), sugar and jaggery (9 gm) and other vegetables (6 gm) over the last four decades. Pulse intake underwent a reduction in the period 1975–1996–1997 but again increased to almost 1975 levels in 2011–12. There was some increase in intake of green leafy vegetables (8 gm) and fats and oils (2 gm). The continued low vegetable intake is the major factor responsible for the high prevalence of micro-nutrient deficiencies in India (ibid.). Surveys in urban areas showed a similar trend.

Computed nutrient intake as percentage of RDA from NNMB surveys over the last four decades for rural areas is shown in Figure 2.2. There has been a reduction in the intake of all the nutrients over this period. The average intake of energy declined by about 500 Kcal/CU/day over the period mainly due reduction in cereals which are a major source of energy in Indian diets. This reduction is not due to poverty and lack of purchasing power (there has been a reduction in poverty over years) or lack of access to foodgrains at affordable cost (foodgrains are available for the poor at subsidised cost through PDS). It might be due to the people's perception that they are physically less active and hence need less energy intake. This reduction is one of the major factors responsible for the relatively slow increase in over-nutrition rate in India as compared to the other developing countries undergoing nutrition transition. The intake of micro-nutrients such as iron, Vitamin A and riboflavin continue to remain well below the RDA (ibid.). This has been the reason for the widespread prevalence of micro-nutrient deficiencies especially anaemia among Indian population.

Physical Activity

In the 1970s, Indians spent a lot of energy in occupational activities, domestic chores and getting from one place to another without mechanised transport. Between 1990 and 2010, there has been a steep increase in the mechanisation of the occupational, transport and domestic work domains. This has resulted in substantial reduction in physical activity in all segments of the population both in urban and rural areas. The NNMB survey of 1996–97 shows that even in the rural areas over one-third of men and two-thirds of the women were sedentary (ibid.) (see Table 2.1); the magnitude of mechanisation and reduction of physical activity was even higher in the urban areas. The steep reduction in physical activity and relatively lower

FIGURE 2.2 Time Trends in Nutrient Intake as Percentage of RDA (Rural)



Note: RDA: Recommended Dietary Allowances.
Source: NNMB (2012).

TABLE 2.1 Physical Activity Levels in Rural Population

Activity status	Men		Women		Total	
	No.	Per cent	No.	Per cent	No.	Per cent
Sedentary	1,349	33.3	2,765	62.7	4,114	48.6
Moderate	2,650	65.5	1,632	37.0	4,282	50.6
Heavy	48	1.2	14	0.3	62	0.8

Source: NNMB (1999).

reduction in energy intake is one of the major factors responsible for the increase in over-nutrition rates in the country.

Recommended Dietary Allowances (RDA) for Indians

FAO/WHO/UNU revised the human nutrient requirements in 2004 taking into account new data on nutrient requirements obtained using newer more precise technologies (FAO, WHO, UNU 2004). India revised the RDA for Indians in 2010. RDA computed the nutrient requirements for the reference Indian population whose body weight was mean +2SD of the NNMB survey population and also provided energy and nutrient requirements per kg so that nutrient requirements could be computed for various groups on the basis of actual weight of the population (ICMR 2010). Computed energy intake for the average Indians of varying age, sex and physiological status based on their current average weight is given in Table 2.2. It is obvious that for their current weight, the current average energy intake of adults by and large met their requirements. However, there are large energy deficits in two groups: adolescents, and pregnant and lactating mothers. Bridging the energy gap in pregnant and lactating women is a priority not only because of the implications of maternal under-nutrition but also because maternal dietary intake and nutritional status are critical determinants of intrauterine growth of the baby and growth during infancy. The ICDS scheme provides food supplements to bridge the energy gaps in pregnant and lactating women, and pre-school children. The MDM scheme is an attempt to bridge this gap in the 6–14 year age group. Adolescent growth represents the last window of opportunity for linear growth and bridging the large energy deficit in this age group has to be undertaken on priority. However, most often, these supplements are either shared with the family or act as substitutes for home food and do not have substantial impact on nutritional status. Currently, the component of these programmes aimed at identifying thin children and providing them double rations and healthcare for infections is not being implemented on scale; if this were done there can be substantial reduction in wasting (under-nutrition) in children.

TABLE 2.2 Energy Requirement for Actual Weight (Computed from RDA for Indians)

Group	Actual weight (Average of Group in Kg)	Requirement for actual weight (Kcal)	Actual intake (Kcal)	Gap (Kcal)
Adult men	51	1,989	2,000	11
Adult women	46	1,656	1,738	82
Pregnant women		1,906	1,726	–180
Lactating women		2,155	1,878	–277
Children				
1–3 yr	10.5	840	714	–126
4–6 yr	14.6	1,095	978	–117
7–9 yr	19.7	1,379	1,230	–149
Boys				
10–12 yr	26.6	1,729	1,473	–256
13–15 yr	36.8	2,208	1,645	–563
16–17 yr	45.7	2,514	1,913	–601
Girls				
10–12 yr	26.7	1,469	1,384	–85
13–15 yr	36.9	2,030	1,566	–464
16–17 yr	42.6	2,130	1,630	–500

Source: Author's calculations based on NNMB reports and ICMR (2010).

National Food Security Act (NFSA)

Over the last five years there has been a steep and sustained increase in food prices, globally, and in India. There were growing concerns that sustained increase in food price inflation may adversely affect the household food security and nutritional status of the citizens. In September 2013, India became the first country to enact food security legislation through which over two-third of the citizens are entitled to get subsidised foodgrains through the PDS. The National Food Security Act (NFSA) aims to improve household food security by providing subsidised foodgrains (rice at Rs 3, wheat at Rs 2 and millets at Re 1) as a legal entitlement to over 67 per cent of the Indian citizens. Priority households are entitled to 5 kgs of foodgrains/person/month. The poorest of the poor (Antyodaya) households are entitled to 35 kgs/household/month. The combined coverage of Priority and Antyodaya households (called 'eligible households') is upto 75 per cent of the rural population and upto 50 per cent of the urban population. In the ration card, the oldest woman in the household will be designated as the head of the household. In addition to this, on-going programmes of food supplementation to pregnant and lactating women and pre-school children (ICDS) and school children (MDM) will be supported through the NFSA.

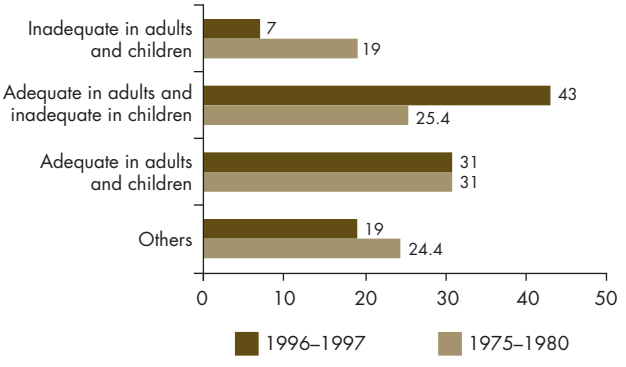
Foodgrains alone cannot provide a balanced meal needed for optimal nutrition. States like Chhattisgarh and Tamil Nadu provide pulses at subsidised cost through PDS. Chhattisgarh provided iron fortified iodised salt (double fortified salt) through PDS at a subsidised cost to combat both iodine and iron deficiency. However, it will never be possible to provide all the food items needed for balanced diet at a subsidised cost to all the needy. There is an urgent need for a nutrition awareness campaign with focus on women (who are head of the household for the ration card) on how the money saved because of subsidised foodgrains (Rs 20 x 25 kg = approximately Rs 500 per month) can be used for purchasing vegetables and pulses so that the family can have a balanced diet.

Improving access to foodgrains by itself might not be sufficient to improve the nutritional status of the population if there is nutrient loss due to infections. Therefore, the Act also calls for improvement in access to safe drinking water, improvement in environmental sanitation to prevent infections, and improved primary healthcare for early detection and effective management of infections to prevent nutrient loss.

Intra-family Differences in Dietary Intake and Nutritional Status

In India, efforts have been focused on improving household access to food with the assumption that food will be shared within the household on the basis of need. NNMB survey data showed that this may not be the case (see Figure 2.3). Energy intake was adequate in both adults and children in one-third of the families both during the 1975–80 and 1996–97 surveys. During this period there was a fall (from 19.1 to 7.2 per cent) in the households where all the members had inadequate energy intake. This might be due to reduction in poverty and better access to subsidised food in the 1990s. During the same period, the proportion of families where adults have adequate energy intake but children do not increased from 25.4 to 42.9 per cent. Subsequent NNMB surveys have shown that in the current decade there has been a further increase in the proportion of the families where adults are getting adequate energy but children do not. In these families, which consume about 11,000 Kcal energy/day (2,200 Kcal x 5 persons), poverty and household food insecurity are unlikely to be the reason for a gap of 300–400 Kcal energy intake among children. Poor child feeding and caring practices might be a major factor responsible for the problem, while nutrition education holds the key for correcting this.

FIGURE 2.3 Intra-family Distribution of Food



Note: All other combinations and permutations are labelled as 'others'.
Source: NNMB (1999).

NUTRITIONAL STATUS OF INDIANS

Low Birth Weight

Global data on low birth weight (LBW) indicate that the prevalence of LBW is highest in the South Asian

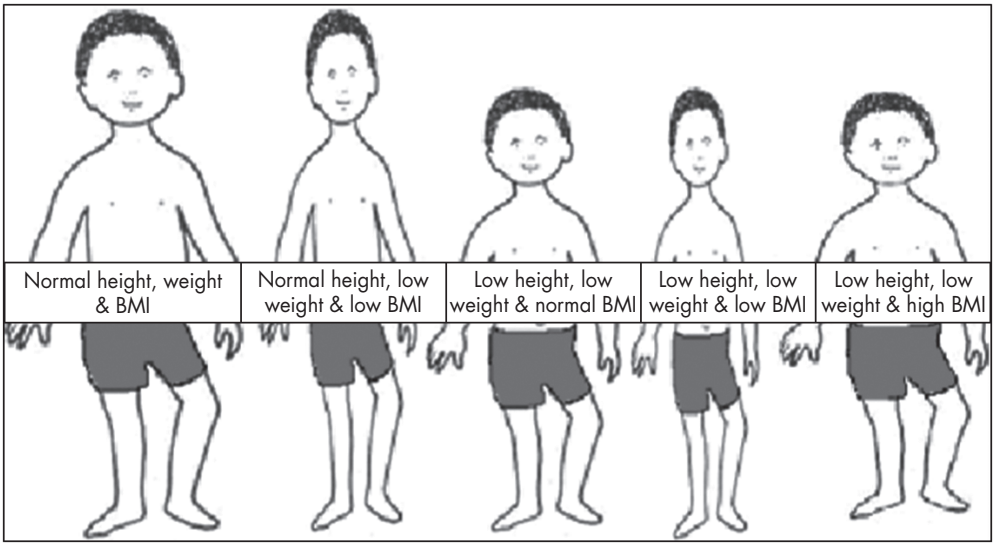
region. India, the population billionaire, accounts for nearly 40 per cent of global LBW infants. Estimates based on available data from institutional deliveries and smaller community-based studies suggest that nearly one-third of all Indian infants weigh less than 2.5 kg at birth. Low maternal and paternal height, low pre-pregnancy weight, low pregnancy weight gain, anaemia, poor antenatal care are major factors responsible for LBW in India. Factors associated with LBW such as low paternal and maternal height and low pre-pregnancy weight cannot be modified during pregnancy. However, universal access to antenatal care will result in early detection and effective management of low pregnancy weight gain, maternal anaemia, and pregnancy-induced hypertension, and bring about a 5 per cent reduction in LBW. Improving coverage, content and quality of antenatal care can be readily achieved through convergence of services under National Rural Health Mission (NRHM) and ICDS for pregnant women at anganwadis during the Village Health and Nutrition Days (VHND).

Research studies in India showed that a majority of Indian low birth weight babies are mature; they are small because of intrauterine growth retardation. If given essential newborn care consisting of warmth, breast-feeding and protection against infection, they survive. Only pre-term neonates (about 12 per cent) or neonates weighing less than 2 kg at birth, requires intensive care. These findings laid the foundation of neonatal care in the country. States like Kerala, Puducherry and Goa with functional primary healthcare services have achieved infant mortality rates (IMRs) below 20/1,000 decades ago inspite of high LBW rates. However, birth weight is a major determinant of growth in childhood; mature LBW children had a lower growth trajectory as compared to children with normal birth weight, and underweight rates are higher in childhood and adolescence in LBW infants.

Assessment of Nutritional Status Using Anthropometric Indices

Three anthropometric indices (weight, height, and body mass index [BMI]) have been widely used to assess nutritional status in children and adults. Weight (weight-for-age in growing children) indicates the cumulative impact of past and current under-nutrition; because of ease of measurement it is the most widely used indicator for assessment of nutritional status. Underweight due to chronic energy deficiency can be partly reversed and the reversal can be monitored by improvement in weight. Stunting in children due to poor growth is an important indicator of cumulative impact of past under-nutrition. Improvement in dietary intake can prevent further stunting but, unlike underweight, stunting cannot be reversed. BMI (given by weight in kg/height in metre^2) for age taking into account weight for the current height and age is an important indicator for assessment of current nutritional status of children in countries with high stunting rates and facing dual nutrition burden. BMI is an indicator for current energy deficiency/

FIGURE 2.4 Use of BMI-for-Age for Assessment of Nutritional Status in Children



Source: Author's illustration.

excess, which can be readily reversed. In 2007, the World Health Organisation (WHO) had provided the standards for BMI-for-age for the 0–5 year-olds in 2006 and the 6–18-year-olds in 2007, and recommended that BMI-for-age which provides information on current nutritional status should be used as the indicator for defining under- and over-nutrition in children (see Figure 2.4). Association between increased risk of infections with low BMI-for-age and increased risk of cardiovascular diseases with high BMI or rapid increase in BMI in childhood has been demonstrated in India, and India has accepted the WHO recommendation.

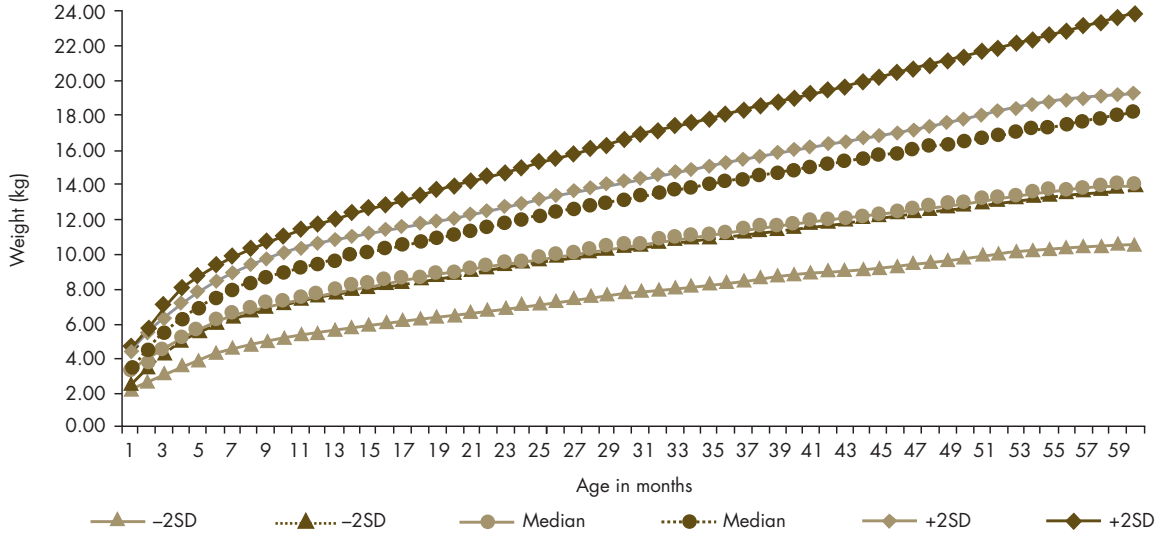
Under-nutrition in Early Childhood

Comparison weight-for-age curves of Indian children (data from NHFS-3) with WHO (2006) standards show that in the first month weight of Indian infants are just below the corresponding centiles of the WHO (2006) standards. Between 1–6 months, growth of Indian children falters so that the median of Indian children compares with WHO 3rd centile. By 18 months, Indian children's median lies below the 3rd centile of WHO standards (see Figure 2.5). Height-for-age shows a similar trend. The major factors responsible for the faltering growth are poor infant and young child-feeding practices.

Data from National Family Health Survey-3 (NFHS-3) (2007) and District Level Household Survey–3 (DLHS-3) (2010) showed that in India, though breast-feeding is nearly universal, less than 30 per cent of infants were exclusively breast-fed up to 6 months. A very few infants received semi-solid complementary feeds at 6 months. A majority of children received household food along with breast-feeding by 9–11 months.

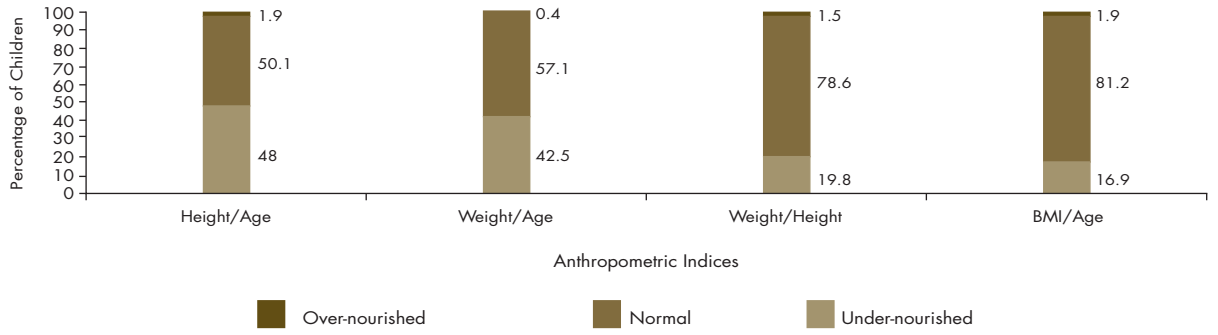
An analysis of data from NFHS-3 shows that underweight rates remain unaltered between birth and 3 months when most of the infants are exclusively breast-fed. Inspite of advice that they should exclusively breast feed their infants in the first 6 months, many women start introducing animal milk between 3–5 months; this practice results not only in reduction in breast milk secretion due to reduction in suckling stimulus, but also increase in morbidity due to infections. As a result, infants become under-nourished (NFHS-3 2007). These findings should be used to mount effective campaign for exclusive breast-feeding during the first 6 months for prevention of under-nutrition in early infancy. Further, rise in underweight rates occurs between 6–11 months due to late introduction, inadequate quantity, and low calorie density of complementary feeds, and increase in morbidity due to infections. Nutrition education on how appropriate complementary feeds prepared by modifying household food and fed 4–6 times a day can prevent deterioration in infant nutrition. Inadequate food intake because children are fed only 3–4 times a day with household diets (though many continue to be breast-fed 3–4 times a day) is the cause of increase in the underweight

FIGURE 2.5 Weight-for-Age (NFHS-3) of Indian Children vs WHO (2006) Standard



Note: The lines in darker shade indicate WHO data. The lines in lighter shade indicate NFHS data.
Source: Ramachandran and Gopalan (2011).

FIGURE 2.6 Nutritional Status of Pre-school Children



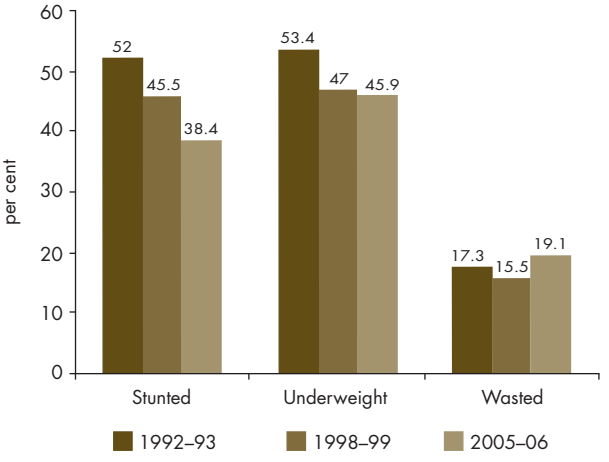
Source: Author's calculations based on raw data of NFHS-3 (2005–06).

rates between 12–23 months. Children in the 2–5 year age group have small stomachs and have to be fed 5–6 times a day to meet their nutrient requirements. Trying to fit them into the three-meal pattern results in low dietary intake and thereby under-nutrition. Health education and increasing access to healthcare can lead to early diagnosis and management of infections. The health and nutrition education for preventing rise in under-nutrition rates in the critical first two years of life are incorporated in the Mother Child Protection Card jointly published by the Ministry of Women and Child Development (MoWCD) and Ministry of Health and Family Welfare (MoHFW). Providing these cards to all eligible children, tracking their growth, and intervening if there is growth faltering will go a long way in reducing under-nutrition in infancy and early childhood.

Data on prevalence of under-nutrition in pre-school children (from NFHS-3 2007) is shown in Figure 2.6. In India, stunting rates are high. Over 40 per cent of the Indian pre-school children are stunted and underweight. But a majority of the short children have weight appropriate for the height and age, and only about 17 per cent are thin. Height is an important determinant of weight. Infants and children who are short and have weight appropriate for their height and age get misclassified as being underweight if weight-for-age is used as the index for assessment of nutritional status. Short infants may be having high BMI-for-age and be still underweight because they are short. Use of BMI-for-age will reduce the risk of misclassifying short children. Only 17 per cent of Indian pre-school children are wasted. Identifying them during the VHND and providing them with double rations/treatment of infection will result in substantial improvement in wasting. Correction of wasting will prevent stunting and allow the child to grow along the linear trajectory.

Data from the three NFHS rounds provide several insights into the nutrition transition in the last two decades. Over this period there has been sustained reduction in stunting (see Figure 2.7). The reduction in stunting between NFHS-2 and 3 was of a greater magnitude as compared to reduction in underweight and therefore there was a rise in wasting rates. The policies and programme documents have been emphasising the need for screening of pre-school children, identifying under-nourished children, and providing them take-home rations and healthcare. When these programmes get fully operationalised, there will be a substantial reduction in wasting and stunting.

FIGURE 2.7 Time Trends in Nutritional Status of Children under 3 Years in India

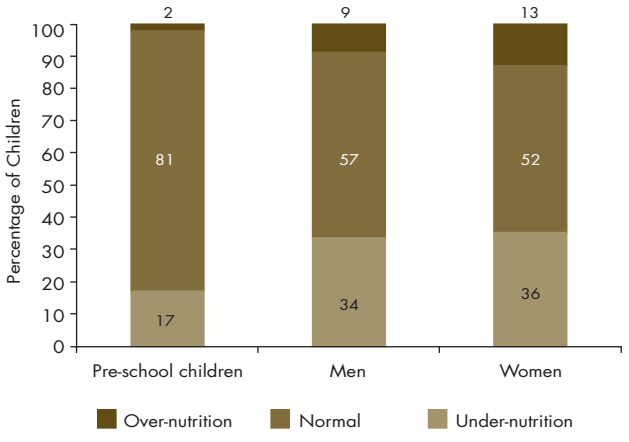


Source: Author's calculations based on raw data of NFHS-1 (1992–93), NFHS-2 (1998–99) and NFHS-3 (2005–06).

Nutritional Status of School Children

Available data on prevalence of under- and over-nutrition in pre-school children and adults from the NFHS-3 is given in Figure 2.8. Data from the survey indicates that if BMI is used as the indicator for assessment of nutritional status, both under- and over-nutrition are lowest in pre-school children and highest in adults.

FIGURE 2.8 Nutritional Status of Children under 5 Years and Adults



Source: Author's calculations based on raw data of NFHS-3 (2005–06).

Data from NNMB surveys indicate that school-age children have under-nutrition and over-nutrition midway between the pre-school children and adults. The gap between the requirements and the actual energy intake is high in school children, especially in adolescents (Table 2.2). The MDM programme covers school children between 6–14 years. Currently, the Ministry of Human Resources Development is providing cooked MDM with 450 calories and 12 gm of protein to every child at primary level and 700 calories and 20 gm of protein at upper primary level. The energy and protein requirement for a primary child comes from cooking 100 gm of rice/flour, 20 gm pulses, 50 gm vegetables and 5 gm oil, and for an upper primary child comes from 150 gm of rice/flour, 30 gm of pulses, 75 gm of vegetables and 7.5 gm of oil. Currently, more than 10.35 crore children (75 per cent of the enrolled children) in 11.55 lakh schools in the country get MDM. It has been reported that MDM has helped in preventing classroom hunger, promoting school enrolment, and improving attendance, fostering social integration and improving gender equity. MDM coverage is universal and foodgrains for the programme are provided under the NFSA.

Currently, height and weight measurements are being done in most schools in most states under the school health programme held once a year. But these measurements are neither taken with accurate equipment, nor are they used for the identification of under-nourished children to provide them with double rations. Measuring height and weight with inexpensive accurate equipment, computing BMI-for-age and identifying thin/fat children is feasible in schools by improving the co-ordination and collaboration between MDM and school health system. It might be possible to reduce under-nutrition and prevent over-nutrition in school children by:

- undertaking height and weight measurements and computing BMI-for-age twice a year,
- identifying under-nourished children (lean children),
- getting under-nourished children checked by school health system for infections and if present treating the same,
- providing under-nourished children with double helping of MDM if low food intake is the problem,
- identifying over-nourished children and ensuring that they play and improve physical activity.

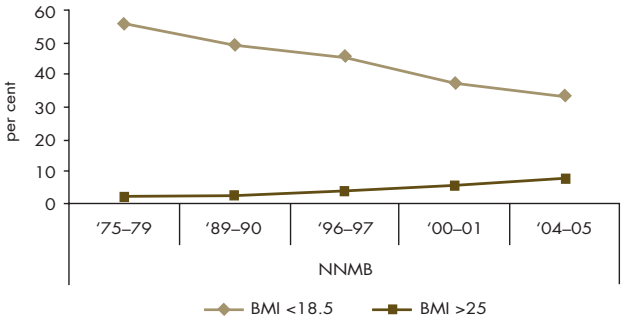
Nutritional Status of Adults

Under-nutrition in Adults

Data from NFHS-3 showed that under-nutrition remains a major problem in adults—about a third of both men and women are under-nourished. About half of the men and women are normally nourished. Over-nutrition is a problem both in men and women. Both under- and over-nutrition are more common in women (see Figures 2.9 and 2.10). There are huge inter-state differences in prevalence of both under- and over-nutrition. By and large, states with low under-nutrition rates had high over-nutrition and vice versa (Figure 2.11).

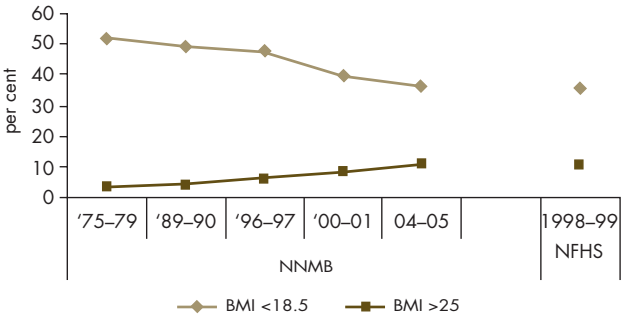
Under-nutrition in women is more common among the rural and tribal population, and among younger (Figure 2.12), poorer (Figure 2.13) and less educated segments of the population wherever they live. Prevalence of over-nutrition is higher among urban, older, educated and high income group population. The proportion of normally nourished women is the same in all segments of the population (Figure 2.12 and Figure 2.13) (ibid.). The decline in under-nutrition rates can be accelerated through the effective implementation

FIGURE 2.9 Time Trends in Nutritional Status of Adult Men



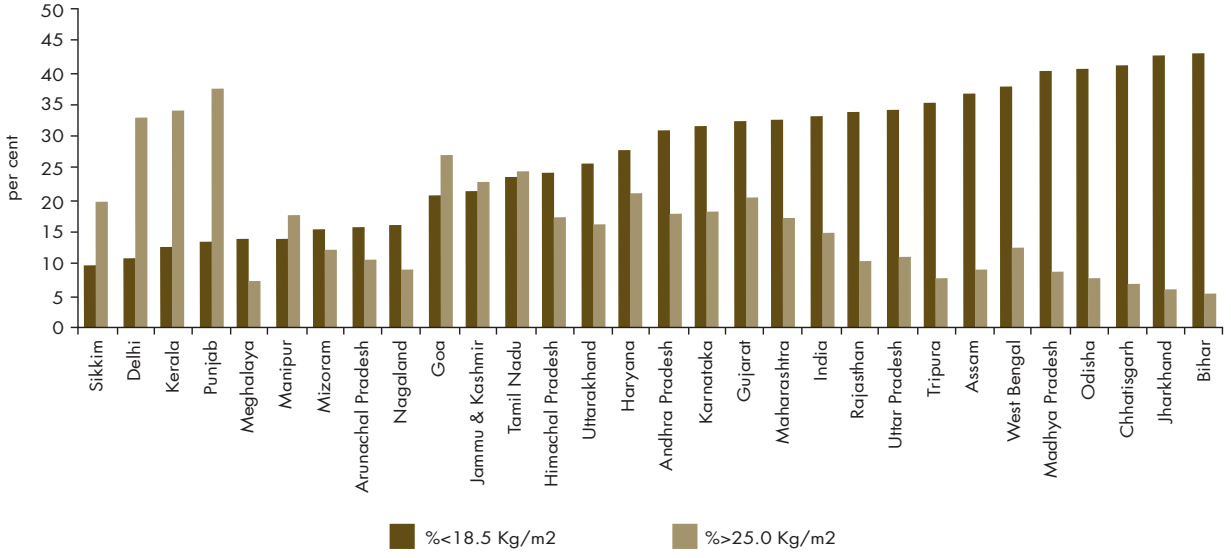
Sources: NNMB (1980, 1991, 1999, 2002, 2006).

FIGURE 2.10 Time Trends in Nutritional Status of Adult Women



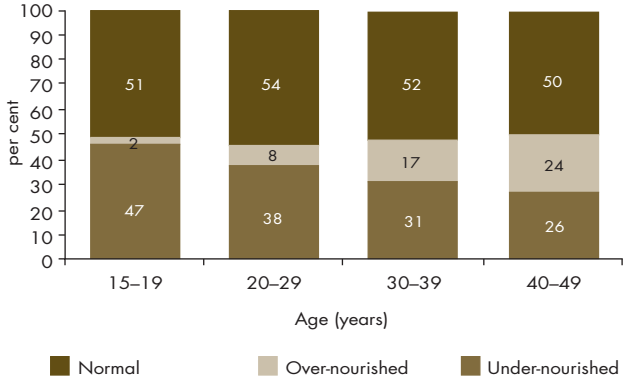
Sources: NNMB (1980, 1991, 1999, 2002, 2006), NFHS-2 (2000).

FIGURE 2.11 Nutritional Status of Women



Source: NFHS-3 (2007).

FIGURE 2.12 Effect of Age on Nutritional Status of Women



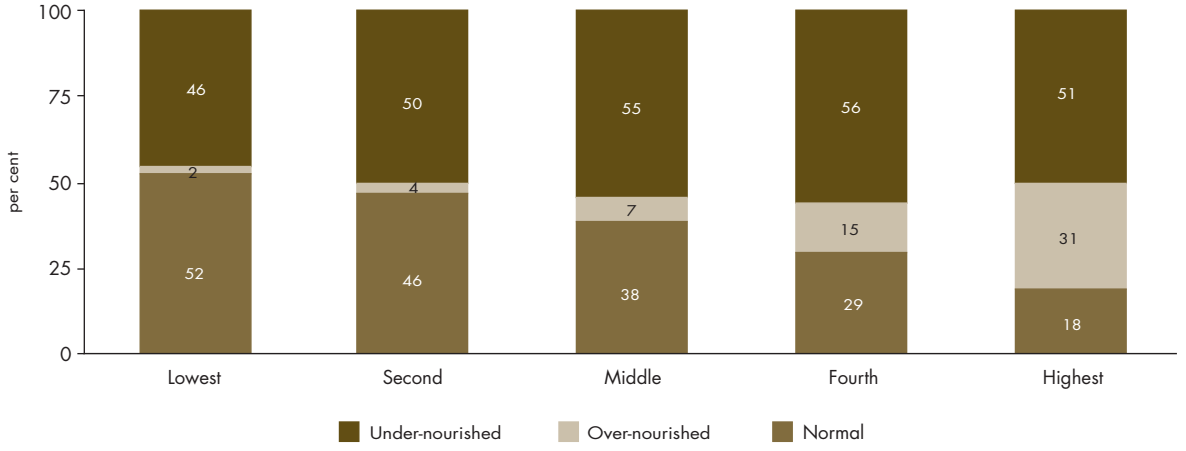
Source: NFHS-3 (2007).

of the NFSA, ongoing food supplementation of the vulnerable groups and improved access to healthcare for infections. The country has to strive to ensure that high under-nutrition rates are not replaced by high over-nutrition rates.

Over-nutrition in Adults

Over-nutrition (BMI>25) rates were less than 5 per cent in the 1970s and 1980s. Over the last 15 years, there has been a progressive, but slow rise in over-nutrition rates both in women and men (see Figures 2.9 and 2.10) (Ramachandran 2006, 2007). However, over-nutrition rate in India is still less than 15 per cent. India has two major advantages in combating rising over-nutrition rates. Unlike many developing

FIGURE 2.13 Nutritional Status of Women in Different Wealth Quintiles



Source: NFHS-3 (2007).

countries, economic growth in India was not associated with increased energy intake (ibid.). Steep reduction in physical activity is the major factor responsible for the rise in over-nutrition (ibid.). The population is becoming aware that moderate physical activity is essential for optimal nutrition and health. If energetic steps are taken to promote discretionary physical activity in all segments of the population, it will be possible to prevent the projected rise in over-nutrition. At present, over half of the Indians are normally nourished. With the efforts to reduce under-nutrition and steps to prevent escalation of over-nutrition, it is possible that a majority of Indians may remain normally nourished and not incur the health hazards associated with under- and over-nutrition.

Micro-nutrient Deficiencies

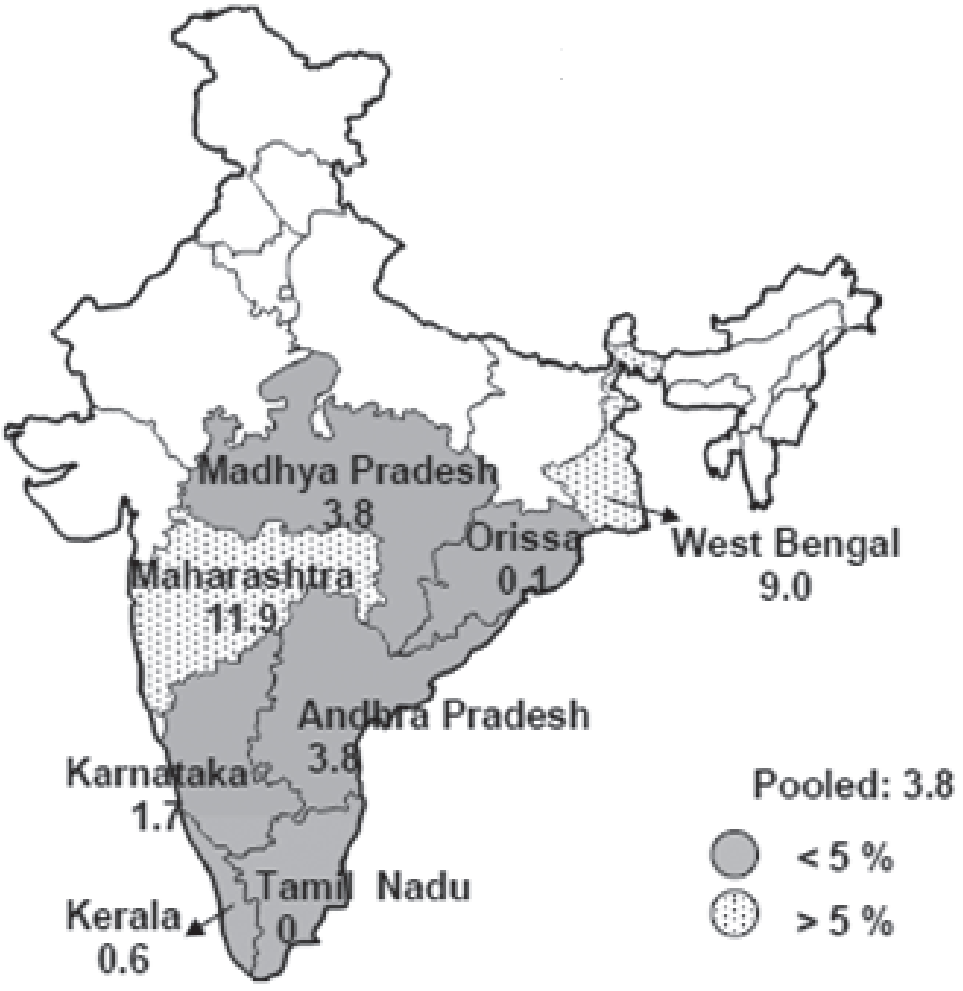
Micro-nutrient deficiencies referred to as hidden hunger are the most common forms of nutritional deficiencies globally as well as in India. While under-nutrition is due to inadequate energy intake, micro-nutrient deficiencies reflect the poor quality of food consumed. Goitre due to iodine deficiency, blindness due to Vitamin A deficiency, dry and wet beriberi and pellagra were the major public health problems in pre-independent India. Sustained dietary changes of the population resulted in the elimination of beriberi and pellagra. Keratomalacia due to severe Vitamin A deficiency is no longer a public health problem and prevalence of night blindness and Bitot spots are low except in some pockets; but subclinical Vitamin A deficiency is reported to be common. The country is nearing the goal of universal household access to iodised salt. However, due to iron and folic acid deficiencies, there has not been any decline in the prevalence of anaemia.

Iodine Deficiency Disorders

Iodine Deficiency Disorders (IDD) has been recognised as a major public health problem in India. Unlike other micronutrient deficiencies, IDD is due to deficiency of iodine in water, soil and food items, and affects all socio-economic groups living in defined geographic areas. Although the prevalence of IDD in India is lower than in most South Asian countries, the problem is ubiquitous.

Salt fortification with iodine has been used worldwide for prevention of IDD for nearly a century. The National Goitre Control Programme (NGCP) was launched by the Government of India in 1962. Initially, the programme aimed at providing iodised salt to the population living in the well-recognised sub-Himalayan 'goitre' belt. However, availability of salt was erratic and a majority of households did not have access to iodised salt and used cheaper non-iodised salt. As a result, there was no substantial reduction in IDD. In the 1980s, the data from DGHS/ICMR (Directorate General of Health Services/Indian Council of Medical Research) surveys showed that IDD is not a problem confined to the sub-Himalayan regions alone; there are pockets of iodine deficiency in all the states. In 1992, NGCP was renamed as National Iodine Deficiency Disorders Control Programme (NIDDCP), and it was decided to iodise all edible salt for human consumption in the country. The goal of the NIDDCP is to ensure universal household

FIGURE 2.14 Prevalence (%) of Goitre among 6 ≤12-year-old Children



Source: NNMB (2003).

access to iodised salt and reduce the prevalence of IDD below 10 per cent in the endemic districts of the country. Data from NNMB surveys show that in 2003 in only two of the eight states surveyed goitre rates in 6≤12-year-old children exceeded 5 per cent (Figure 2.14). UNICEF's survey conducted in 2009 show that 71 per cent of households accessed adequately iodised salt; iodisation was inadequate in 20 per cent households and only 9 per cent had not accessed iodised salt (see Table 2.3). Efforts have been intensified to ensure that 100 per cent of households get access to adequately iodised salt and hopefully the ongoing national surveys (Annual Health Survey and DLHS-4) will confirm that the goal of universal access to iodised salt has been achieved if not by 2012 at least a couple of years later.

TABLE 2.3 Household Access to Iodised Salt

Iodine content of salt consumed	*2006*	*2009*
Adequate (>= 15 ppm)	51%	71%
Inadequate (<15 ppm)	25%	19%
No iodine	24%	9%

Note: ppm: parts per million.
Sources: NFHS-3 (2007), UNICEF (2010).

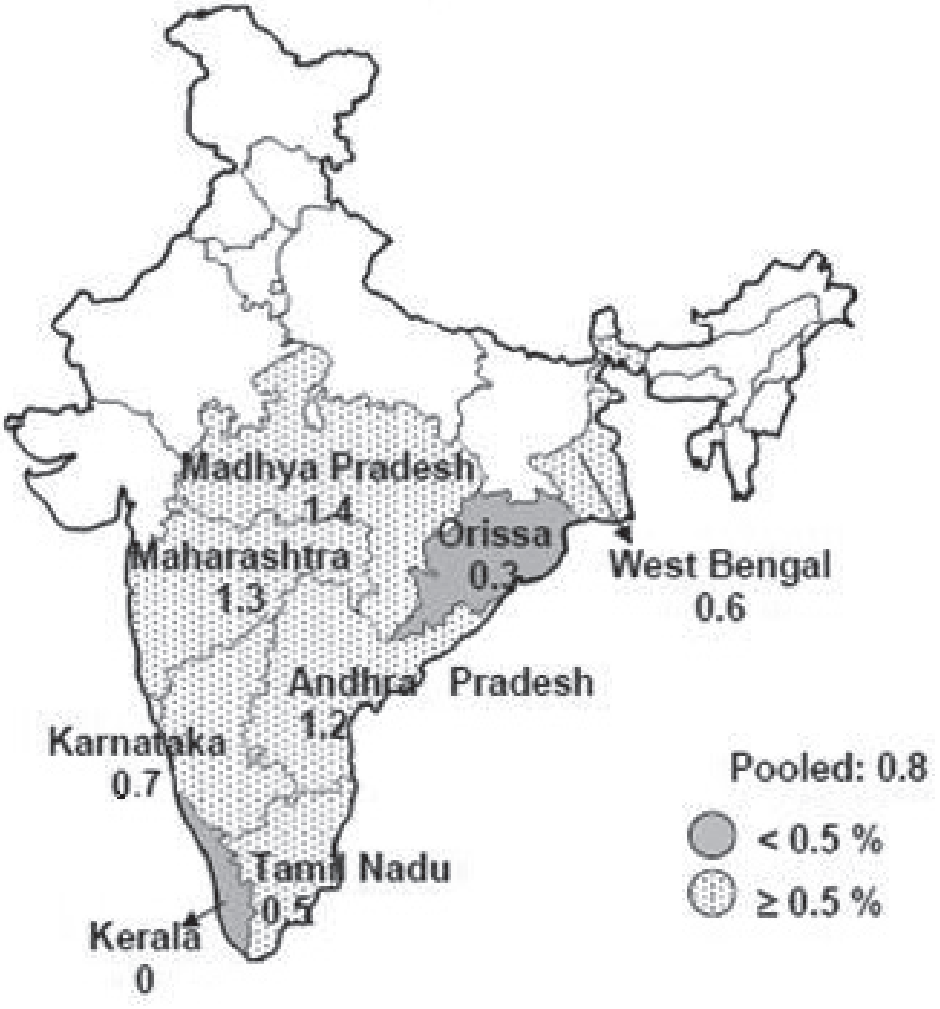
Vitamin A Deficiency

Vitamin A is an important micro-nutrient 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 dietary allowances. In spite of the

fact that there has not been any significant improvement in the dietary intake of Vitamin A and coverage under Massive Dose Vitamin A programme has been low, there is a decline in clinical Vitamin A deficiency in under-five children in the country. NNMB surveys showed that even though keratomalacia has not been seen in the last four decades, prevalence of Bitot Spots in 1–5-years-old children was less than 0.5 per cent in only two of the eight states surveyed in 2003 (Figure 2.15). Prevalence of night blindness in pregnant and lactating women was reported to be low between 1–5 per cent. However, low blood levels suggestive of deficiency of Vitamin A is reported in about 20–50 per cent of women and children. Currently, over 80 per cent of pregnant women do seek antenatal care; nutrition education to increase intake of β carotene rich food items in their diets has to be given to all pregnant women to ward off subclinical Vitamin A deficiency. During antenatal care, it is possible to identify women having night blindness and Bitot Spots and provide them with 10,000 IU of Vitamin A daily for a fortnight.

Since 1970, the country has a massive dose Vitamin A supplementation programme covering all children between 9 and 72 months. However, the coverage under this programme has been very low. In the last decade, the country switched over to the biannual administration of Massive Dose Vitamin A supplementation. This has resulted in substantial improvement in the coverage of Massive Dose Vitamin A supplementation. The increasing emphasis on production of locally consumed

FIGURE 2.15 Prevalence (%) of Bitot Spots among 1–5-year-old Children



Source: NNMB (2003).

micro-nutrient-rich vegetable cultivation, improvement in processing, grading, storage and marketing, it is possible that vegetables will be available at affordable cost in urban and rural areas throughout the year. Ready availability of vegetables and inclusion of vegetables in the MDM and ICDS food supplementation programmes coupled with nutrition education will result in improvement in vegetable consumption, Vitamin A, folate and other micro-nutrient intake among vulnerable segments of the population.

Anaemia

India is among the countries with the highest prevalence of anaemia in the world (see Figure 2.16). With over a billion population, the country accounts for the largest number of anaemic persons in the world. Over the last six decades there has been a reduction in severity of anaemia and some of the adverse consequences associated with it, but there has not been any substantial reduction in the prevalence of anaemia. It is estimated that about 20–40 per cent of maternal deaths in India are due to anaemia; India contributes to about 50 per cent of global maternal deaths due to anaemia (Table 2.4).

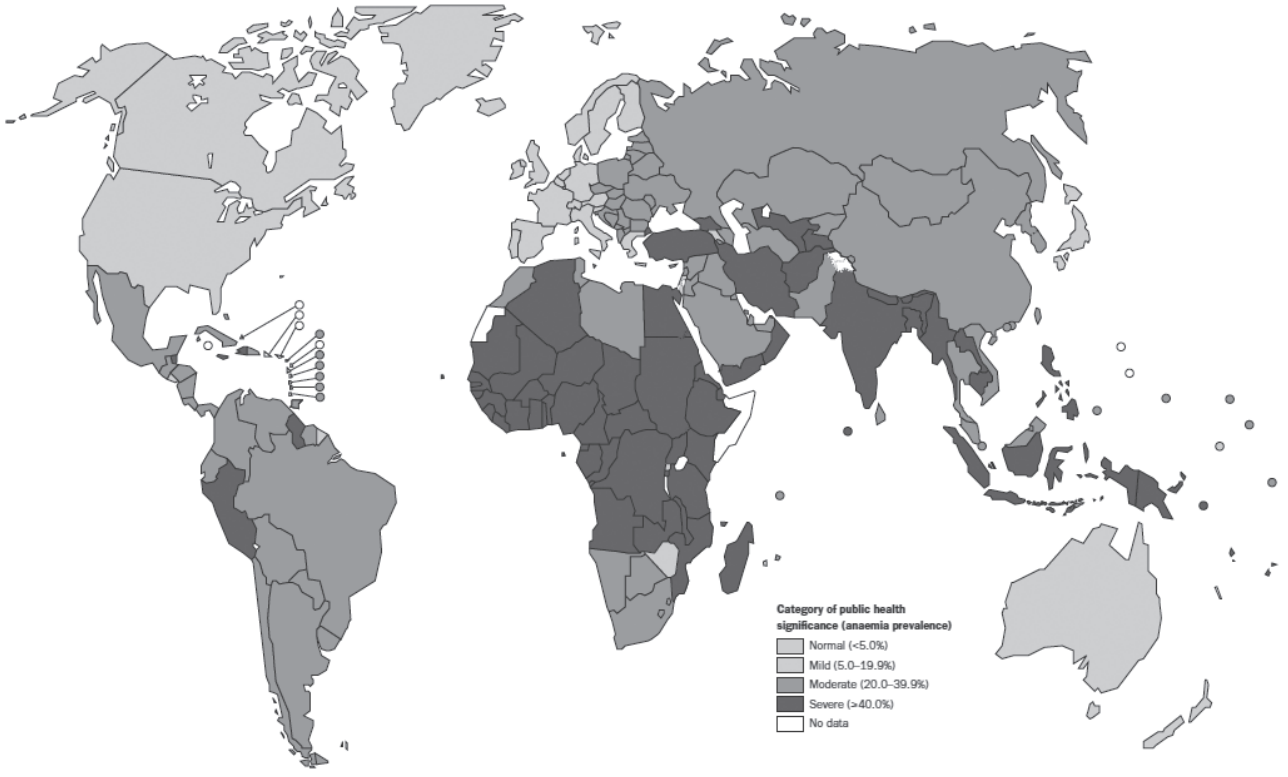
In India, anaemia begins right at infancy and childhood, increases in severity during adolescence in girls, antedates pregnancy and gets aggravated during pregnancy (see Figure 2.17). Prevalence of anaemia is high even in high income groups and among well-educated pregnant women. Prevalence of anaemia is high not only among under-nourished persons but also in normal and over-nourished individuals (see Figure 2.18). The high prevalence of anaemia is due to:

- low dietary intake, poor iron (less than 20 mg/day) and folic acid intake (less than 70 mg/day);
- poor bio-availability of iron (3–4 per cent only) in phytate fibre-rich Indian diet;
- chronic blood loss due to infection such as malaria and hookworm infestations.

The major intervention strategies envisaged for prevention and management of anaemia are:

- health and nutrition education to improve over-all dietary intakes and promote consumption of iron and folate-rich food items;

FIGURE 2.16 Prevalence of Anaemia in Pregnant Women



Source: WHO (2008).

TABLE 2.4 Prevalence of Iron Deficiency Anaemia and Maternal Deaths due to Anaemia in South Asia (%)

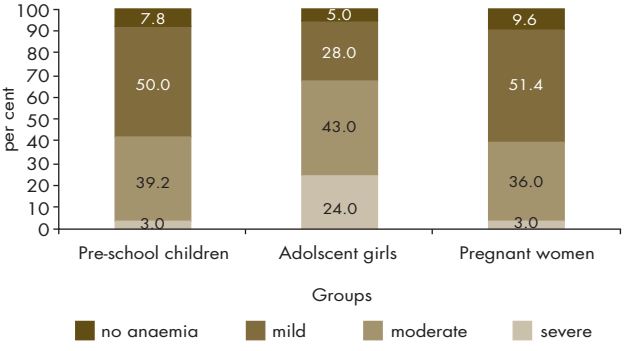
Country	*Children (<5yrs)*	*Women (15–49 yrs)*	*Pregnant women*	*Maternal deaths from anaemia/yr*
Afghanistan	65	61	–	–
Bangladesh	55	36	74	2,800
Bhutan	81	55	68	< 100
INDIA	75	51	87	22,000
Nepal	65	62	63	760
Pakistan	56	59	–	–
S.A region total				25,560
World total				50,000

Source: De Mayer and Tegman (1998).

- food fortification, especially introduction of iron fortified iodised salt;
- screening for early detection of anaemia among vulnerable groups (such as pregnant women).

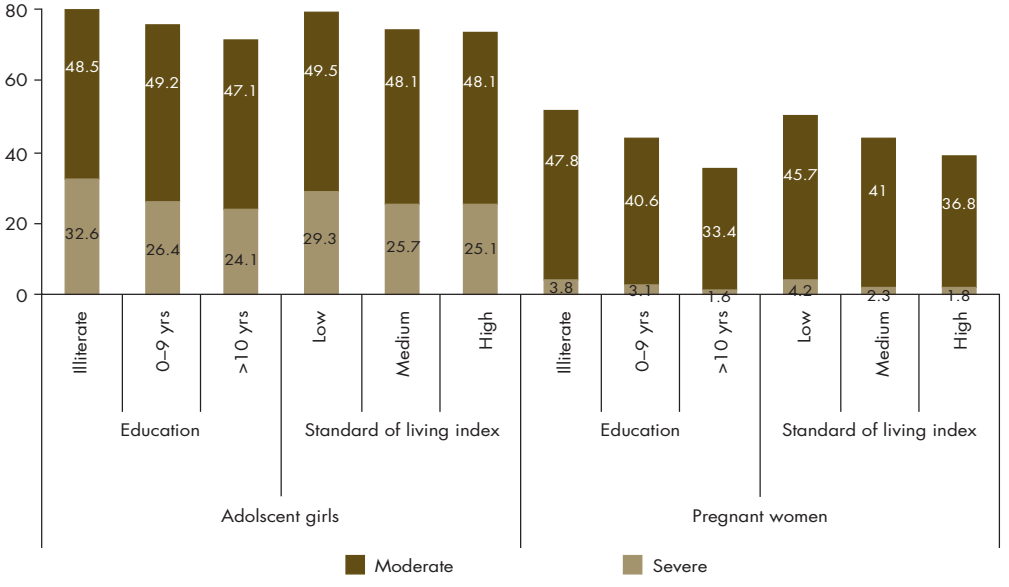
Appropriate management of anaemia varies depending upon its severity, chronicity, physiological status of the individual and the time available for correction of anaemia. In 2013, the Government of India brought out the revised guidelines for prevention and management of anaemia which emphasise the importance of consuming iron folate-rich vegetables as well as vegetables promoting iron absorption. The national guidelines also recommend that iron fortified iodised salt should be used in ongoing

FIGURE 2.17 Prevalence of Anaemia (%)



Source: Author's calculations based on raw data of DLHS-2 (2002–04).

FIGURE 2.18 Prevalence of Anaemia (%) in Adolescent Girls and Pregnant Women



Source: Author's calculations based on raw data of DLHS-2 (2002–04).

food supplementation programmes such as ICDS and MDM. The guidelines envisage medicinal iron and folic acid supplementation to school children and screening for anaemia and appropriate treatment of anaemia in pregnant women. It is expected that with vigorous implementation of these comprehensive guidelines, it will be possible to achieve substantial reduction in prevalence and severity of anaemia.

Conclusion

India had been undergoing socio-economic, demographic, nutrition and health transitions. The pace of these interrelated transitions has been relatively slow and uneven, across the decades, states and segments of the population. While the overall impact of these transitions has been beneficial, it is inevitable that there are some undesirable consequences. Changes are an inevitable part of growth and development; but if changes are anticipated, they can be shaped or modified to maximise the impact of beneficial changes and minimise the impact of adverse changes.

Over the last two decades, there has been a growing recognition among the programme implementers and the people themselves, that the country is facing dual burden of under- and over-nutrition. However, there is very little awareness that the micro-nutrient deficiencies are widely prevalent in the country or that a majority of Indians are anaemic, and anaemia accounts for substantial morbidity in children and even mortality in pregnant women. It is imperative that the third component of triple burden is recognised and addressed.

Six decades ago most of the households in India were poor, illiterate and under-employed and food insecure. There has been a steady but slow economic growth and poverty reduction for the past five decades; in the last decade India has become the second fastest growing economy with rapid increase in per capita income and acceleration in poverty reduction.

India has been self-sufficient in cereal production for the past four decades, and is expected to become self-sufficient in pulse production by 2017. Subsidised foodgrains had been available for the poor through PDS for the past four decades. But seasonal food insecurity is seen in pockets even today. The NFSA can improve household food security among the poor, provided it is effectively implemented and carefully monitored. The Panchayati Raj Institutions (PRIs) will have to play a major role both in preventing leakages at various levels and in ensuring that the most needy do get the foodgrains they are entitled to.

India's horticultural mission has made the country No. 1 or 2 in production of several vegetable and fruits in the world. However, the vegetable intake of the population continues to remain low and micro-nutrient deficiencies continue to remain a major cause for public health problems. Current efforts to increase availability and access to micro-nutrient rich, inexpensive vegetables in urban and rural areas if coupled with nutrition education on need to increase vegetable intake to prevent micro-nutrient deficiencies there can be a substantial improvement in micro-nutrient intake. Increased access to and use of iron fortified iodised salt can enable the country not only eliminate IDD as a public health problem, but also achieve sustained improvement in iron intake of 1.3 billion Indians.

ICDS and MDM programmes provide food supplements to pre-school and school children, and pregnant and lactating women. But the most needy mothers and children often cannot come to an anganwadi or a school. Though coverage under these programmes is universal, there are problems in terms of content, quality and quantity of food provided. Many use these as substitutes and not addition to home food; take-home rations are often shared. As a result, the gap in energy intake of the vulnerable segments has not decreased. Nutrition education holds the key to motivate the family to strive and close the energy gap by appropriate intra-family distribution of food and ensuring that food supplements are not substitutes to home food.

The Tenth Five Year Plan called for a paradigm shift to accelerate the pace of reduction in under-nutrition by screening persons from vulnerable segments, identifying under-nourished persons, providing appropriate interventions and monitoring the improvement. A beginning has been made with the introduction of village health, sanitation and nutrition days when the anganwadi worker and auxiliary nurse midwife (ANM) work together, provide health and nutrition care based on the need. The Mother-Child protection card provides the chart for monitoring growth. If these focused interventions are scaled up, there can be substantial reduction in under-nutrition.

Over the last two decades, there has been a slow but steady rise in over-nutrition due to steep reduction in physical activity. The rise in over-nutrition rate is relatively slow because of the concurrent reduction in energy intake. Currently, over-nutrition is seen among

all segments of the population, though prevalence rates vary; prevalence of over-nutrition is lowest in areas with high under-nutrition and vice versa. Moderate physical activity is essential for healthy living; if current efforts to promote physical activity and early detection and effective management of over-nutrition are scaled up and sustained, it will be possible to prevent further rise in over-nutrition and associated health hazards.

Height and weight have been widely used as indicators for assessment of nutritional status. Indians are shorter by 10–15 cm compared to their developed country counterparts; it will take decades to bridge the gap. Recognising variation in height between countries, BMI has been used for assessment of under- and over-nutrition in adults. However, in children, until recently, weight-for-age has been used as the criterion for assessing nutritional status; short children with weight appropriate or high for their current height, were misclassified as underweight. WHO recommended that their BMI-for-age standards for 0–5 yrs (2006) and 6–19 yrs (2007) should be used for the assessment of over- and under-nutrition in children, and India has accepted this. If the WHO standards for BMI-for-age is used for assessment of nutritional status in pre-school children, only 17 per cent of Indian children are under-nourished. Identifying these children and providing appropriate intervention can result in rapid reversal of thinness and prevent further stunting. Use of this index will also enable early identification of fat over-nourished short children who need more exercise to become normally nourished.

Nutritionists screen and identify under-nourished persons, provide appropriate care so that there is improvement in their nutritional status. The Tenth Five Year Plan emphasised that in order to accelerate the pace of reduction in under-nutrition, the ongoing nutrition programmes should adopt a similar approach. A beginning has been made with the introduction of VHND during which the anganwadi worker and ANM work together, provide health and nutrition care based on the need. There is an urgent need to ensure that the strategy to screen, identify and treat under-nourished persons is scaled up.

Combating triple burden of malnutrition is usually considered a major challenge. India has the necessary knowledge, technology, infrastructure, human and economic resources to implement interventions on scale. If the ongoing programmes across sectors are effectively implemented with participation of people's institutions and people themselves, India can cope with the triple nutrition burden and the health consequences effectively within a short period, and at an affordable cost.

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