

*Research Paper***Nutrition Transition in India: Challenges in Achieving Global Targets**

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In 1947, when India became independent, the country was not self-sufficient in food production; over three-quarters of the population were poor, food insecure, under-nourished and often ill; the life expectancy at birth was 33 years. The country invested in planned development, utilized technology and human resources as change agents to hasten nutrition and health transition and improve “quality of life” of the citizens.

Seven decades later, India is the fastest growing economy. The country is self-sufficient in food production and is likely to achieve SDG target of being self-sufficient in producing all food stuffs needed for optimal nutrition till 2030. The National Food Security Act will protect the poor and vulnerable segments against adverse consequences of food inflation. There has been reduction in morbidity due to infections and life expectancy has more than doubled.

There has been a steady decline in under-nutrition; less than one fifth of the 0-18 year group are wasted. But one fourth of the women in 19-29 years age group are thin; early detection and appropriate management will improve nutritional status of the mothers and birth weights of the offspring.

In India, over 80% of the 0-18 year group and over 60% of adults are normally nourished. Every effort should be made to ensure that they continue to have appropriate life style, dietary practices and physical activity, and remain normally nourished throughout their lives.

Over the last two decades, over-nutrition has emerged as a problem: 5% of under-five children, over 20% adults; and over 30% of older urban women are over-nourished. This is mainly because of steep reduction in physical activity. Over-nourished adults are at risk of NCDs; NCDs are asymptomatic. NCD management requires life-style modification and life-long medication. India’s nutrition and health system has to re-orient and gear itself up for successfully ensuring prevention, early detection and effective management of dual nutrition and disease burden.

**Keywords:** Nutrition Transition; Under-Nutrition; Over-Nutrition; Food Security; Non-Communicable Diseases; Dual Nutrition Burden

**Introduction**

When India attained independence in 1947, the country was not self-sufficient in food production. Over three-quarters of the population was poor, food-insecure and under-nourished. Under-nutrition, poor environmental sanitation and poor access to health services resulted in high mortality rates; the life expectancy at birth was 33 years. Recognising the primacy of nutrition in human and national development, the Constitution of India stated “the state shall regard raising the level of nutrition and standard of living of all people to attain improvement in public

health among its primary duties”. The country invested in planned development, utilized technology and human resources as change agents to hasten nutrition and health transition and improve the quality of life of citizens. Given the vast and varied regions, limited economic and natural resources, the country faced many challenges in its efforts to improve quality of life of the citizens; the progress in second half of the last century was slow but sustained; there were regional disparities and progress was slowest amongst vulnerable segments (Ramachandran, 2008; Ramachandran, 2013).

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The new century and the Millennium Development Goals (MDG) gave an extra impetus to India's ongoing efforts to reduce poverty, under-nutrition and ill-health. The country was able to achieve or get very close to achieving the MDG targets for poverty and mortality reduction; but under-nutrition persisted (Ramachandran, 2016). In addition, the last two decades witnessed the emergence of over-nutrition and non-communicable diseases as major public health problems.

The United Nations General Assembly (2016) took cognizance of the global dual nutrition and health burden and proclaimed that 2016-2025 will be the United Nations Decade of Action on Nutrition. In 2017 WHO (WHO 2017) brought out a document: "Ambition and Action in Nutrition 2016-2025", setting global targets to be achieved by 2025 in reducing maternal, infant and young child malnutrition, over-nutrition, salt intake, hypertension and reduction in premature mortality due to non-communicable diseases (NCDs). This paper reviews India's nutrition transition, assesses the current status, and explores the challenges that the country will face in achieving the World Health Assembly (WHA) nutrition targets for 2025 and the Sustainable Developmental Goal (SDG) targets by the year 2030 (UNDP 2015).

### "Ship to Mouth" to Self-Sufficiency in Food Production

In the 1950s India was not self-sufficient in food production and had to depend on imported food to combat hunger. The country accorded very high priority to food production. There was excellent convergence between policy (land reforms), programmes (irrigation, fertilizer subsidy), R&D (high-yielding variety of rice and wheat), and 'lab-to-land' educational programmes enabling farmers to take up the new technologies. As a result, the country moved from "ship-to-mouth existence" to "self-sufficiency" in food production within a decade. Since 1970s, food grain production has kept ahead of population growth, and is expected to do so till 2030 (Fig. 1) (Agricultural Statistics - India -2017).

But over time, mono-cropping with cereals, over-use of water, inappropriate and excessive use of fertilisers and pesticides, impaired soil nutrition; productivity continued to be low. Farmers faced major financial problems due to fragmentation of land

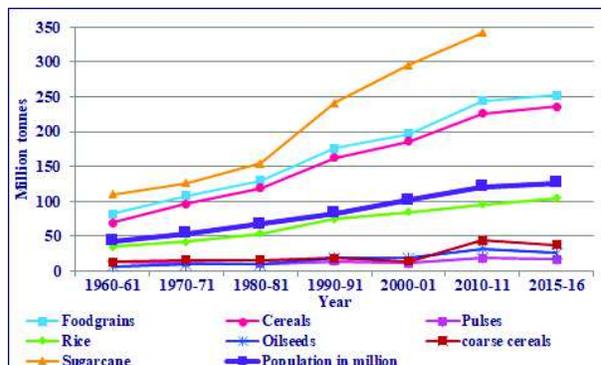


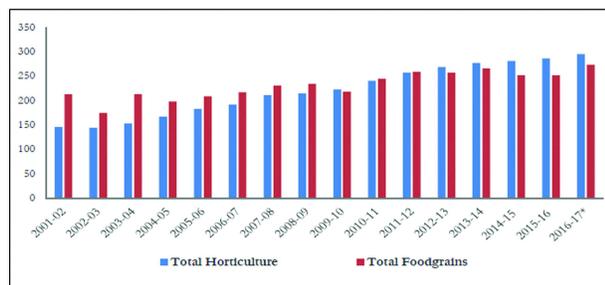
Fig. 1: Time trends in food grains production. Source: Agriculture Statistics - India

holdings, low productivity and lack of crop diversity. Agricultural scientists emphasised on the need to change over to integrated farming systems, ensure sustainable 'evergreen revolution', and make farming economically viable. These efforts will have to succeed not only to provide sufficient food but also appropriate crop diversification (cereal, pulse and vegetable) for meeting nutrient needs of the population.

### Current Priority: Provide Dietary Diversity

Pulses are the major source of protein in Indian diets. The production of pulses has been stagnant for decades and pulse consumption has been falling due to their high prices. The National Food Security Mission helped in increasing pulse production; but fluctuations in the availability of pulses have driven up prices. Ensuring the availability of pulses at stable prices throughout the year would enable adequate pulse consumption. The National Horticultural Mission had invested in increasing vegetable production. India is now a global leader in vegetable production; and the current production levels are sufficient to meet the desirable per-capita vegetable requirements (Fig. 2) (Economic Survey 2017). However, the actual per-capita consumption levels remain low because of high wastage and the unaffordable prices of vegetables.

In the coming decades, the country has to invest in sustainable programmes aimed at providing a diverse basket of foods needed for meeting all the macro-, micro- and phyto-nutrient needs of the people, and to make them accessible and affordable. In the context of the emerging problem of over-nutrition, an increase in the intake of vegetables can provide satiety



Source: Directorate of Economics & Statistics, Department of Agriculture, Cooperation & Farmers Welfare

Fig. 2: Time trends in food grains and horticulture production (2001-2017). Source: Economic Survey 2016-17

and help in the reduction of overweight and obesity; higher intakes of anti-oxidants and phyto-nutrients from vegetables can help in combating the rising burden of non-communicable diseases. Investment in sorting, storage, processing and marketing of agricultural products will prevent distress sales by the farmer, prevent wastage in vegetables and improve price stability of vegetables so that consumers get them at an affordable cost. Effective implementation of ongoing programmes in the agricultural and allied sectors will enable the country to achieve the SDG target of providing adequate and diversified food to all Indians by 2030.

If agriculture is to remain productive and provide sustainable employment, the farming itself has to become sufficiently remunerative and attractive to the farming community. It is important to remember that poverty, food insecurity and under-nutrition rates are high among the small and marginal farmers and also landless labourers who form the majority of work force in agricultural sector. It is essential that nutrition, health and economic improvement of these farming households are ensured.

### Economic Growth and Energy Consumption

Between 1960 and 1990, the Indian economy grew relatively slowly. In the new century, India became the second-fastest-growing economy in the world. Global experience has shown that when developing countries experienced rapid economic growth, there is an increase in total energy intake and consumption of animal foods. These coupled with a change towards sedentary lifestyles, led to a rapid increase in over-nutrition rates. Data on gross domestic product (GDP) growth in India at constant prices (2004-05)

from 1950-2012 (Economic Survey 2018), and the per capita energy intake of both urban and rural households over the same period [based on data from surveys carried out by the National Sample Survey Organisation (NSSO)] (Fig. 3) showed that the higher GDP growth and rise in per capita income in the last three decades was associated with a progressive reduction in per capita energy intake in both urban and rural areas. Data from surveys carried out by National Nutrition Monitoring Bureau (NNMB) showed similar trends (Fig. 4). It is possible that perceptive Indians realized that there has been a steep reduction in their physical activity, and therefore voluntarily reduced their energy intake. This could partly explain the relatively slower increase in over-nutrition rates in India, as compared to other developing nations that are undergoing rapid economic transition.

### Poverty Reduction and Food Security

Data from studies undertaken in the 1970s showed that attainment of self-sufficiency in food grain production at the national level had very little impact

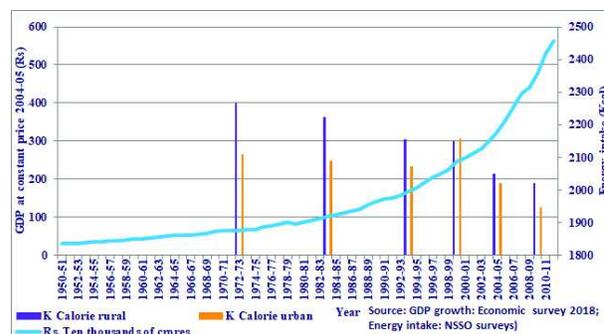


Fig. 3: Time trends in the GDP growth and the energy consumption. Source: GDP - Growth Economic Survey 2017-18, energy consumption NSSO surveys

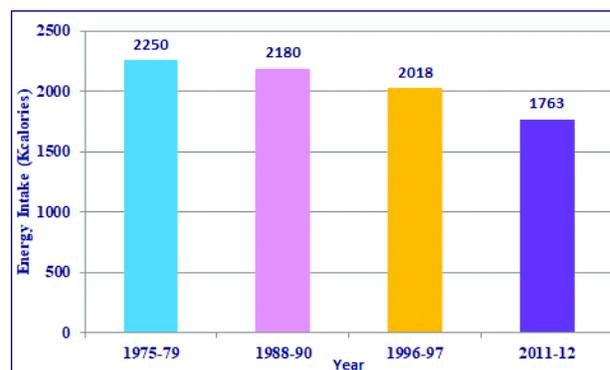


Fig. 4: Time trends in the energy intake. Source: NNMB surveys

on poverty and household food insecurity and hunger; over 70% households remained poor, food insecure; and under-nourished. The country therefore embarked on:

- employment programmes to improve purchasing power;
- providing subsidised food grains to the poor to improve household food security;
- food supplementation programmes to bridge the gaps between requirement and actual intake in vulnerable groups;
- health care to reduce nutrient loss due to infections, and family welfare services to prevent unplanned pregnancies.

It is noteworthy that these interventions preceded by two decades, the redefinition of food security by the World Food Summit in 1996: “a situation in which all people, at all times, have access to sufficient, safe and nutritious food to meet their dietary needs and food preferences for an active and healthy life” (FAO 1996).

Lack of gainful employment had been identified as a major factor responsible for persistent poverty and household insecurity. The Food for Work programme was aimed at directly improving household food security by providing food as wages to poor people participating in the employment programmes. Much more recently, the National Rural Employment Guarantee Act (NREGA) came into effect to provide paid jobs to unemployed rural persons as a legal entitlement. Despite infirmities in the implementation of these employment programmes, the landless marginalised segments of rural households did benefit from them in terms of reduction in acute distress and seasonal migration, and some improvement in household food security. In the last two decades, there has been a steep reduction in poverty rates, partly due to India’s rapid economic growth. India achieved the MDG target for poverty reduction in 2012, three years ahead of the target date (Fig. 5) (Ramachandran, 2016).

### Subsidized Food Grains to Improve Household Food Security

India built up the Public Distribution System (PDS) to overcome regional and seasonal food grain shortages;

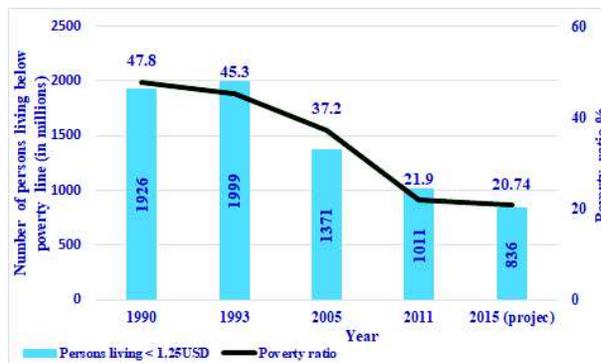


Fig. 5: Poverty reduction 1990-2011. Source: India MDG report MOSPI 2015

PDS also provided food grains at heavily subsidised costs to those below the poverty line. Despite the shortfalls in the distribution system and substantial leakages, the PDS has helped in keeping the food prices low. Data from NSSO show that between 1970 and 2012, there has been a progressive reduction in the household expenditure on food as a percentage of household income (Fig. 6). The reduction in food expenditure was mainly due to reduction in expenditure on purchase of cereals. It is noteworthy that, despite reduction in overall food expenditure, there was an increase in cereal consumption in the lowest tertile of the population (Fig. 7). This is likely to be due to access to subsidised food grains through PDS.

Globally, and in India, there was a steep rise in food prices between 2008 and 2010. In an effort to prevent the adverse effect of food price inflation on household food security, India enacted the National Food Security Act (NFSA 2013) to provide subsidised food grains to two-thirds of India’s population as a legal entitlement. The Act also provides food grains



Fig. 6: Expenditure on food as percentage of the consumer expenditure. Source: NSSO surveys

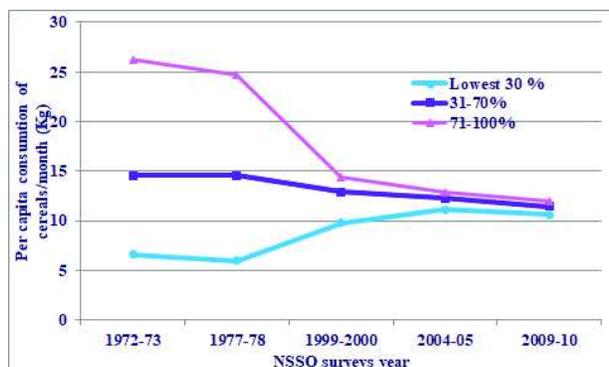


Fig. 7: Average per capita intake of cereal by expenditure classes Source: NSSO surveys

at subsidized cost for food supplementation programmes under Mid-Day Meal (MDM) and Integrated Child Development Services (ICDS). It is expected that effective implementation of the NFSA will enable the country to achieve the SDG target of providing adequate food to all, especially the vulnerable segments of population.

### Intra-family Differences in Dietary Intake and Nutritional Status

Most of the intervention programmes aimed at improving household food security did so with the assumption that within the family food will be shared equitably. Data from NNMB survey in mid-nineties showed that this assumption was no longer correct. Even in households where adults are getting adequate food, children are not getting adequate food (Fig. 8). Data from subsequent NNMB surveys have shown that the situation has worsened over years; in 2012 in over 50% of the households, adults are getting adequate food but children do not. These data suggest

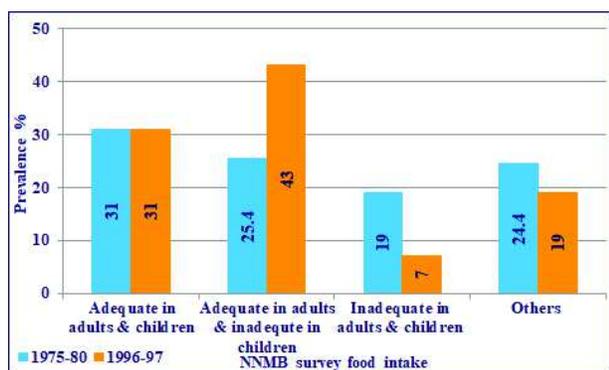


Fig. 8: Intra-family differences in the energy intake. Source: NNMB reports

that poor child feeding and caring practices and not poverty is increasingly becoming the major factor leading to under-nutrition in pre-school children.

Ever since these data became available, there had been a debate whether these are persistent enough to have any impact on nutritional status. Data from National Family Health Survey (NFHS) 3 (IIPS 2006) were analysed and nutritional status of mother was compared with nutritional status of her under-five child. Child wasting rates were higher -25% when the mother was under-nourished. But even if mother was normally nourished, over 17% of children were wasted (Fig. 9). These confirm that poor child feeding and caring practices are persistent enough to have an impact on wasting rates in children.

### Changes in Life Style and Physical Activity

In the 1950s and 60s, Indian adults, both men and women had adequate physical activity because a lot of manual work was involved in domestic as well as occupational activities. Walking or riding a bicycle were the major modes of getting from one place to another. In the last three decades, there has been a vast improvement in access to mechanised transport; consequently there has been a steep reduction in walking. Occupational and household activities have become increasingly mechanised; and as a result, majority of Indians especially those living in urban areas have a sedentary life style (Fig. 10). With the pervasive presence of TV and digital devices in every home, people spend more and more time sitting and less time on their feet. Research studies in urban areas and NNMB surveys in rural areas showed that, by the mid-1990s a majority of Indian women and one-

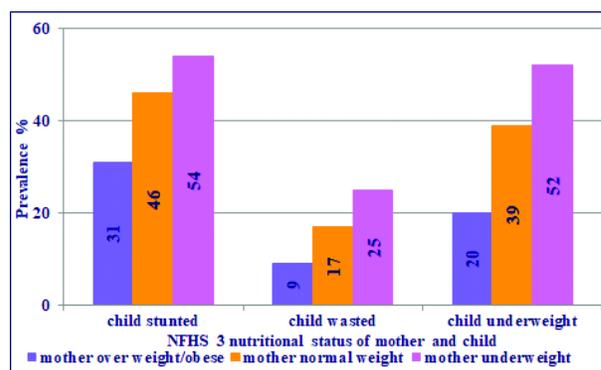


Fig. 9: Intra-family differences in the nutritional status Source: NFHS 3 report

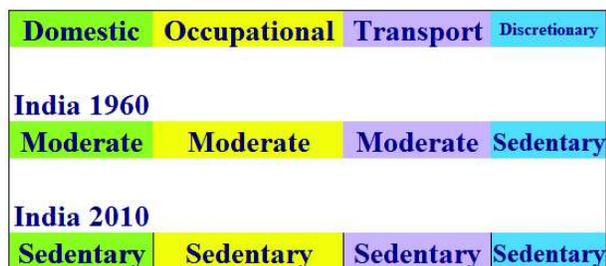


Fig. 10: Changes in the physical activity in India (1960-2010)

third of Indian men had sedentary life styles (Table 1) (NNMB 1995). The situation has worsened over the last couple of decades and currently a majority of people even in the rural areas have sedentary lifestyles. In India, a steep fall in physical activity appears to be the major driver for rising over-nutrition rates. Moderate physical activity is essential for maintaining the health of muscles, bones and joints and for prevention of non-communicable diseases. It is imperative that all Indians take up discretionary moderate physical activity for at least 30-60 minutes/day, so that they could ward off over nutrition and non-communicable diseases.

Table 1: Physical activity in rural men and women (NNMB 1995)

Activity status	Men		Women		Total	
	No	%	No	%	No	%
Sedentary	1349	33.3	2765	62.7	4114	48.6
Moderate	2650	65.5	1632	37.0	4282	50.6
Heavy	48	1.2	14	0.3	62	0.8

**Changes in Dietary and Nutrient Intake**

NNMB repeat surveys provide time series data on dietary and nutrient intake of rural populations between 1975 and 2012. Dietary intake of food stuff expressed as a percentage of Recommended Dietary Intake (RDI) is presented in Fig. 11. Over the last four decades there has been a progressive reduction in cereal intake; there was a reduction in pulse intake till 1997, but the trend was reversed by 2012. There has been some increase in the intake of fats and oils and green leafy vegetables. The intake of vegetables and milk remain lower than the recommended intakes. Over the years, there has not been any increase in

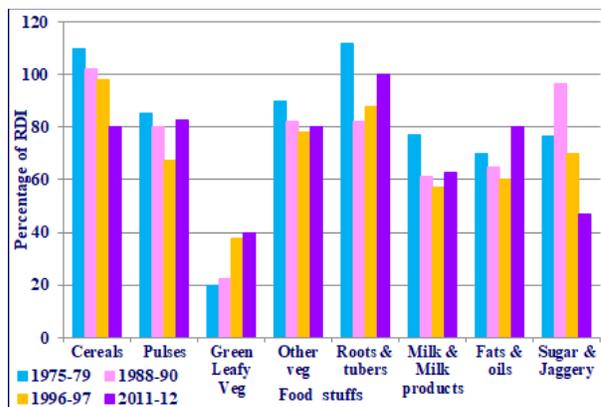


Fig. 11: Time trends in food intake as percentage of RDI Source: NNMB reports

the intake of animal products, except eggs. There was not much difference in the dietary intake between vegetarians and non-vegetarians because non-vegetarians consumed animal products (such as poultry, meat and fish), either in small quantities or only once in a week or once a fortnight.

NNMB data on nutrient intake as a percentage of Recommended Dietary Allowance (RDA) is given in Fig. 12. There has been a considerable reduction in the intake of total energy and of protein over years, especially in the last decade. The sharply lower figure for iron intake shown in the 2012 survey is due to correction for surface iron contamination, and does not reflect any real fall intake of iron-containing foods. There has not been any increase in micronutrient adequacy.

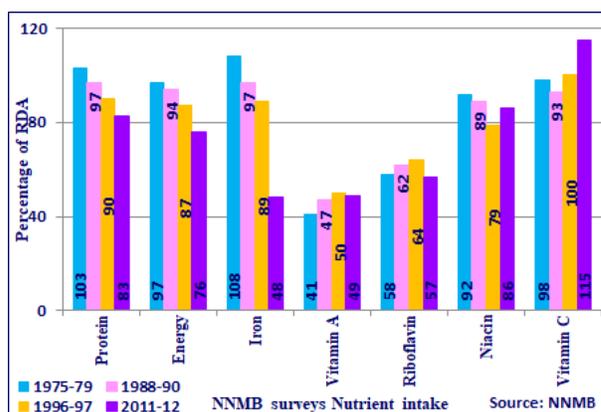


Fig. 12: Time trends in nutrient intake as percentage of RDA Source: NNMB reports

### Changes in the Nutritional Status

NNMB surveys provide data on the nutritional status of pre-school children, men and women in rural areas in 10 states between 1975 and 2012. The National Family Health Survey provides information between 1995 and 2015 on the nutritional status of these three groups, as well as of adolescent girls (15-19 years) at state and national levels. Weight, height and Body Mass Index (BMI) (for age in children) are the three indicators used for assessment of the nutritional status across various age groups.

### Nutritional Status of Pre-school Children

Pre-school children have been considered to be the most vulnerable group for under-nutrition, and health and nutrition services have focused on improving their nutritional status. NNMB repeat surveys indicate that, over the last four decades, there has been a slow, steady and sustained reduction in stunting and underweight rates in pre-school children. However, there is no consistent reduction in the wasting rates (low BMI-for-age, Fig. 13). FAO has stated (SOFI 2013) food insecurity is not the factor responsible for the high under-nutrition rates in South Asia. In India, one-third of neonates weigh less than 2.5 kg at birth. These small, but gestation-wise mature, infants survive with just the essential new-born care, but they grow along a lower growth trajectory, as compared to normal birth-weight infants. A part of the stunting and under-weight in under-five children could be attributable to low weight at birth.

NFHS 1, 2, 3 and 4 provide data on height and weight measurements in pre-school children. Of the

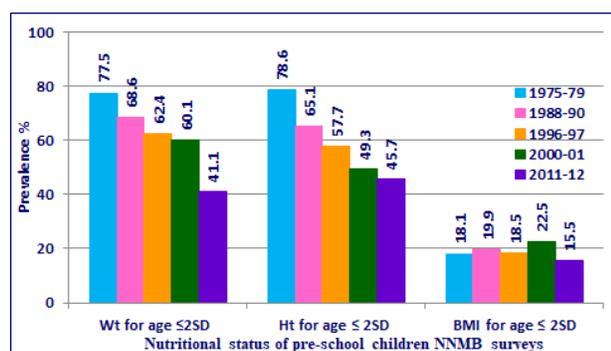


Fig. 13: Time trends in prevalence of under-nutrition in pre-school children Source: NNMB reports Weight-for-age (wt-for-age), Height-for-age (Ht-for-age) Body Mass Index (BMI) for age

four surveys, NFHS 2 provides data only for under-three children. As age is an important factor that influences nutritional status in pre-school children, it is essential to compute and compare nutritional status of under-three children between these surveys. Raw data from NHFS 1, 2, 3 and 4 were analysed and stunting, underweight and wasting rates in under-three children were computed (Fig. 14). These data also show that, over the years, there has been a progressive reduction in stunting and underweight. However, there has been an increase in wasting rates in the last fifteen years.

### Relationship Between Stunting and Wasting

Changes in frequency distribution of z scores for height-for-age and BMI-for-age in under-three children between NFHS 1, 2, 3, and 4 are given in Fig. 15. Between NFHS 1 and NFHS 4, there has been a consistent shift to the right in z scores for height-for-age, confirming that there is sustained reduction in stunting in under-three children. India will have a long way to go before Indian children catch up with the frequency distribution for height seen in WHO MGRS standards. A comparison of the changes in BMI z scores shows that there has been a small shift to the left in the BMI z scores over the years, but concurrently, there has been reduction in severe wasting.

Height- and BMI-for-age should always be considered together while assessing nutritional status, especially in young children. A relatively more rapid reduction in stunting would result in increase in wasting (as has been reported between NFHS 2, 3 and 4). This should not be interpreted as deterioration

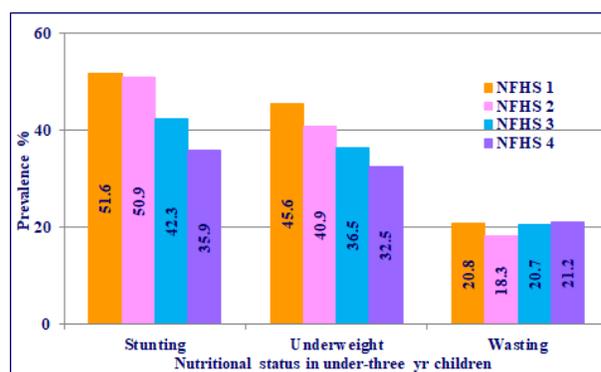


Fig. 14: Time trends in prevalence of under-nutrition in under-three year children Source: NFHS surveys

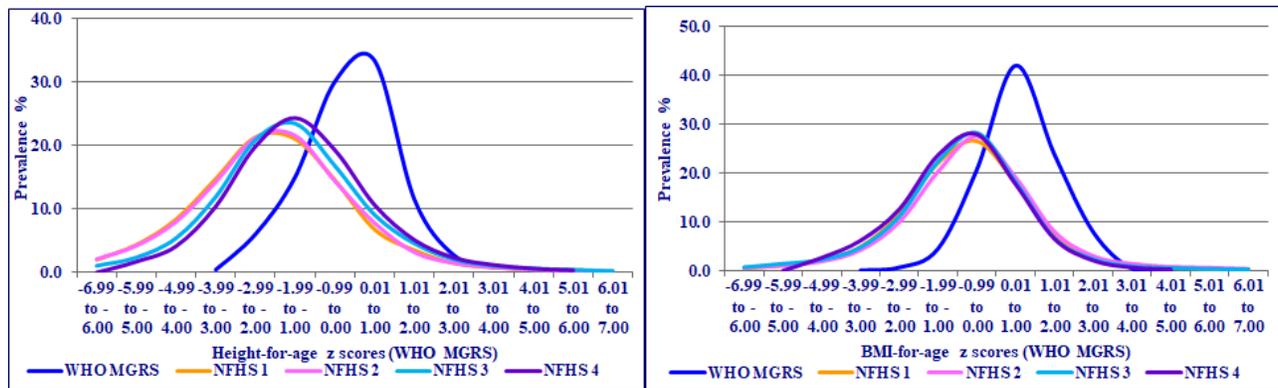


Fig. 15: Frequency distribution in height-for-age and BMI-for-age in under three children NFHS surveys

in nutritional status, if there has been concurrent reduction in stunting rates. When stunting rates fall, the children will follow a higher trajectory for linear growth and this should be viewed as improvement in nutritional status. Early detection and effective feeding will reverse wasting; children will grow along their linear trajectory; this will prevent stunting and accelerate reduction in stunting rates.

WHA (2012) has set the target of 40% reduction in stunting by 2025 (WHO 2017). Data from NNMB surveys and NFHS surveys indicate that, in India, over the last four decades, stunting has been declining at the rate of about 1% per year. It will not be possible for India to accelerate the rate of stunting reduction four-fold over the coming decade and achieve the WHA target set for stunting reduction. Wasting (low BMI-for-age) is an indicator of current energy deficiency. WHA has set the target of reducing childhood wasting to less than 5% and maintaining this improvement. Wasting rates in India range between 5-25% in different states. It is possible for some of the better performing states to achieve this target by detecting wasting using BMI-for-age and correcting the factor responsible (wrong infant and young child feeding practices and/or infections). Such an intervention will not only achieve reduction in wasting but also accelerate the rate of reduction in stunting.

**Nutritional Status of Adults**

In adults, BMI is used for assessing both under-nutrition (UN) (<18.5) and over-nutrition (ON) (<25). NNMB repeat rural surveys showed that, between 1975 and 2012, there was a reduction in under-nutrition

from 59% to 32% in men and from 52% to 33% in women. Over the same period, prevalence of over-nutrition increased from 2% to 12% in men and 3 to 16% in women (Fig. 16).

Data from NFHS 2, 3 and 4 showed that, both in men and women, there was a sustained fall in under-nutrition rates and a steady rise in over-nutrition rates (Fig. 17). It is a matter of concern that the reduction in under-nutrition is matched by the rise in over-nutrition, and so the proportion of normally-nourished (NN) persons remained unchanged at around 60%.

Frequency distribution curves of BMI for women (NFHS 2, 3 and 4) and men (NFHS 3 and 4) and showed that there was a clear shift to the right in BMI both in men and women (Fig. 18). A shift to the right in BMI values below 18.5 is welcome because it implies reduction in under-nutrition. However, the

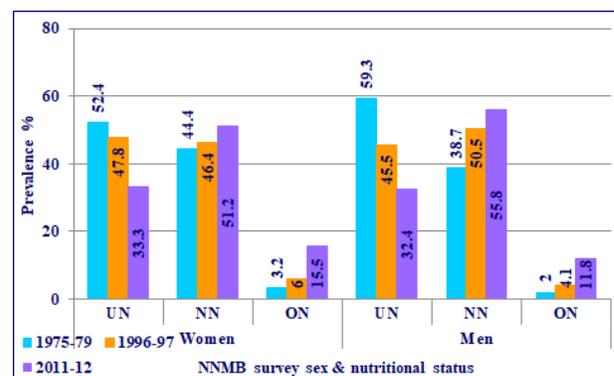


Fig. 16: Dual nutrition burden in men and women 1975-2012 Source: NNMB reports. Under-nutrition (UN), Normal nutrition (NN), Over-nutrition (ON)

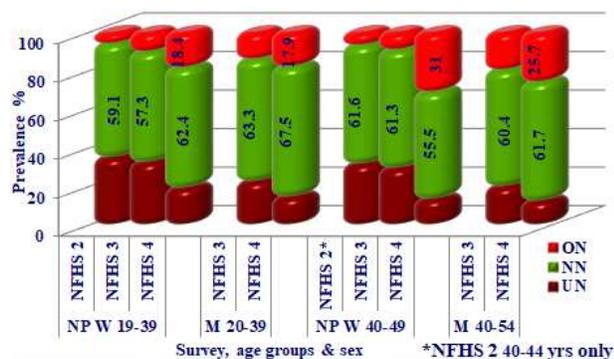


Fig. 17: Dual nutrition burden in men and women 1998-2015 NFHS surveys. Under-nutrition (UN), Normal nutrition (NN), Over-nutrition (ON)

shift to the right beyond median and especially beyond 23 is a matter of concern, because it implies increase in over-nutrition and all its adverse health consequences.

### Current Nutritional Status of the Indian Population

DLHS 4 (2014) and AHS CAB (2015) between them carried out assessment of nutritional status of all members of the selected households, and were the first surveys to provide district-level and state-level information on the prevalence of under-nutrition and over-nutrition across all age groups in both sexes. Only BMI indicates current energy inadequacy, adequacy or excess. Hence, in the dual nutrition burden era BMI which can detect both under-nutrition and over-nutrition has to be used for computing nutritional status across age groups. Data from DLHS 4 and AHS CAB, were analysed using BMI (BMI-for-age in 0-18 years) as the indicator for assessing under- and over-nutrition

across age groups in both sexes and the results are presented in Figs. 19 and 20.

### Nutritional Status of Children and Adolescents

When BMI is used as the indicator of nutritional status, over 80% of pre-school children are normally nourished. In the age group 0 to 18 years, the prevalence of under-nutrition was higher in boys as compared to girls, both in AHS and DLHS states. The prevalence rates of under-nutrition in children and adolescents in AHS states were higher as compared to those in DLHS states. Wasting rates in these age groups is not high. If energetic interventions are undertaken to screen all children, identify wasted children and provide them food supplements and health care to fight infection, and monitor improvement over the next six months, it will be possible to bring down wasting substantially. Though the country as a whole may not be able to achieve the WHA target of reduction in under-nutrition in under-five to less than 5%, some states can do so and thereby, show the way.

Recent surveys indicate that 4-5% of under-five children are over-nourished. Because of the large size of its child population, India has the largest number of over-nourished under-five children in the world. Many of these over-nourished children are short for their age, and are labelled as stunted and underweight based on height and weight standards, but are actually over-nourished because their BMI is high for their age and height. Detection and correction of over-nutrition especially in short pre-school children should receive high priority because over-nutrition in young children has been shown to persist into adolescence

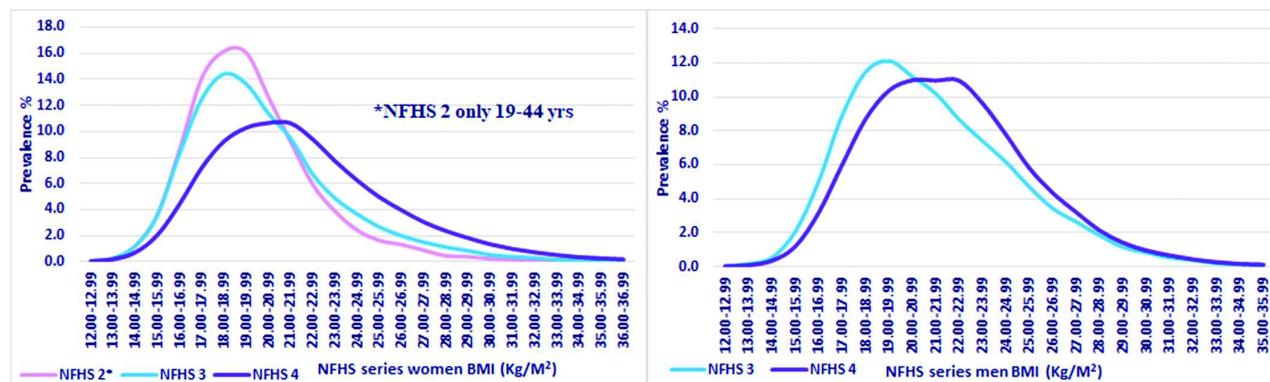


Fig. 18: Time trends in frequency distribution of BMI in men (19-54 years) and women (19-49 years) NFHS surveys. Body Mass Index (BMI)

and adult life. Data from the New Delhi birth cohort studies have shown that children who were under-nourished in the first few months of life, but gained weight (and BMI) subsequently were at high risk of over-nutrition, hypertension and diabetes by the time they reach their thirties (Bhargava 2004; Fall 2013).

The proportions of over-nourished 5-9-year-old children and adolescents are also low (range 0.6 to 11%). Low physical activity is a major factor in over-nutrition in these children. Habitual consumption of high fat, high sugar, high salt, energy dense snacks and soft drinks has been shown to be an important factor associated with over-nutrition in children from upper income groups. Recent data suggest that this may be a problem in lower income group also because many of the energy dense food stuffs are tasty and are sold as inexpensive street foods. Inculcating healthy eating habits and adequate exercise in these age groups will establish healthy life styles and prevent over-nutrition and NCDs in later life. If India succeeds in preventing further increase in over-nutrition rates across various age groups, it may be able to prevent projected escalation of NCD rates.

There is a need to focus the attention on the fact that over three fourths of the 0-18-year age group are normally nourished and that by inculcating right eating habits, adequate physical activity and appropriate lifestyles during this period, these children will grow into normally nourished adults.

### **Nutritional Status of Adults**

Both in AHS and in DLHS states, the prevalence of under-nutrition in women was higher as compared to men in the 19-39-year age group. This is likely to be due to the additional energy and nutrient needs for pregnancy, lactation and child rearing. In both AHS and DLHS states, the prevalence of under-nutrition was lowest in men and women in the 40-59 years of age. There is a progressive rise in over-nutrition with age, right from their thirties both in men and women. Over-nutrition rates in women are higher than those in men (Figs. 19, 20). Women tend to ignore weight gain in their forties because they believe that it may be related to menopause.

For any given BMI, Indians have higher adiposity as compared to Caucasians. In view of the data that risk of cardiovascular diseases rises when BMI is

over 23 in Indians, it has been suggested that the BMI cut-off for 'over-nutrition' in Indians should be set at 23 instead of 25 (Ramachandran, 2006). If the lower cut-off point is used, the prevalence of over-nutrition will be even higher. Over-nutrition is associated with increased risk of hypertension, cardiovascular disease and diabetes. Hypertension and diabetes occur a decade earlier in life in Indians (Gupta, 2009). Both hypertension and diabetes are:

- asymptomatic in the early stage (detection is delayed in the absence of routine screening programmes);
- require life-long lifestyle modification (which is not easy) and
- life-long medication (with cost and compliance implications).

In view of this, prevention, early detection and effective management of over-nutrition are of paramount importance.

The ongoing efforts to undertake screening for over-nutrition and NCDs as an essential component of preventive health care at all levels, will go a long way in reducing the projected increase of over-nutrition and NCDs and enable the country to achieve the WHA targets of reduction in premature mortality rates due to NCD.

### **Nutritional Status of the Elderly**

In India, there has been a substantial increase in longevity; over the next two decades there will be a further increase in the number and proportion of the elderly in the country. AHS and DLHS 4 were the first surveys that undertook nation-wide assessment of nutritional status of the elderly. Data from these surveys clearly showed that there was a rise in under-nutrition and a small fall in over-nutrition in men and women beyond 60 years of age as compared to younger adult men and women. Under-nutrition rates among the elderly were higher than the over-nutrition rates among elderly in AHS states; the reverse was true for the DLHS 4 states (Figs. 19, 20). These surveys also collected information on the incidence of non-communicable diseases among the elderly. It is important to analyse all these data state-wise and district-wise and use them for creating the appropriate interventions.

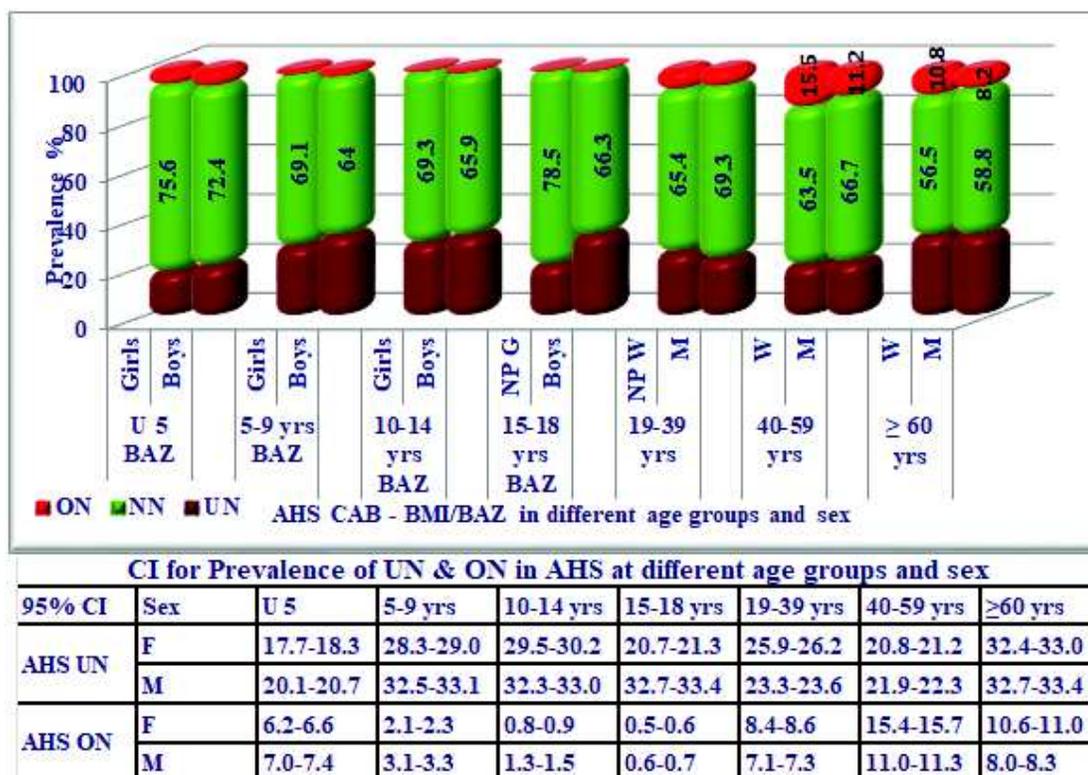


Fig. 19: Current nutritional status AHS CAB survey (2015). U5 under five year children, NPG non-pregnant girls, NP W non-pregnant women, W women, M men; Under-nutrition (UN), Normal nutrition (NN), Over-nutrition (ON)

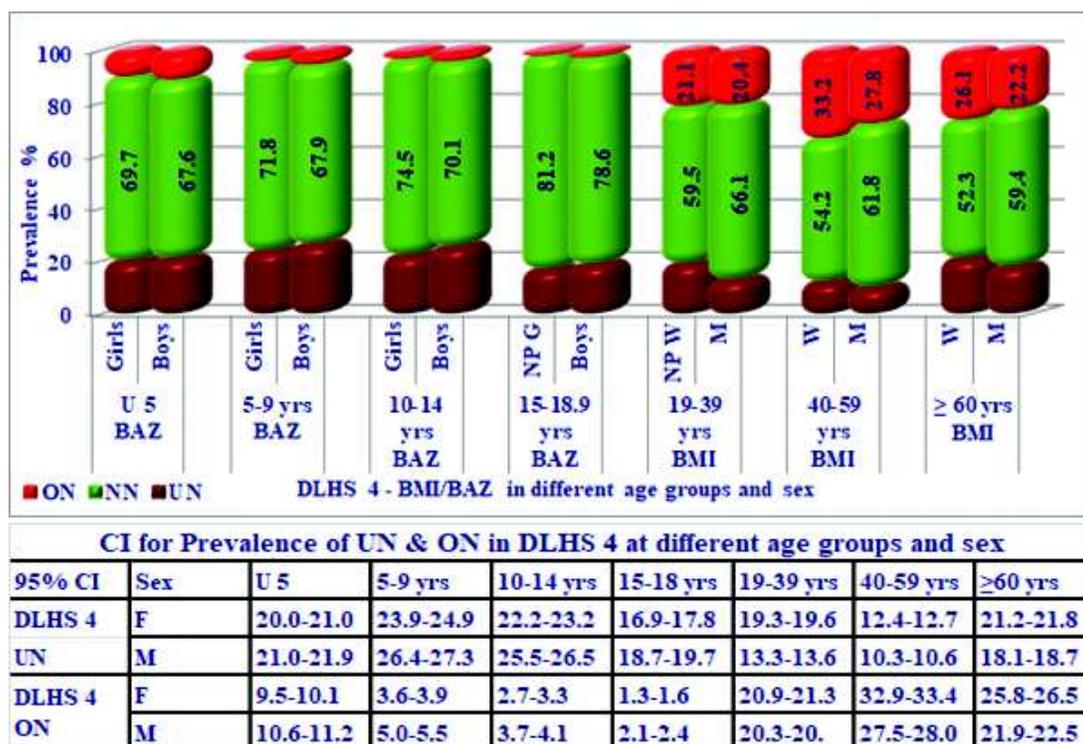


Fig. 20: Current nutritional status DLHS 4 (2014). U5 under five year children, NPG non-pregnant girls, NP W non-pregnant women, W women, M men; Under-nutrition (UN), Normal nutrition (NN), Over-nutrition (ON)

## Summary and Conclusions

A review of the food security situation in India indicates that:

- the country is self-sufficient in food production and is likely to remain so up to 2030;
- economic growth is adequate to enable the country to achieve the poverty reduction, and improvement in “quality of life” envisaged in the SDG targets for 2030.
- effective implementation of the National Food Security Act will protect the population from the adverse effects of food price inflation and provide near-universal household food security.

Over the last seven decades, there has been considerable reduction in under-nutrition across all age and sex groups but even today, under-nutrition and poor maternal and child health indices are still public health problems. India’s health system has been able to take care of these and almost achieve MDG targets for mortality reduction, mainly because these problems are acute, symptomatic, readily treated and cured.

In the last two decades, newer challenges have emerged in the form of a rise in over-nutrition and associated non-communicable diseases. In the dual

nutrition burden era, it is important that nutritional assessment is carried out periodically in all individuals, using BMI/BMI-for-age as the indicator for current nutritional status. Neither nutrition and health services, nor our population, are geared for such routine periodic assessment and appropriate counselling for early detection and effective management of under- or over-nutrition and their health consequences. The country can begin the process by undertaking assessment of nutritional status of every person, as when they seek health or nutrition care.

Most of the non-communicable diseases are asymptomatic in the initial phases. Patients seek care mostly after complications set in. NCD management requires lifestyle modification and lifelong medication. India’s health system has to reorient and gear itself up for successfully ensuring prevention, early detection and effective management of dual nutrition and disease burden. The systems have to leverage the strengths built up over decades, correct weaknesses such as delays in scaling-up and poor implementation of interventions. The citizens should ensure necessary modifications in lifestyle and improve compliance with treatment regimens. If we do so, these challenges will become opportunities for progress enabling the country to achieve the WHA/SDG nutrition targets, and improve the “quality of life” (QoL) of citizens.

## References

- Bhargava S K, Sachdev H P S, Fall C H D, Osmond C, Lakshmy R, Barker D J P, Biswas S K D, Ramji S, Prabhakaran D and Reddy K S (2004) Relationship of Serial Changes in Childhood Body Mass index to Impaired Glucose Tolerance in Young Adulthood *N Engl J Med* **350** 865-75
- Department of Agriculture (2017) Agricultural Statistics-India <http://agricoop.nic.in/nfsm/nfsm.pdf> accessed on 10.7.2018
- Fall C H D (2013) Fetal Programming and the Risk of Non-communicable Disease *Indian J Pediatr* **80** S13-S20
- Food and Agricultural Organisation (FAO 1996) Rome Declaration on World Food Security and World Food Summit Plan of Action [www.fao.org/ag/againfo/programmes/en/lead/toolbox/.../romedec.pdf](http://www.fao.org/ag/againfo/programmes/en/lead/toolbox/.../romedec.pdf) accessed on 10.7.2018
- FAO (2013) The State of Food Insecurity in the World [www.fao.org/publications/sofi/2013/en](http://www.fao.org/publications/sofi/2013/en) accessed on 10.7.2018
- Gupta R, Misra A, Vikram N K, Kondal D, Gupta S S, Agrawal A and Pandey R M (2009) Younger age of escalation of cardiovascular risk factors in Asian Indian subjects *BMC Cardiovasc Disord* **9** 2-34
- International Institute of Population Sciences (IIPS) ‘National Family Health Survey-1, 2, 3 and 4’ [http://rchiips.org/NFHS/factsheet\\_NFHS-4.shtml](http://rchiips.org/NFHS/factsheet_NFHS-4.shtml), [http://rchiips.org/nfhs/pub\\_nfhs-3.shtml](http://rchiips.org/nfhs/pub_nfhs-3.shtml), [http://rchiips.org/nfhs/pub\\_nfhs-2.shtml](http://rchiips.org/nfhs/pub_nfhs-2.shtml), [http://rchiips.org/nfhs/pub\\_nfhs-1.shtml](http://rchiips.org/nfhs/pub_nfhs-1.shtml), accessed on 10.7.2018
- IIPS District Level Household and Facility Survey (DLHS-4) 2014 <https://data.gov.in/.../district-level-household-and-facility-survey-dlhs-4> accessed on 10.7.2018
- Ministry of Statistics and Programme Implementation (2015) Millennium Development Goals India Country Report-2015 [www.mospi.nic.in/sites/default/files/publication\\_reports/mdg\\_](http://www.mospi.nic.in/sites/default/files/publication_reports/mdg_) accessed on 10.7.2018
- National Sample Survey Organisation (NSSO) Reports of the

- various round of NSSO surveys [http://mospi.nic.in/Mospi\\_New/site/inner.aspx?status=3&menu\\_id](http://mospi.nic.in/Mospi_New/site/inner.aspx?status=3&menu_id) accessed on 10.7.2018
- National Nutrition Monitoring Bureau (NNMB) All the Technical Reports of the NNMB <http://nnmbindia.org/downloads.htm>, accessed on 10.7.2018
- National Food Security Act, 2013 - India Code <http://indiacode.nic.in/acts-in-pdf/202013.pdf>. accessed on 10.7.2018
- Ramachandran P (2006) The Double Burden of Malnutrition in India <ftp://ftp.fao.org/docrep/fao/009/a0442e/a0442e01.pdf>. Rome, Italy; Food and Agriculture Organization; accessed in 10.7.2018
- Ramachandran P (2008) Nutrition Transition in India 1947-2007 <http://wcd.nic/publications.htm> accessed on 10.7.2018
- Ramachandran P (2013) Food & nutrition security: Challenges in the new millennium *Indian J of Med Research* **138** 373-382
- Ramachandran P and Kalaivani K (2016) Millennium Development Goals (MDG): India's progress and way forward to Sustainable Development Goals *Proc Indian Natn Sci Acad* **82** 1351-1365
- Registrar General of India RGI (2015) Annual Health Survey CAB component State Fact Sheets [www.http://www.censusindia.gov.in/2011census/hh-series.cab.html](http://www.censusindia.gov.in/2011census/hh-series.cab.html) accessed on 10.7.2018
- UNDP (Sustainable Development Goals (2015) [www.undp.org/content/undp/en/home/sustainable-development-goals.htm](http://www.undp.org/content/undp/en/home/sustainable-development-goals.htm) accessed on 10.7.2018
- Union Budget: Economic Survey 2016-17-<https://www.indiabudget.gov.in/es2016-17/echapter.pdf> accessed on 10.7.2018
- Union budget: Economic Survey 2017-18 [mofapp.nic.in:8080/economicsurvey](http://mofapp.nic.in:8080/economicsurvey) accessed on 10.7.2018
- WHO (2017) Ambition and Action in Nutrition 2016-2025 [www.who.int/nutrition/publications/nutrition-strategy-2016to2025/en](http://www.who.int/nutrition/publications/nutrition-strategy-2016to2025/en) accessed on 10.7.2018.