# REVIEW OF LITERATURE

The review of literature pertaining to the present study entitled "**Intra family differences in nutritional status between mothers and their preschool children in urban low income group families**." is presented under the following headings.

**2.1 Evolution of Concept of Food security**

**2.2 Programme to improve Food security**

**2.3 Current scenario of Food Security**

**2.4 Changes in Dietary and Nutrient Intake**

**2.5 Intra-family Differences in Dietary Intake and Nutritional Status**

**2.6 Changes in Life Style and Physical Activity**

**2.7 Current Nutritional Status of the Indian Population**

**2.8 Nutritional Status of Pre-school children**

**2.9 Changes in Relationship between Stunting and Wasting**

**2.10 Nutritional Status of Children and Adolescents**

**2.11 Nutritional Status of Adults**

**2.12 Intrafamily differences in nutritional status between under five children and other members**

## 2.1 EVOLUTION OF CONCEPT OF FOOD SECURITY

History documents India's struggle to achieve food security. India has seen multiple terrible famines and food shortages that have killed millions of people (Bhowmick, 2018; Pillay & Kumar, 2018). Even throughout the Mughal era, India had no rational and consolidated policy for famine relief. The food security policy developed during colonial times. In helping those suffering from famine, the British government was quite active. Famine commissions had been established, and famine rules had been defined. The Famine Inquiry Commission of 1944 recommended the introduction of rationing.

This helped people in India realise the significance of their public distribution system. However, India had always been portrayed as a prosperous country and a fascinating travel destination for robbers. It is indisputable, however, that the Indian economy contributed 24% of the global economy during the Mughal Empire, which was

reduced to 2% in 1947. By the time of Independence, the frequency and persistence of famines and food shortages were extremely high.

At that time, the nation understood the importance of achieving food grain sufficiency. Under the direction of Sir Purshottam Das Thakur Das, the Food Grains Policy Commission conducted an analysis of India's food policy in 1947. In addition to emphasizing system rationing to combat the inflationary pressure that lingered in the economy owing to the war, he insisted on increasing imports to maintain the national food grain reserve as a precaution against crop failures. The country moved and entered the first stage of national food security as a result of this being the first significant governmental effort (Pillay and Kumar, 2018). The Indian Constitution's Article 47, states that the State shall regard raising the level of nutrition, improvement of public health and their standard of living as among its primary duties."

To ensure sufficient food production for self-sufficiency, the agricultural sector was boosted during the first five-year plan. However, the second five-year plan placed more emphasis on industrialization and dependence, leaving the agricultural sector largely neglected. As a result, the country experienced another severe food crisis in the middle of the 1960s. Later, in the late 1960s and early 1970s, India experienced the first phase of the Green Revolution. The country was able to escape productivity stagnation because of the Green Revolution, which also increased the output of food grains. The agricultural industry has made outstanding progress as a result of high-yield seeds, land reforms, increased fertilizer use, and irrigation plans. However, only wealthy farmers and locations with vast resources could benefit from these advancements.

Additionally, on January 14, 1965, under the authority of the Food Corporation Act, the Indian government founded the Food Corporation of India to combat the country's pervasive hunger and starvation problem. The role of FCI involves maintaining a sufficient level of buffer stocks to assure national food security, operating the price support system to protect the interests of the farmers, and operating the public distribution system. The Public Distribution System (PDS) is a method for giving food to the destitute and underprivileged. The Targeted Public Distribution System (TPDS), which supported numerous schemes, was created from it. To ensure food and nutritional security for the nation's most deprived groups through its linked schemes and programmes, the Indian government passed the National Food Security Bill in 2013. (Ganguly and Bandyopadhyay, 2015).

**2.2 PROGRAMME TO IMPROVE FOOD SECURITY**

A vision of massive development vision calls for inexpensive health care, reliable electricity, stable environmental conditions, and food security. Indian resources have expanded as a result of the growth and development of essential technological skills. Development is a systematic process that gives greater emotions and opportunities in a variety of domains. Development cannot occur overnight, and sustainable development cannot, under any circumstances, represent indiscriminate growth. The main concern is ensuring food security for everyone at all times, and we must find an appropriate solution. As previously indicated, the Indian government has been consistently promoting food security. Checking out the current status and the results of governmental initiatives is as follows: -

1. **Buffer Stock in India** - The buffer stocking policy of India acts as protection against a reduction in output levels, much like an insurance policy. After the Bengal Famine of 1943, it has grown to be a crucial part of food management policy. The severe Orissa Famine of 1865–1867 gave rise for the first time to the concept of a food grain reserve. Additionally, the Indian government established its first Famine Insurance Fund under Lord Lytton. After India gained its independence, Mr. Rafi Ahmed Kidwai, the country's former food minister, concentrated on increasing food grain production since, by 1955, the buffer stock of food grains had fallen to 0.92 million tonnes, which had led to a rise in grain prices. However, wheat production rose as a result of Green Revolution in the 1960s. After the 1960s, our nation had the capacity to produce buffer stocks from extra food grain output. Prior to this time, only imported food grains were used to generate buffer stock. As a result, after 1965, the supply of food grains grew substantially.**(Figure 2.1)**
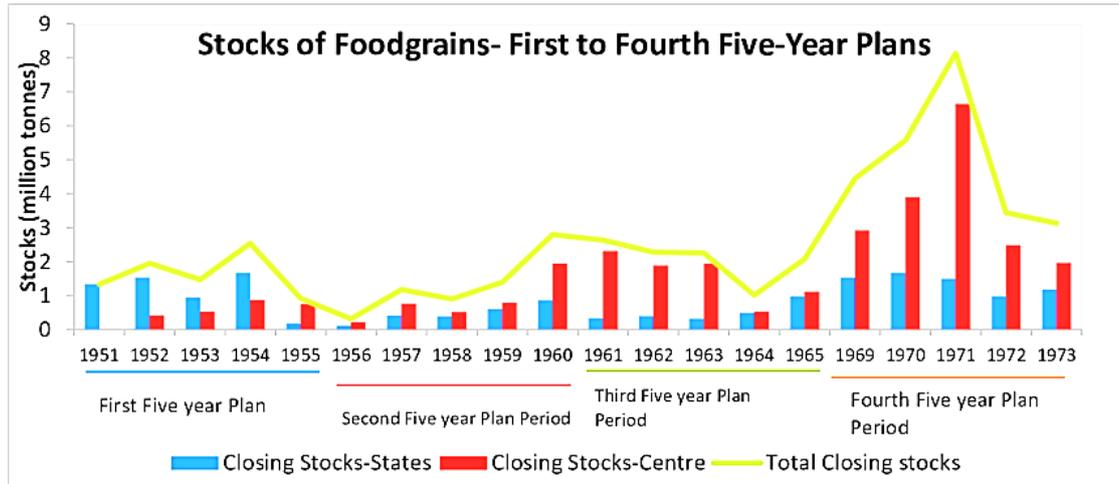
**Figure 2.1 Stock of food grain: 1951 to 1974 (Source: (Chopra, 1981))**

However, after 1965, when production and buffer stock both increased, the government established the Food Corporation of India (FCI) and Agriculture Price Commission for the management and strategic goals of the public sector and food grain trade. In fact, before 1965, food policies were primarily implemented by ad-hoc committees.

After 2006–2007, the level of food grain buffer stock consistently increased (**Figure 2.2**). As a result, we have a large food grain buffer stock today. To ensure national food security, the government should continue doing this. Contrarily, our nation still struggles with widespread food insecurity, and our future depends on finding a quick solution.
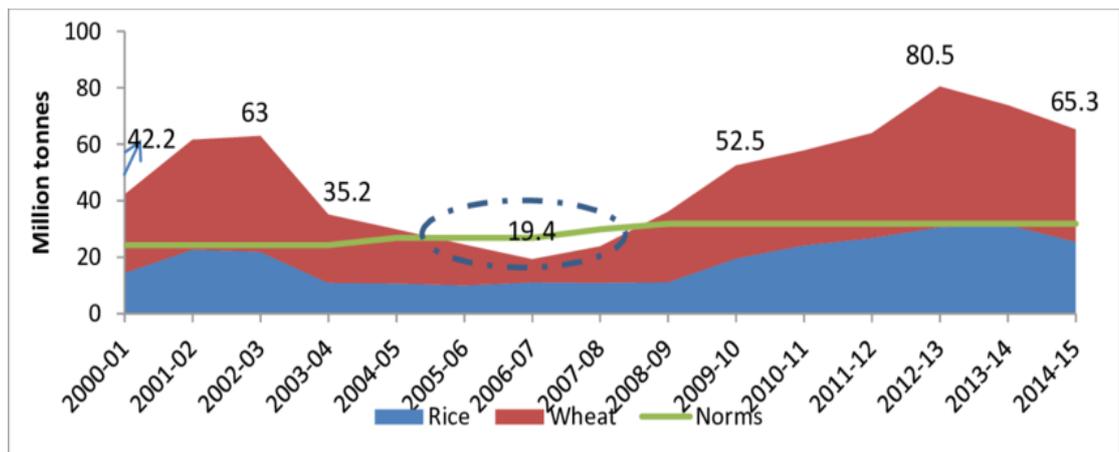


**Figure 2.2 level of Buffer Stock vs norms for Rice and Wheat (in million tonnes)**
**(Source: FCI : Improvement of Public Distribution System:)**

2. **Improvement of Public Distribution System**- India experienced severe food scarcity during the Indo-China War and the Indo-Pak War (**Figure 2.3**). Following the Green Revolution, the Indian government created laws and

programmes to distribute food to metropolitan areas with a food shortage. This distribution system was then expanded to include tribal communities and blocks with high rates of poverty. The Public Distribution System (PDS) was run jointly by the Central and State governments. Through the Food Corporation of India (FCI), the Central Government was in charge of deciding how to procure, store, and distribute food grain to the State Government. The State Government had the authority to choose how much food grain to distribute, which families qualified for ration cards, how to operate distribution centers, and how to oversee them.
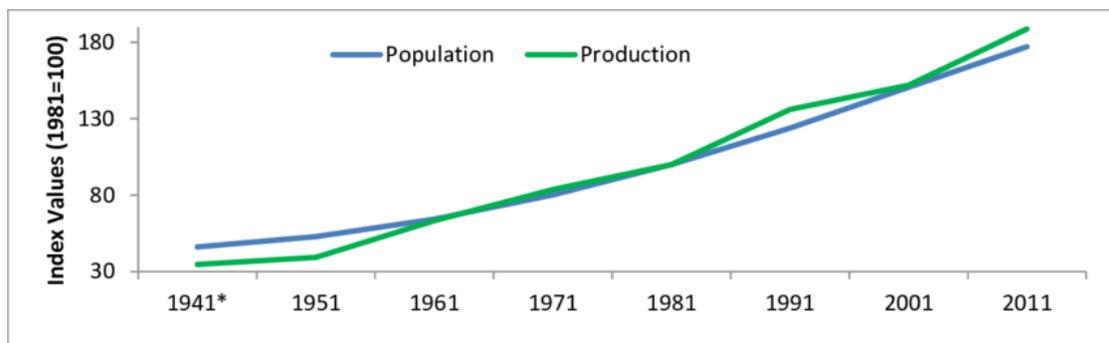


**Figure 2.3 Trend of Indian Population and Production Indices 1980-81=100**

**(Source: Joseph S. C. (1961))**

The PDS was updated after June 1992 and is now known as the Revised Public Distribution System (RPDS), which was introduced in 1775 blocks across the nation. RPDS changed its name to the Targeted Public Distribution System in June 1997 (TPDS). Initially, at the time of establishment, the intended audience were six crore poor families. Food grain prices were set by the governments of the States or UTs under the TDPS arrangement. While 596.23 lakh families were initially estimated when the TPDS was founded, the number of BPL families increased steadily and eventually reached 652.03 lakh.

3. **Antyodaya Anna Yojana (AAY)**: Antyodaya Anna Yojana, which aims to provide the BPL population with at least a minimal level of food security, is comparable to an enhanced version of TDPS. Nearly 5% of all Indians, according to an NSS survey, slept without eating two square meals each day. It is without a doubt the worst part of reality. In essence, AAY was created by our government for those who were also "hungry." It was introduced in December 2000 for 1 crore poorest of the poor families. For example, the government offered food grain under this programme at a heavily discounted rate of Rs. 2/- per kg for wheat and

Rs. 3/- per kg for rice. From April 1, 2002, until April 16, 2002, 35 kg of food grain per month was made available through this programme, and it benefited around 242.121 lakh of the poorest households.

4. **Integrated Child Development Service (ICDS)**: On October 2, 1975, the Government of India sponsored the establishment of ICDS. With the help of this programme, the government aimed to enhance the health of young children under the age of six, pregnant women, breastfeeding mothers, and adolescent girls as well as to minimise malnutrition among these groups. Its primary goals were

➢ to improve the nutritional status of women and below 6 years old children,

➢ help to improve the mental, physical and social situation,

➢ reduce mortality rate, malnutrition problems

The Ministry of Health and Family Welfare ran the Integrated Child Development Service scheme through Aanganwadi centres, and health-oriented associate services were offered. The World Bank and WHO have occasionally given the necessities. About 80.6 pregnant and breastfeeding mothers and approximately 3.93 crore children benefited from this scheme. Additionally, this programme is supporting 1241749 Aanganwadi centres and 6,719 operational projects.

5. **Mid-Day Meals Scheme (MDMs):** The British government first proposed a mid-day meal programme in Madras Corporation in 1925; later, in Pondicherry, which was governed by the French, in 1930. However, this program's motto differs from the one now being used by the Indian government. Following independence, MDMs gradually spread to several states, first in Tamil Nadu, then in Kerala, and finally in other states. This programme was started by the Indian government in 1995 as part of the National Program of Nutritional Support to Primary Education. About 12 crore children nationwide are covered by this programme. MDMs' primary goals are

➢ to improve the nutrition level of children,

➢ to encourage them to attend school regularly,

➢ to provide food security and nutrition support to children in drought-affected areas,

➢ to provide help to improve the educational status of poor households.

The Panchayat, local educational committees, and the school-parent association work with the local government to coordinate this initiative. For lower primary students, this programme provides about 300 calories and 8–12 grams of proteins

per day, whereas upper primary students receive 700 calories and 20 grams of proteins daily. The Mid-Day Meals Scheme (MDMs) served over 8.41 crore lower elementary kids and 3.36 crore upper primary students from 2009 to 2010.

## 2.3 CURRENT SCENARIO OF FOOD SECURITY

Achieving self-sufficiency in food grain production at the national level had almost little effect on poverty, household food insecurity, and hunger, according to data from studies conducted in the 1970s; more than 70% of families remained hungry, food insecure, and destitute. Therefore, the nation began employment programmes to improve purchasing power

➢ providing subsidised food grains to the poor to improve household food security

➢ food supplementation programmes to close the gap between needed nutrition and what vulnerable people actually consume

➢ health care to reduce nutrient loss due to infections, and family welfare services to prevent unplanned pregnancies.

The World Food Summit redefined food security in 1996: "a position in which everyone, at all times, has access to enough food that is healthful, safe, and satisfies their dietary needs and tastes for an active and fulfilling life". Notably, these interventions occurred 20 years before that definition. (FAO 1996). A significant contributor to ongoing poverty and household instability has been highlighted as the absence of productive employment. The Food for Work programme gave food as payment to low-income individuals participating in work programmes with the goal of immediately enhancing household food security. The National Rural Employment Guarantee Act (NREGA), which was passed much more recently, established paid employment for rural residents who were unemployed as a legal right. 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 The remarkable decline in poverty rates over the past 20 years is partially attributable to India's explosive economic development. India accomplished the MDG goal of reducing poverty in 2012, three years ahead of schedule (**Figure 2.4**). (Ramachandran, 2016).
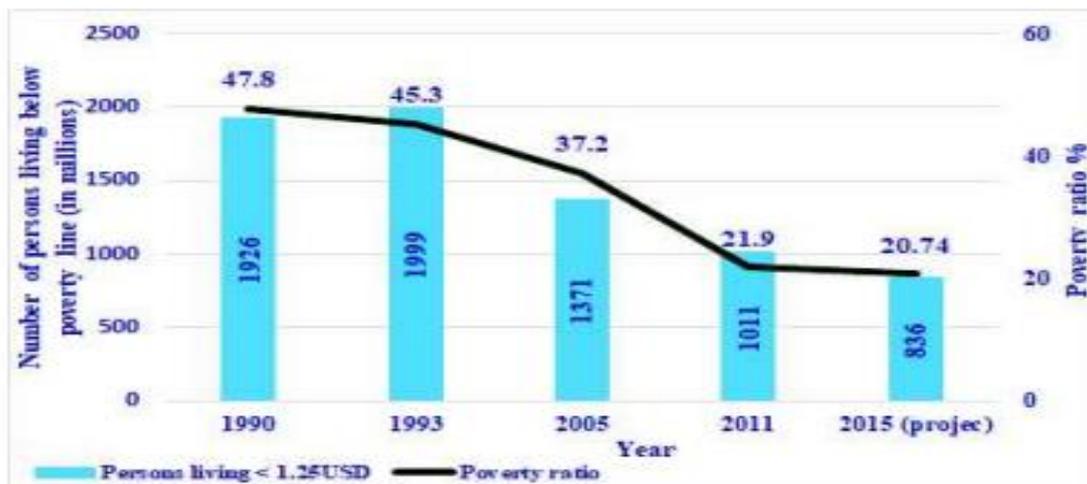
**Figure 2.4 Poverty reduction 1990-2011. (Source: India MDG report MOSPI 2015)**

Subsidized Grains to Increase Food Security in the Home the Public Distribution System (PDS) was developed in India to address regional and seasonal food grain shortages. Additionally, PDS offered food grains to people living in poverty at prices that were significantly subsidised. The PDS has assisted in keeping food prices low despite significant leakages and distribution system flaws. According to NSSO data, the percentage of household income that households spent on food between 1970 and 2012 gradually decreased (**Figure 2.5**).
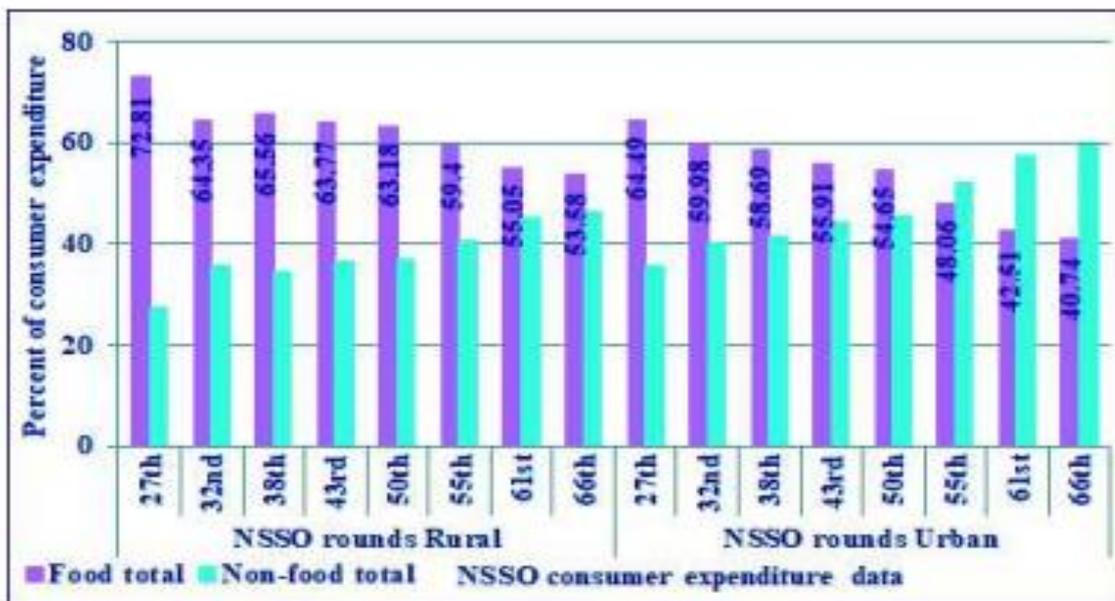


**Figure 2.5 Expenditure on food as a percentage of consumer expenditure.**

**(Source: NSSO surveys)**

The reduction in food expenditure was mainly due to reduction in expenditure on purchase of cereals.. It is interesting to observe that despite a decrease in overall food spending, cereal consumption increased in the lowest tertile of the population (**Figure 2.6**). This is probably because PDS provides access to food grains with subsidies. Between 2008 and 2010, there was a sharp increase in food costs both globally and in India. Indian lawmakers passed the National Food Security Act (NFSA 2013) to make subsidised food grains available to two-thirds of the country's citizens as a legal right in an effort to mitigate the negative impact of food price inflation on household food security. Food grains are also provided under the Act.
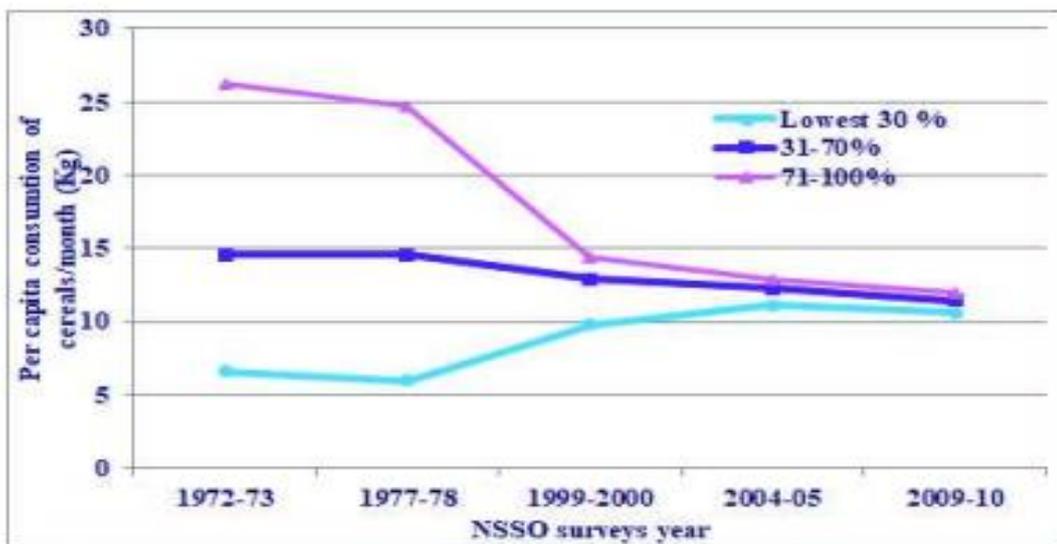


**Figure 2.6 Average per capita intake of cereal by expenditure classes**
**(Source: NSSO surveys)**

**2.4 CHANGES IN DIETARY AND NUTRIENT INTAKE**

Time series information on the food and nutritional intake of rural populations between 1975 and 2012 is provided by NNMB repeat surveys. **Figure 2.7** displays the dietary consumption of food items expressed as a proportion of the Recommended Dietary Intake (RDI). Cereal consumption has decreased steadily over the past 40 years; up until 1997, pulse consumption decreased, but by 2012 the trend had turned around. The consumption of lipids, oils, and green leafy vegetables has somewhat increased. Vegetables and milk intake continue to be below the suggested levels. With the exception of eggs, there hasn't been any rise in the consumption of animal products over time. Non-vegetarians ingested animal items (such as poultry,

meat, and fish), either in samll quantities or only once a week or once a fortnight, thus there wasn't much of a difference in their diets over time.
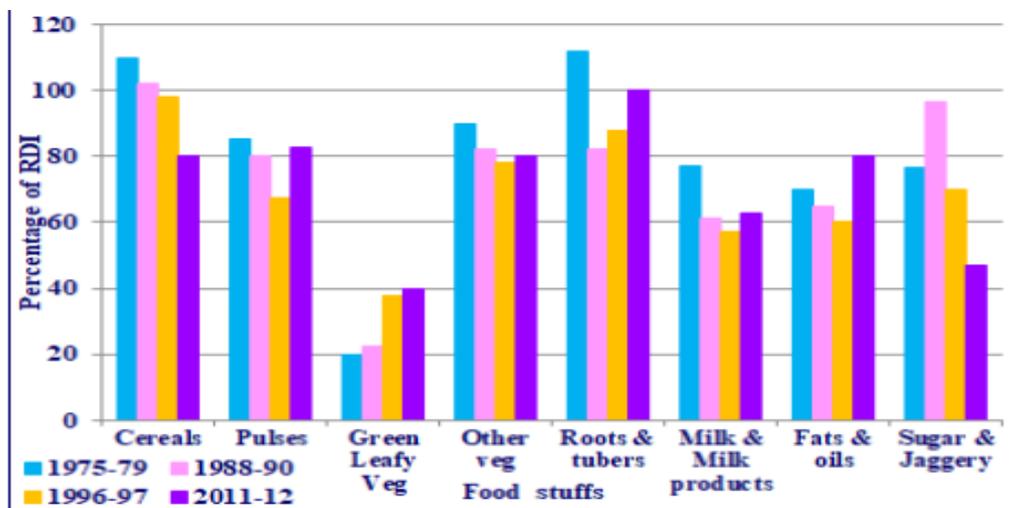


**Figure 2.7 Time trends in food intake as percentage of RDI (Source: NNMB reports)**

**Figure 2.8** shows NNMB data on nutrient intake as a proportion of the Recommended Dietary Allowance (RDA). The consumption of total energy and protein has decreased significantly throughout the years, notably in the last ten years. The drastically reduced iron intake amount reported in the 2012 survey is the result of an adjustment for surface iron contamination and does not actually represent a decrease in the consumption of foods containing iron. The adequacy of micronutrients has not improved.
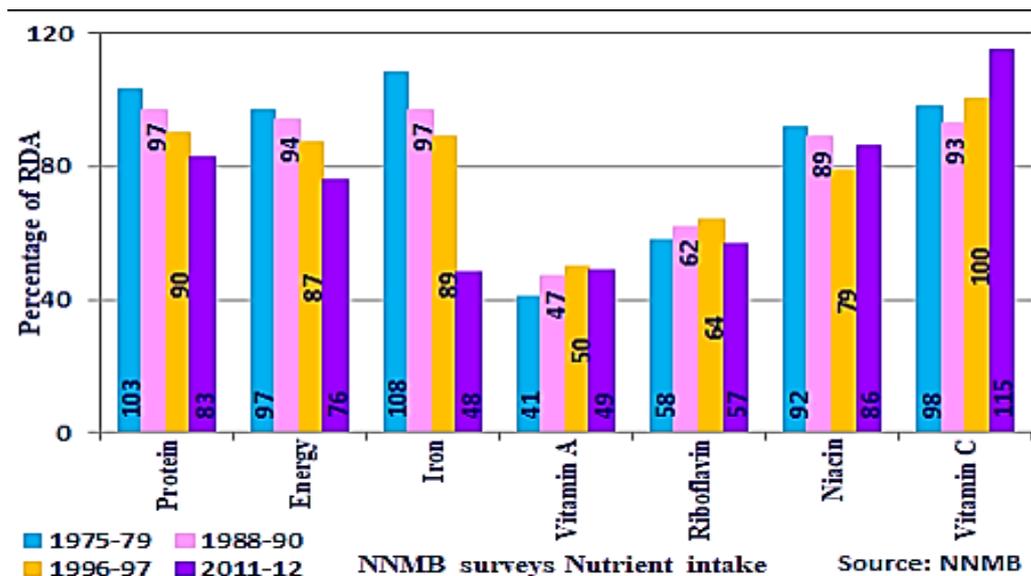


**Figure 2.8 Time trends in nutrient intake as percentage of RDA (Source: NNMB reports)**

## 2.5 INTRA-FAMILY DIFFERENCES IN DIETARY INTAKE AND NUTRITIONAL STATUS

The majority of intervention programmes designed to increase household food security did so with the presumption that food will be distributed fairly among family members. Mid-nineties NNMB survey results revealed that this presumption was no longer true. Children do not receive appropriate nutrition, even in houses where adults do (**Figure 2.9**). Data from consecutive NNMB surveys have shown that the situation has gotten worse over time; in 2012, adults were receiving enough food in more than 50% of homes, but children were not. These findings imply that the main cause of increasing undernutrition in preschool children is because of inadequate child feeding and caring behaviour rather than poverty.
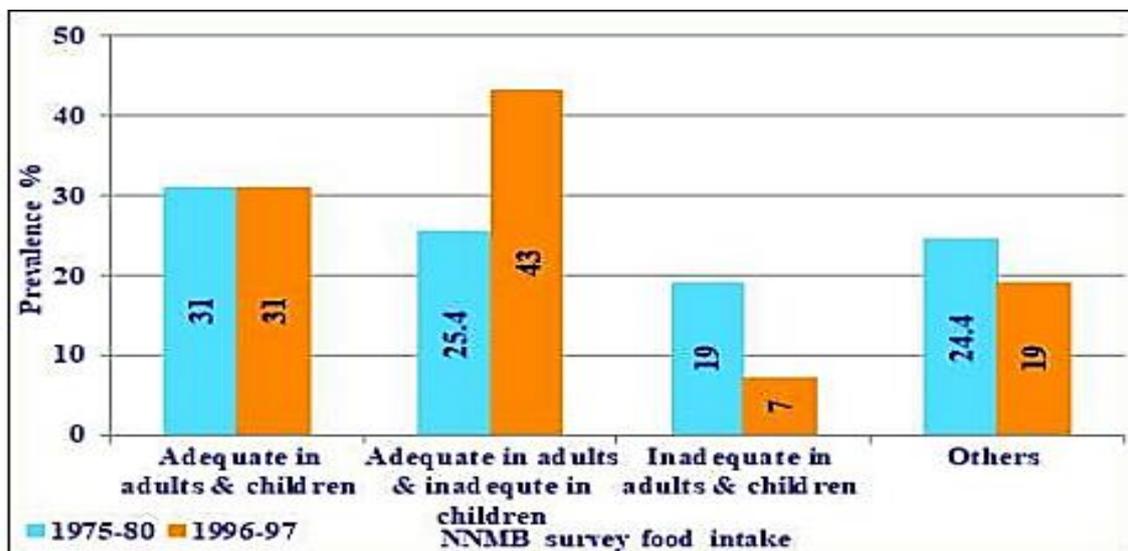


**Figure 2.9 Intra-family differences in energy intake. (Source: NNMB reports)**

Ever since these data became available, there has been discussion over whether these statistics are persistent enough to have any effect on nutritional status.. The nutritional condition of the mother and her under-five child was compared using data from the National Family Health Survey (NFHS) 3 (IIPS 2006). When the mother was undernourished, there was a 25% increase in the rate of child wasting. However, more than 17% of children were wasted even if the mother was normally nourished **(Figure 2.10)**. These demonstrate that inadequate child feeding and care practices are persistent enough to affect children's wasting rates.
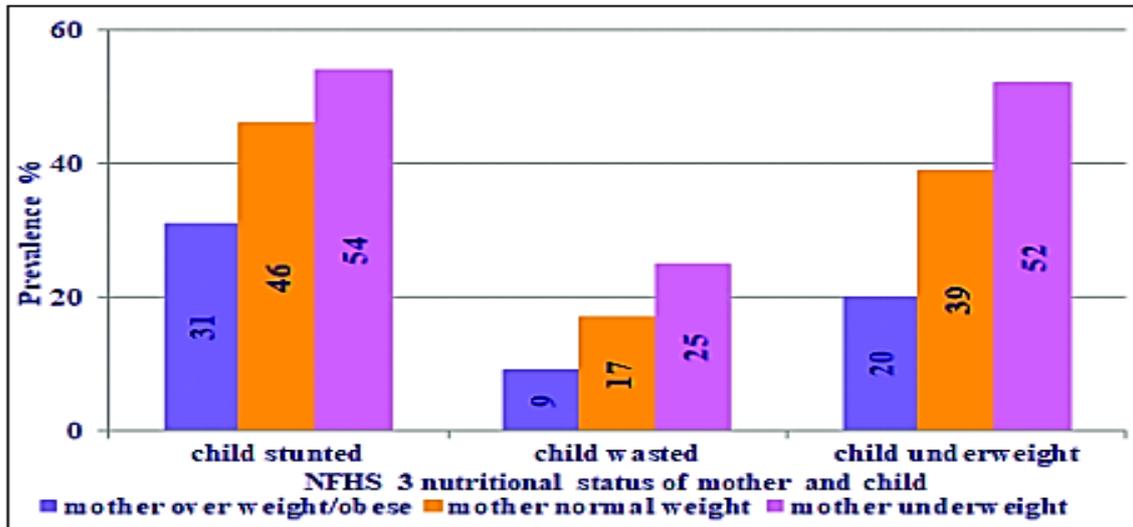
**Figure 2.10 Intra-family differences in the nutritional status (Source: NFHS 3 report)**

**2.6 CHANGES IN LIFE STYLE AND PHYSICAL ACTIVITY**

Indian adults in the 1950s and 1960s engaged in an adequate amount of physical activity since both home and professional tasks required a lot of manual labour. The two main ways to travel from one location to another were on foot or by bicycle. Access to mechanized transportation has greatly improved over the past three decades, which has led to a sharp decline in walking. Most Indians, especially those residing in metropolitan areas, lead sedentary lifestyles as a result of the increasing mechanization of occupational and home tasks. People spend less time standing and more time sitting because of TV or other digital devices being there in every home. By the middle of the 1990s, research studies in urban regions and NNMB surveys in rural areas revealed that most Indian women and one-third of Indian males had sedentary lifestyles. (NNMB, 1995). Over the past two decades, the situation has gotten worse, and today, even in rural regions, the majority of people lead inactive lifestyles. The main cause of India's rising rates of overnutrition appears to be a sharp decline in physical activity. Maintaining the health of muscles, bones, and joints as well as preventing obesity and non-communicable diseases it is essential that all Indians engage in discretionary moderate physical activity for at least 30 to 60 minutes each day.

**Physical activity in children and Adolescent**

Greco et al, (1998) studied that the physical activities of children are reducing due to concerns of safety by the current society and also with educational institutions which continuously reduce the time for motor and sports practices. (Greco and Banda, 1998) A study revealed that children who were proportionally overweight or obese had the lowest physical activity levels, but there was no relationship between physical activity levels and body mass index (Vale,2014). Numerous studies have demonstrated the benefits of regular physical activity for both physical and mental health throughout childhood. (Anderson, Wedderkopp, Hansen et. al., 2003) Although there was evidence in some research to imply that at least 50% of young people were physically inactive at a level that would provide health benefits. (Armstrong and Van Mechelen ,Welk ,1998) (Stone and McKenzie,1998), other studies demonstrated that this aim was being achieved (Sleap and Tolfrey, 2001)( Pate, Freedson, et. al., 2001) (Sproston and Primatesta, 2003). It has not always been stated that levels of physical activity drop with age. Although it is sometimes claimed that girls experience a greater fall in physical activity than boys, a symposium revealed the reverse (Sallis and JF, 2000) (Telama and Yang, 2000) (Van Mechelen and Twisk,Kemper et al, 2000).

Growing and developing is a phase during childhood. Maintaining proper nutrition during this time will influence adult nutritional health in addition to encouraging optimal physical growth and development. Childhood, the time between infancy and puberty, is frequently referred to as the latent growth stage. The child is developing, but the rate of growth is noticeably slower than in infancy and generally does not approach the dramatic changes that typically take place in adolescents. Meanwhile, throughout this time, resources are being set aside in preparation for the fast development that will come with puberty (Brunner,1998). The few years of primary school are a crucial time for social, intellectual, and emotional development. Due to significant physical and psychological changes, this age group is particularly vulnerable (Kumari, 2005). Adding health advantages, engaging in physical activity is crucial for a child's social and cerebral growth (Logstrup, 2001). According to Dunn et al, (2001) among the psychosocial advantages of physical activity include a decrease in depressive symptoms and perhaps even tension and anxiety (Logstrup, 2001) as well as improvements in self-esteem, energy levels, sleep quality, and focus (Shilton and Naughton, 2001).

**Physical activity in Adults**

In the past three decades, Asia has seen a socioeconomic change that has improved the country's access to food, better transportation options, and better healthcare. According to epidemiological statistics from China and India, changes in eating practises, decreased physical activity as a result of mechanisation, a preference for watching TV and movies, outdoor games, and increased usage of automobiles are all linked to changes in obesity rates. A similar situation developed in rural areas in recent years, following the initial observation of the changing trend in urban populations (Ramachandran, Chamukuttan and Susairaj, 2012).

According to Dunstan et al. (2005), 6,241 persons over the age of 35 who were not taking any lipid-lowering or antihypertensive medications and did not have diabetes mellitus or self-reported ischemic illness were the volunteers in this population-based cross-sectional trial. Increasing TV watching was linked to a higher incidence of metabolic syndrome, but the increased exercise was associated with a lower prevalence. Population-wide programmes should encourage physical exercise while reducing sedentary behaviour like watching TV (Dunstan, Salmon, Armstrong, 2005).

There is an urgent need to improve physical activity levels in rural as well as in urban areas and among all age groups. From the beginning of life, involving physical activity in day-to-day life should be imparted. Measures to increase physical exercises both at home and at workplace could be undertaken using the behaviour change communication strategy. People reporting day-to-day habits such as walking and usage of bicycles seem to have lower prevalence of obesity levels. People should also be promoted to do physical activity so that they can enjoy their health. Our Indian traditions also can be used like dance, yoga, walking, and meditation. (Kamath, 2017).

In a study the author assessed the prevalence and factors associated with insufficient physical activity (PA) in urban and rural Vellore, Tamil Nadu, India, among adults aged 30–64 years. Women had a higher prevalence of insufficient PA compared to men, in both urban (70.8% vs. 53.8%) and rural areas. The study shows that targeted interventions are needed to reduce insufficient PA, especially for women and urban populations (Devamani,Oommen and George, 2019).

Walking was identified as a major contributor in females while vigorous activity contributed maximally in males. The Leisure-time domain was observed as major contributor and work was the least contributor to the total PA levels. A total of 255 students were interviewed using IPAQ long form (Singh& Singh, 2017).

A large percentage of people in India are inactive with fewer than 10% engaging in recreational physical activity. Phase 1 of the ICMR-INDIAB study was conducted in four regions (Tamilnadu, Maharashtra, Jharkhand and Chandigarh) Physical activity was assessed using the Global Physical Activity Questionnaire (GPAQ) in 14227 individuals aged ≥ 20 years. Subjects in all four regions spent more active minutes at work than in the commuting and recreation domains. Males were significantly more active than females (Anjana, Pradeepa, Joshi, 2014).

**2.7 CURRENT NUTRITIONAL STATUS OF THE INDIAN POPULATION**

Together, DLHS 4 (2014) and AHS CAB (2015) assessed the nutritional status of all members of the chosen households, and they were the first surveys to offer district- and state-level data on the prevalence of under- and over-nutrition in people of both sexes across all age categories. Only BMI indicates current energy deficiencies, balances, or surpluses. Therefore, in the age of dual nutrition burden, it is necessary to compute nutritional status across age groups using a BMI that can detect both under and over-nutrition. The results are shown in **Figures 2.11 and 2.12.** 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.
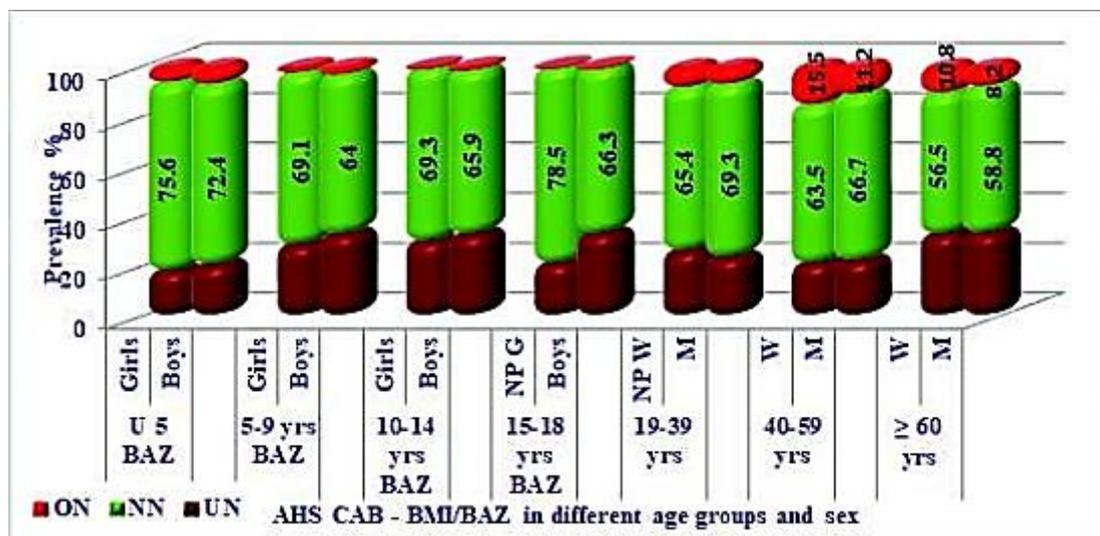


**Figure 2.11 Current nutritional status AHS CAB survey (2015).**
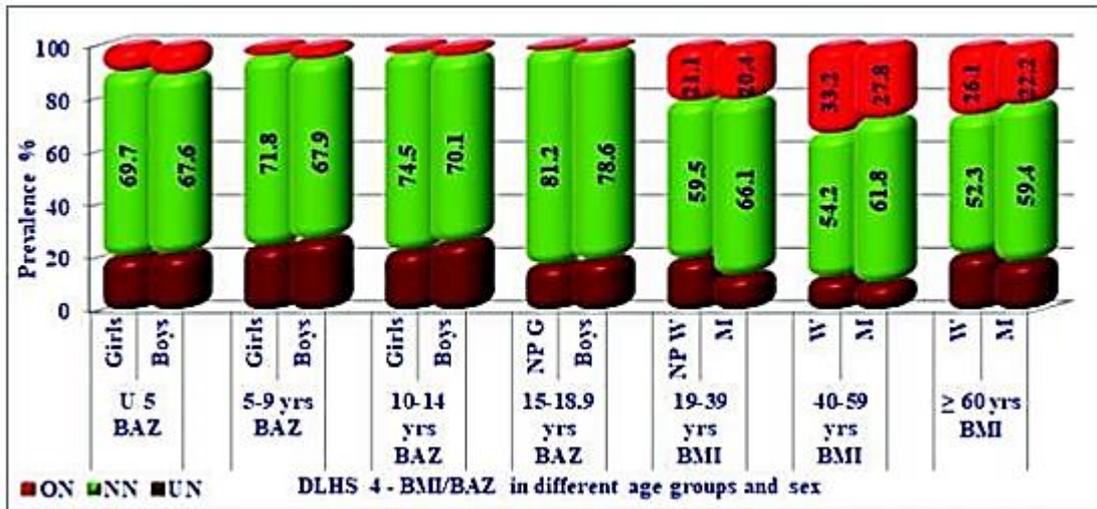
**(Source- Ramachandran,2018)**

**Figure 2.12 Current nutritional status DLHS 4 (2014). (Source- Ramachandran et al., 2018)**

## 2.8 NUTRITIONAL STATUS OF PRE-SCHOOL CHILDREN

Data on the nutritional status of preschool children, men, and women in rural areas in 10 states between 1975 and 2012 are provided by NNMB surveys. Information on these three groups' nutritional health as well as that of adolescent girls (15–19 years old) at the state and federal levels is available between 1995 and 2015 from the National Family Health Survey. The three variables used to evaluate the nutritional status across various age groups are weight, height, and body mass index (BMI) (for age in children).

The nutritional status of preschool children is thought to be the most at risk of undernutrition. Health and nutrition services have concentrated on enhancing the nutritional status of the preschool children. According to NNMB repeat surveys, the rates of stunting and underweight in preschool children have been steadily declining over the past 40 years. However, the waste rates have not consistently decreased (low BMI-for-age, **Figure 2.13**). According to FAO (SOFI 2013), the high rates of undernourishment in South Asia are not caused by food insecurity.

One-third of new-borns in India are under 2.5 kilograms at birth. These tiny, but gestationally mature, infants survive with only minimal new-born care, but they develop at a slower rate than infants of typical birth weight. Low birth weight may contribute to some of the stunting and underweight in children under the age of five.
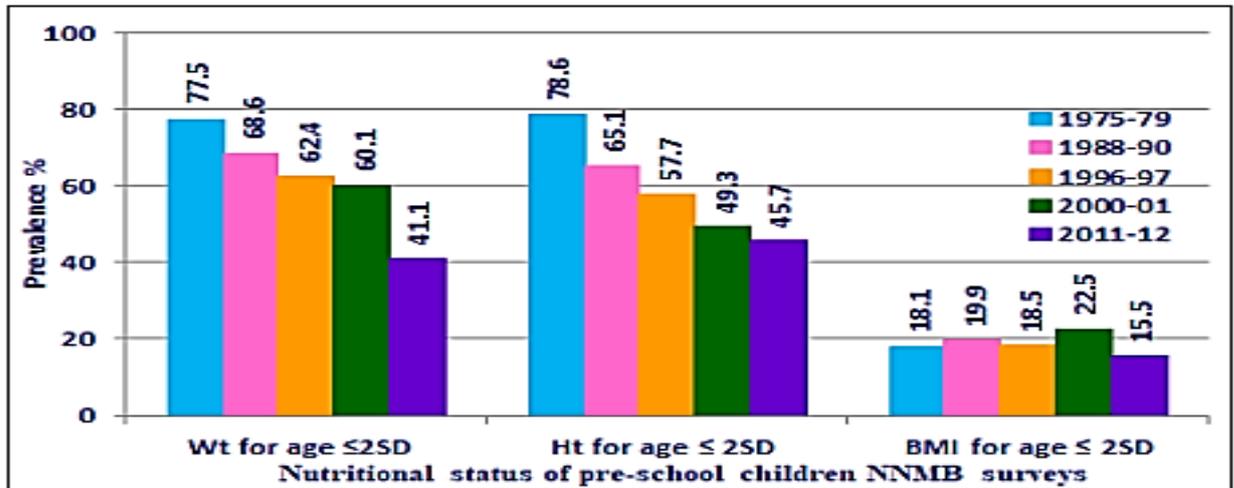
**Figure 2.13 Time trends in the prevalence of under-nutrition in preschool children (Source: NNMB reports)**

NFHS 1, 2, 3, and 4 provide data on height and weight measurements in preschool children. Only statistics for children under the age of three are provided by NFHS 2 of the four surveys. It is crucial to calculate and compare the nutritional status of children under three across these surveys because age is a significant element that affects how well-nourished pre-schoolers are. In order to calculate the rates of stunting, underweight, and wasting in children under the age of three, raw data from NHFS 1, 2, 3, and 4 were analysed (**Figure 2.14**). These statistics also demonstrate a progressive decline in stunting and underweight over time. But during the past fifteen years, rate of wasting has increased.
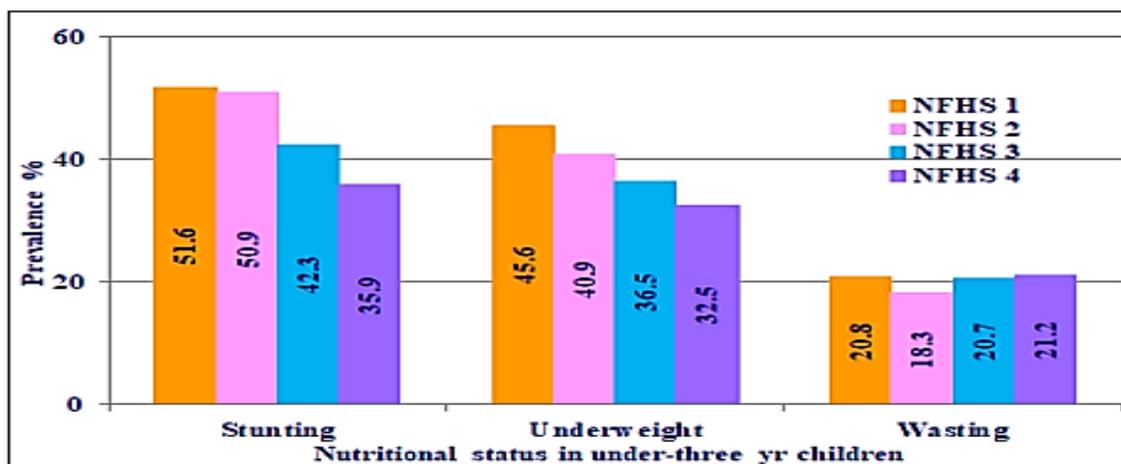


**Figure 2.14 Time trends in the prevalence of under-nutrition in under-three-year children (Source: NFHS surveys)**

According to WHO child development criteria, the majority of children had varying degrees of malnutrition, according to research on the nutritional status of Under-five children (Meena, Kaushal and Saxena 2015). Stunting rates were significantly higher in Indian children aged 0-5 compared to the WHO MGRS growth guidelines. Stunting was more common and wasting was less common as children's ages increased. Rapid reduction in low birth weight or stunting may be impossible, but it may be possible to meet targets for long-term waste reduction (Kalaivani and Ramachandran 2022).

Sumita B. et al, (2008) conducted research to evaluate the dimensional distribution of the nutritional status of children less than three years old in India. Z scores showed a ghastly portrait of health conditions all over India. The badly affected states are Bihar, Madhya Pradesh, Orissa, Uttar Pradesh, and Rajasthan (Sumita et al., 2008).

The largest incidence of wasting and low BMI for age occurred during birth. Stunting is hard to reverse; hence it is crucial to prevent it. Low BMI is a sign of a current energy deficit, which can be prevented by early detection and measures to make up the deficit (Ramachandran. et al, 2011).

The study included 545 children ranging in age from 9 to 36 months. Three fourth of the children were underweight, with 35% severely malnourished. Findings show that low food intake is the primary cause of under/malnutrition and growth retardation (stunting) (Kaur, Singh and Singa, 2005).

Ramesh et al, (2008) conducted a research study in an urban pocket of Rohtak city. undernutrition affected 48.7% of the children, with 33.2% in grade I and 14.3% in grades II and III. The children of laborers had the highest incidence of undernutrition (61.2%) (Ramesh,Verma and Shankar, 2008).

Awaasthi et.al., (2003) investigated the prevalence of anemia among preschool children (3-5 years old) in the rural Barabanki area of Uttar Pradesh, India. Boys and girls had average hemoglobin levels in g/dl of 10.1 and 9.9, respectively. Girls were shorter and lighter than boys (Awasthi , Verma and Vir, 2003).

Uppal et al, (2005) investigated the health and nutritional status of Scheduled Caste preschool children in the Amritsar region of Punjab. A total of 1,000 children, aged 1 to 5, were included in the study. Approximately 90.80% of children suffered from various levels of under-nutrition (Uppal, Kumari, Sidhu, 2005).

**2.9 CHANGES RELATIONSHIP BETWEEN STUNTING AND WASTING**

**Figure 2.15** shows changes in the frequency distribution of z scores for height-for-age and BMI-for-age in children under three years of age between NFHS 1, 2, 3, and 4. The z scores for height-for-age have consistently moved to the right between NFHS 1 and NFHS 4, indicating a continuous decline in stunting in children under three.
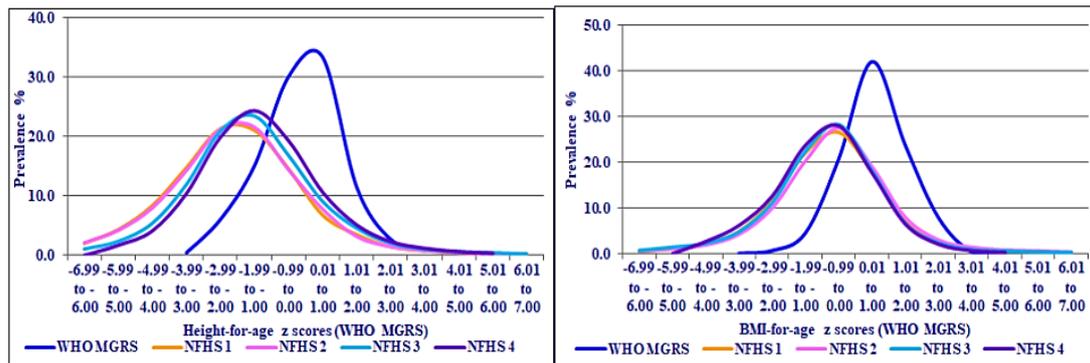


**Figure 2.15 Frequency distribution in height-for-age and BMI-for-age in under-three children NFHS surveys**

Before Indian children catch up to the frequency distribution for height found in WHO MGRS norms, India still has a long way to go. A study of the variations in BMI z scores reveals a slight shift to the leftover time, but concurrently, there has been a decline in severe wasting. When evaluating the nutritional status, especially in young children, height and BMI for age should always be taken into account jointly. An increase in wasting would follow a comparatively faster decrease in stunting (as has been reported between NFHS 2, 3and 4). If there has also been a contemporaneous decline in stunting rates, this should not be regarded as a worsening in nutritional status. When stunting rates decline, children's linear growth will follow a higher trajectory, which should be interpreted as an improvement in nutritional status. Children will grow following their linear trajectories thanks to early detection and good feeding, which will also prevent stunting and promote a decline in stunting rates.

By 2025, WHA (2012) has set a goal of reducing stunting by 40%. (WHO 2017). Stunting has decreased in India over the past 40 years at a rate of roughly 1% per year, according to data from NNMB and NFHS surveys. India won't be able to double the rate of stunting reduction over the next ten years and meet the WHA's aim for the

reduction of stunting. Wasting is an indicator of current energy inadequacy. WHA has set a goal of continuing this improvement while lowering childhood wasting to less than 5%. Different states in India have waste rates from 5-25%. Some of the states that perform better may be able to meet this goal by identifying wasting using BMI-for-age and addressing the contributing factors, such as improper baby and young child feeding habits and/or infections. Such action will enhance the rate of wasting reduction while simultaneous reduction in stunting. (Low BMI for age).

## 2.10 NUTRITIONAL STATUS OF CHILDREN AND ADOLESCENTS

More than 80% of preschool children have normal nutritional status when using BMI as the criteria. In both the AHS and DLHS states, the prevalence of undernutrition was higher in boys than in girls for the age range of 0 to 18 years. Compared to DLHS states, AHS states had higher prevalence rates of undernutrition in children and adolescents. These age groups do not have high levels of wasting. It will be able to significantly reduce wasting if active measures are adopted to screen all children, detect wasted children, and give them food supplements and medical care to fight infection, and evaluate improvement over the next six months. Although the nation as a whole might not be able to reduce undernutrition in children under the age of five to less than 5%, some states can do it and so demonstrate the way. According to recent research, 4-5% of children under the age of five are overfed. India has the most under-five children who are over-nourished in the world due to the magnitude of its child population. According to height and weight standards, many of these overfed children are short for their age and are classified as stunted and underweight; nevertheless, their BMI is high for their age and height, indicating that they are actually over-nourished. Because overnutrition in early childhood has been observed to continue throughout adolescence and adulthood, the detection and treatment of overnutrition should be given high attention, especially in short preschool children. Then the fact that more than three-fourths of people aged 0 to 18 are usually nourished must be brought to light. By instilling healthy food habits, sufficient physical activity, and acceptable lifestyles throughout this time, these children will develop into normally nourished adults. Agers and children aged 5 to 9 who are overfed have low proportions (0.6 to 11%). One of the main causes of these children's overnutrition is their lack of physical activity. In children from higher income groups, habitual eating of high-fat, high-sugar, high-salt, energy-dense

snacks, and soft beverages has been linked to overnutrition. Due to the fact that many of the calorie-dense items are pleasant and are offered as cheap street snacks, recent studies indicate that this may also be an issue for lower-income groups. Healthy lifestyles will be established and overeating and NCDs will be prevented in later life by instilling healthy eating habits with adequate activity in these age groups. If India succeeds in preventing the rate of overnutrition from rising further across all age groups, it may be able to stop the predicted rise in NCD rates.

Bhasin et al, (2008) published a study on the growth development in Jammu and Kashmir. Subjects were evaluated for 23 anthropometric and three physiological variables. The study's findings reveal that various Dogra groups have higher growth rates and physiological variable values than their peers (Bhasin, Singh,and Kaur, 2008).

Measurements were taken on healthy school-aged adolescents in 12 Indian cities' public schools. Girls had a higher BMI, ponderal index, and skin fold thickness, according to the findings. There was less variability in these parameters with sexual maturity rating than with age (Aggarwal and Pandey, 2001).

Nutritional deficiency is one of the leading causes of undernutrition in adolescents, which can lead to an increase in disease occurrence. Parimalavalli et al, (2011) examined the nutritional status of adolescent girls in Tamil Nadu. Except for girls from matriculation school, there was a significant difference in weight among selected girls and Indian adolescent girls (Parimalavalli and Sangeetha, 2011).

Around one third of adolescent girls were found to be stunted in a research study. Stunting was more prevalent in the 16 to 19-year-old age group. More than 50% of rural adolescent girls fell below the third percentile of weight for age according to NCHS standards (Saxena and Saxena , 2011).

According to Jalja K et al, (2011), the total prevalence of overweight among adolescents in Guntur, Andhra Pradesh, is 8.4% among girls and 6.9% among boys. Adolescents who purchased lunch at school had a higher risk of being overweight or obese (95% CI: 1.441 and 1.19-1.64). Parents and schools facilitate public-health initiatives that aim to decrease childhood and adolescent overweight and obesity (Jalja K and Sri Hari Krishna, 2011).

In a study on the Health Status of School Children in Ludhiana City, the prevalence of wasting and stunting in these children was high (52.2% wasted and 26.3% stunted), with boys and girls experiencing it nearly equally. Adolescents of both sexes had a

high rate of anemia but way higher in girls (30.5%) than in boys (22.9%) (Benjamin, 2000).

Nutritional status during school age is a major determinant of nutritional and health status in adult life. The past two decades have witnessed the emergence of over nutrition as a problem in school age children in developed countries and in affluent urban segments in developing countries. In developed countries, the consumption of high calorie food and the increasingly sedentary life style have been implicated as a major factor responsible for the rising obesity rates. In India there has not been a substantial increase in energy intake among children except those in urban affluent families. The increasing obesity rates in children are attributable mainly to the substantial reduction in physical activities in the form of household chores, methods of commuting and methods of recreation over the past two decades. Overweight children are at a higher risk of becoming over nourished adults and thereby incurring a higher risk of developing non-communicable diseases.

Surveys carried out by the NNMB (1979-2002), and research studies in urban and rural school children have shown that under nutrition remains a major problem in school age children (Ramachandran, 1947-2007). This is mainly attributable to the fact that energy intake in these children is inadequate to meet the requirements of adolescent growth spurt.

Data from the NNMB survey showed that though there has not been any substantial increase in the dietary intake of children and adolescents, there has been some improvement in height (2.5-6 cms), weight (2-6 kgs) and BMI between 1975-79 and 2005-06. Data from NNMB also shows that over this period there has been some increase in over nutrition among children and adolescents. Though there has been improvement in the height and weight over the past 25 years, stunting and underweight are common in the rural children even in the year 2012.

Over nutrition is emerging as a major public health problem in affluent school children especially in urban areas. Nutrition education on avoiding habitual intake of energy dense fried food and soft drinks is now being taken up as a part of the campaign to prevent over nutrition. The steep fall in physical activity in school and at home is an important factor responsible for over nutrition in school children. Increase in time devoted to games involving energetic physical activity in school and at home would reduce the prevalence of over nutrition in school children. Such efforts to increase physical activity in school children will have long term health and nutrition

benefits, as these children are likely to grow into physically active adults with healthy lifestyles. In the last two decades, there have been numerous studies assessing nutritional status of school age children. A review of studies carried out in different parts of India is given in the following paragraphs.

Assessment of the nutritional status of 816 primary school children was carried out in the Chiraigaon Community development block of Varanasi. The mean height and height of both boys and girls increased with age. Boys were taller than girls up to the age of 9 years. Out of the total subjects 52.6% were underweight and 9.2% were stunted (Kaushik ,Mishra and Singh ,2012).

A study was conducted in 940 children in the age group of 5-14 years in a Rural Health Block in Kashmir. Both mean weight and height were higher in females than males. The overall prevalence of under nutrition was 19.2%.

Assessment of nutritional status of 484 primary school children (6 to 12 years) in Mandya district in Karnataka showed that prevalence of underweight in boys was 32.3% and in girls, it was 28.3%. Among the boys, underweight was seen more commonly in the age group 6-7 years (44.4%) and among girls in 11-12 year age group (34.1%). The prevalence of stunting in boys was 29.1% while in girls it was 26.5% (Fazili, Pandit and Shamila,2012).

Nutritional status was assessed of school age children (6-14 years) of tea garden workers of Assam. Prevalence of wasting, stunting and underweight was 21.2%, 47.4% and 51.7% respectively among the children in the age group of 6-8 years. Prevalence of stunting and thinness was 53.6% and 53.9% respectively among the children in the age group of 9-14 years age group (Medhi, Barua and Mahanta, 2006).

A study was conducted to explore nutritional status in school-age children (5 to15years) in urban slums of Bareilly, by recording anthropometric measurements and clinical examination findings. A total of 512 children (297 boys and 215 girls) were interviewed and examined. The difference in height of boys and girls was not significant in any age group. The mean weight increased from 16.46 kg and 16.28 kg for boys and girls respectively in the 5 year age group to 49.40 kg and 46.38 kg respectively in the 15 year age group. Prevalence of stunting and underweight was found to be the highest in age group 5-6 years and 11-12 years respectively whereas, maximum prevalence of wasting was found in age group 7-8 years (Srivastava, et al., 2012).

A study was conducted in an urban slum area in Meerut city over a period of five months among 400 children in the age group of 5-14 years to determine the prevalence of under-nutrition among school-aged children. The prevalence of underweight in children was 48.0%; 56% of the undernourished children were boys (Rawat, Kumar and Jose, 2014).

The nutritional status 300 children in the age group 11 to 14 years from urban, semi urban and rural areas of Tamil Nadu was assessed using their BMI and waist hip ratio; relationship between nutritional status and factors like gender, area of residence and socio-economic status were explored. Prevalence of underweight was 65% in semi urban area and 48% in urban area and 89% in rural area. It was found that 20% of children in rural areas and 32% of children in urban areas fall under high-risk category of waist-hip ratio. The prevalence of underweight was 69.09% among boys and 65.19% among girls (Priya, Seenivasan and Annapooran et al, 2014).

## 2.11 NUTRITIONAL STATUS OF ADULTS

Indians have higher adiposity than Caucasians for any given BMI. It has been suggested that the BMI cut-off for "overnutrition" among Indians should be set at 23 instead of 25 in light of the research showing that the risk of cardiovascular illnesses increases when BMI is over 23 in Indians (Ramachandran, 2006). The prevalence of overnutrition will increase if the lower cut-off value is employed. Increased risk of diabetes, hypertension and cardiovascular disease are linked to overeating. In Indians, diabetes, and hypertension start a decade earlier in life (Gupta, 2009). Diabetes and hypertension 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).

Prevention, early detection, and efficient management of overnutrition are therefore of utmost importance. The country would be able to meet the WHA targets for reduction in premature mortality rates related to NCDs by minimising the predicted increase of over-nutrition and NCDs as a result of the continuous efforts to conduct screening for these conditions as a crucial part of preventive health care at all levels.

Joseph A. et al. (2011) showed that the prevalence of overweight was within the range of 11.7% to 23.1% based on studies among medical students in India. Additionally, while having a lower body mass index (BMI) than non-Indians, Indians had a larger

proportion of visceral body fat, increasing their risk of diseases including diabetes and cardiovascular diseases (Joseph, Mohan and Barma et al, 2011).

Barnes et al. (2012) carried out a survey of 264 college students aged 18 to 20 years and found little evidence about the impact of parenting style on eating habits in a college group. According to the findings, 44% of students continued to eat the same way they did before starting college. It was noted that parenting style did not influence college students' (young adults) eating habits as much as it did children's and youth's eating habits (Barnes, Brown and McDermott, 2012).

Longevity rates have significantly increased in India, and during the next two decades, both the number and percentage of the aged will rise even more. The first surveys to measure the nutritional condition of the elderly on a national scale were the AHS and DLHS 4. Data from these surveys clearly demonstrated that, as compared to younger adult men and women, there was a rise in undernutrition and a slight decline in overnutrition in men and women over the age of 60. Elderly undernutrition rates in AHS states were greater than elderly overnutrition rates, whereas the opposite was true for the DLHS 4 states (**Figures 2.11& 2.12**). These surveys also gathered data on the prevalence of non-communicable diseases in senior people. It is crucial to analyse these data on a state and district level in order to use them to develop the best possible interventions.

## 2.12 INTRAFAMILY DIFFERENCES IN NUTRITIONAL STATUS BETWEEN UNDER FIVE CHILDREN AND OTHER MEMBERS

There had been numerous studies both Indian and global on regional, national differences and time trends in the prevalence of undernutrition, nutrient and food intake and factors affecting nutrition status of children especially during the critical first five years of life. India has been having high prevalence of child undernutrition and concurrently high prevalence of overnutrition in adults. In this context it is inevitable that there will be high intrafamily differences in nutritional status. However there are very few studies exploring the intrafamily differences in nutritional status between under five children and other family members.

Using data from a cross-sectional survey undertaken in 1990 in rural central Guinea, Mock et al 1994, (Mock, Magnani, et al,1994) investigated the nature of within-household relationships in maternal and child nutritional status and considered the implications for programme screening strategies. Mothers and their surviving children

under 5 years of age were the focus of the analysis. Correlations between maternal and child nutritional levels were assessed and the performance of maternal-child nutritional indicators as screening tools for household nutritional risk were evaluated by analysing the sensitivity, specificity, and positive-negative predictive values of various indicators. They however did not assess the magnitude of intrafamily differences between the mother and the under five child or factors which might be responsible for the difference.

In 1990s NNMB surveys (NNMB, 1995) high lighted the intrafamily differences in energy intake between adults in the family and children in the family. In a third of the families both adults and children had adequate energy intake but in about 40% of the families adults had adequate energy intake but children did not. This was attributed mainly due to poor child caring and feeding practice in food secure families. Subsequent NNMB surveys have indicate that there has been a progressive increase in the proportion of families where adults had adequate energy intake but children did not. The NNMB surveys did not assess the difference in nutritional status between the adults and children.

Dahal et al, (Dahal, Amita, Chand, et al, 2023) undertook a study the determinants of nutritional status among mothers and their children aged 6–59 months in Nepal's Panauti municipality. The study found that the prevalence of maternal underweight was low (2.7%) whereas the prevalence of overweight and obesity was 36.7% and 13.7%, respectively. Around 27.9% of the children were severely stunted, 3.6% underweight, and 3.5% wasted, whereas 22.1% of the children were overweight. About 54% of the mothers and 57.52% of the children were malnourished. Ethnicity was significantly associated with mothers' nutritional status and factors such as ethnicity, pre-lacteal feeding, and cultural practices of the mother were significantly associated with the nutritional status of children. Demographic factors-like ethnicity were significantly associated with the nutritional status of mothers and children, whereas factors like pre-lacteal feeding and cultural practices of the mother were significantly associated with the nutritional status of the children. The study did not analyze and report the magnitude of intrafamily difference in the nutritional status in mother child pairs or factors responsible for the differences.

NFHS-3 was the first national survey to report differences in nutritional status between mother and her under five children (IIPS 2006). Data from all the subsequent national survey report high overnutrition rates in adults and high undernutrition rates in under five children and other children but have not analysed and reported the data on intrafamily differences in nutritional status between adults and children in the same family.