MILLENNIUM DEVELOPMENT GOALS

Millennium Development Goals (MDG's) is a roadmap representing the world's commitment to deal with global poverty in its many dimensions. MDGs are eight time bound and measureable goals to be reached by 2015. MDGs promote eradication of poverty and hunger, universal education, gender equality, maternal health and aims at combating child mortality, HIV/AIDS, and other diseases. The MDGs are interlinked and progress in one goal supports progress in others (UNDP, 2010)

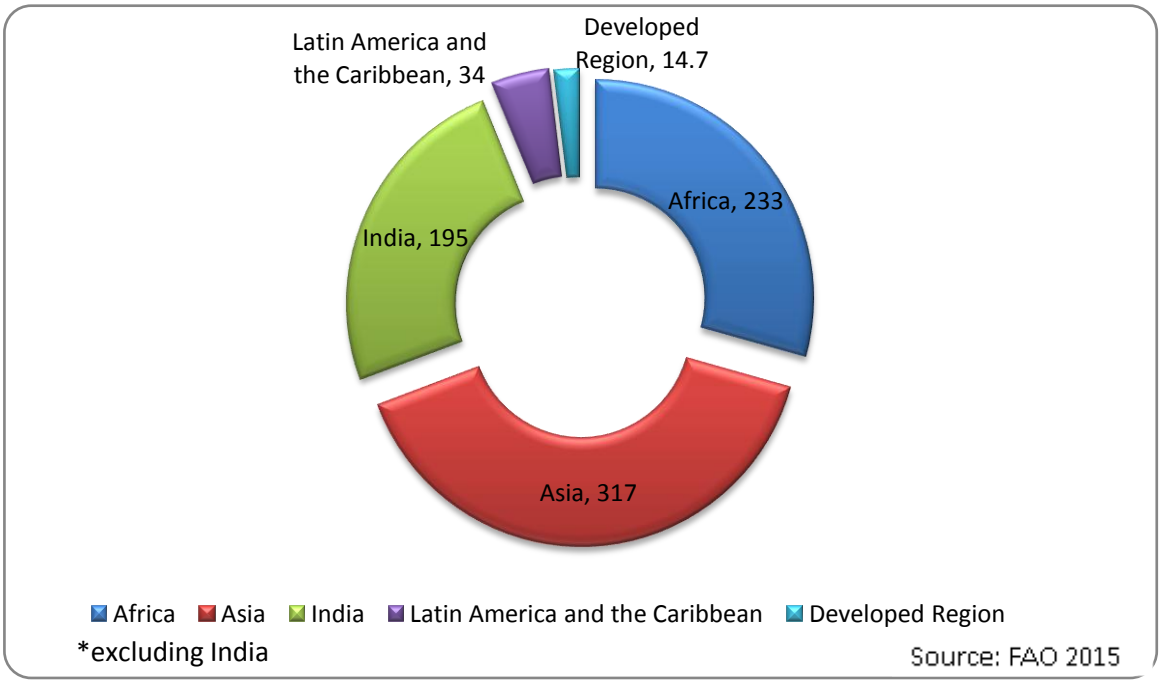
Nutrition is linked to most if not all Millennium Development Goals (MDGs), which are themselves closely interlinked and the right to food and good nutrition for all is fundamental to achieving the MDGs. The most vulnerable are those whose nutritional needs are higher and social status is lowest.

HUNGER AND NUTRITIONAL STATUS

The first Millennium Development Goal calls for the eradication of extreme poverty and hunger, and its achievement is crucial for national progress and development (Ramesh et al., 2013).

Hunger is a clear manifestation of failure in social protection. Hunger and malnutrition are, to a large extent, two sides of the same coin. Recent increase in industrialization and economic growth may have contributed to improving the human development index in under developed and developing countries. However, hunger and food insecurity are still rampant and continue to take a toll on the human population in the developing world. According to the 2015 Food and Agriculture Organization's (FAO) estimate, 795 million people in the world were chronically hungry and the number of undernourished people in India is highest in the world (194.6 million) **(Figure 2.1)**. Many of these are children, and a vast majority of them are in developing countries. These numbers suggest that the Millennium Development Goals

Figure 2.1: Prevalence of Undernourished Population in the World (Millions) in 2014-16



related to hunger and malnutrition may not be met by 2015 (Lawson, 2012). The cost of hunger is extremely high, costing the poor countries up to 3 per cent of their yearly GDP. Improving nutrition could add 2 to 3 per cent a year to a poor nation's GDP.

India is home to the largest number of hungry people in the world. The Global Hunger Index (GHI) 2010 ranks India at 67 out of 122 countries; whereas the '2012 Global Hunger Index' (IFPRI) ranks it at 65 among 79 countries. Similarly, malnutrition in India, especially among children and women, is widespread acute and even alarming (Association of Voluntary Agencies for Rural Development, 2013).

The locus of poverty and undernutrition among children appears to be gradually shifting from rural to urban areas, as the number of the poor and undernourished increases more quickly in urban than in rural areas. The rural-urban gap in nutrition has narrowed in recent decades – essentially because the situation has worsened in urban areas (UNICEF, 2012).

HUNGER AND EDUCATION

Hunger lays the foundation for all other development issues, including health and education (Hunger is the world's greatest solvable problem). Education is the core of human development and it improves the level of human well being-especially with regard to life expectancy, infant mortality and nutritional status. Education is an essential prerequisite for achieving equality, dignity, empowerment and social justice as well as for fighting against poverty. As poverty is the key factor for keeping children out of school results obtained from household surveys in 63 developing countries between 2005 and 2011 (United Nations, 2013). School feeding programs helps poor children to get into school, help them to stay in school as well as help them to learn while they are at school.

As reported by UNICEF (2012), poverty also can severely limit a child's education in urban areas as children from the poorest urban households are

likely to have fewer years of schooling than children from wealthier urban households but also than their rural counterparts.

SCHOOL AGE CHILDREN

Children are the wealth of any country. School age children corresponds to the period from kindergarten, a period of high mortality risk and continues through most of the adolescent growth spurts and sexual maturation to young adulthood. School age children constitute a substantial fraction of world's populace, numbering about 24% of the less developed world and about 15% of that of the industrialized world (Masibo & Labadarios, 2013; Shariff, Bond, & Johson, 2000). In India, about 27% of the population represents school age children (Sultan, 2014).

Urban areas offer great potential to secure children's rights and accelerate progress towards the Millennium Development Goals (MDGs) as cities attract and generate wealth, jobs and investment, and are therefore associated with economic development. The more urban a country, the more likely it is to have higher incomes and stronger institutions. Children in urban areas are often better off than their rural counter. But urban advances have been uneven, and millions of children in marginalized urban settings confront daily challenges and deprivations of their rights (UNICEF, 2012).

The school-going ages have high significance as it is a dynamic period of growth and development as children undergo physical, mental, emotional and social changes during this stage (Bharati, Itagi, & Megeri, 2005). Good nutrition is an essential determinant of the health, physical growth, development, educational performance and progression in life of school-age children (Masibo & Labadarios, 2013). Therefore from the nutritional point of view they constitute a vulnerable group. This vulnerability is easily susceptible to malnutrition and infection (Prabhakar & Gangadhar, 2009).

The physical growth of children is reflected by different anthropometric measurements especially weight and height. The physical dimensions of the

body are influenced by nutrition which play a vital role in growing period of school children. Poor health and inadequate nutrition resulting in underweight, stunting, thinness/wasting, low immunity and therefore reduced work capacity and poor mental and social functions and development (Singh, Kariwal, Gupta, Singh, & Imtiaz, 2014).

Along with nutrition, socio-economic and environmental factors are other problems that are accentuated as they highly affect the growing child (Seetharaman et al., 2007). Child malnutrition has risen in recent years. Globally, malnutrition is a major public health problem especially in developing nations of Africa and South Asia (Banik & Chatterjee, 2010).

GROWTH OF SCHOOL CHILDREN

Growth and nutrition are the best indicators of well-being of children. Growth during childhood is internationally recognised as an important indicator where growth monitoring is an integral component used to assess adequate health, nutrition and development of children, and to estimate overall nutritional status as well as health status of a population. Compared to other health assessment tools, measuring child growth is a relatively inexpensive, easy to perform and non-invasive process (Srivastava et al., 2012).

Anthropometry is the single most universally applicable practical tool used for evaluating the nutritional status of populations, particularly of children in developing countries (Goon et al., 2011). Based on the age, body weight and height, three anthropometric indicators often used to assess nutritional status during childhood are underweight (low weight-for-age), stunting (low height-for-age), and wasting (low weight-for-height) (Bisai & Mallick, 2011). Interpretation of child growth in a population depends primarily on the growth reference used (Mushtaq et al., 2012).

A number of studies have been conducted to assess the nutritional status of children in which different classifications like IAP, Gomez, Waterlows etc were used. Since different cut off value for normality was used in different systems

therefore these cannot be used universally. Even previous studies reported from various populations in the world based on the WHO definitions of the different types of malnutrition in children was derived from the National Centre for Health Statistics (NCHS) growth standards. (Fetuga et al., 2011).

To overcome this problem, WHO has recently recommended the use of Z-Score or SD system to grade undernutrition as this system allows us to measure all the three indices i.e. underweight, stunting, and wasting (Anjum, Pandit, Mir, & Bhat, 2012) and express the results in terms of Z scores or standard deviation. Children who are more than 2 SD below the reference median (i.e. a Z-Score of less than -2SD) are considered to be undernourished i.e. to be stunted, wasted or to be underweight. Children with measurements below 3 SD (a Z-Score of less than -3SD) are considered to be severely undernourished (Seetharaman et al., 2007). Although widely recommended, literature search revealed dearth of local and international data on the clinical use of the Z Scores of WHO 2007 Reference Standards, in the assessment of nutritional status of school children especially in community-based studies. However, the new WHO charts do not contain weight-for-height standards unlike the NCHS charts. This implies that wasting cannot be assessed in children older than five years using the new WHO reference standards (Fetuga et al., 2011). The Body Mass Index (BMI) is another alternative anthropometric indicator that can be utilized for the assessment of the nutritional status among children and this assessment is done in terms of thinness (low-BMI-for-age) (Sen, Dey, & Mondal, 2011). Since weight- for-age (WAZ) is inadequate indicator for monitoring child growth beyond pre-school years due to its inability to distinguish between relative height and body mass, therefore, now BMI-for-age is recommended by the WHO and USCDC to assess thinness/wasting in school-aged children and adolescents (Amare et al., 2012)

Stunting is an indicator of chronic under nutrition, the result of prolonged food deprivation or disease/illness and wasting is an indicator of acute under nutrition, the result of more recent food deprivation or illness; While Underweight is used as a composite indicator to reflect both acute and

chronic under nutrition, although it cannot distinguish between them. The advantages of the z-score system are that besides being sex specific and able to measure all the three indices, it allows comparison across indicators and countries. Since these indices do overlap, because of their overlapping none is able to provide a comprehensive estimate of the number of undernourished children in a population; some children who are stunted will also have wasting or be underweight; some children who are underweight will also have wasting or become stunted and some children who have wasting will also be stunted and/or underweight (Anwar, Gupta, Prabha, & Srivastava, 2013). Subsequently, the use of the Composite Index of Anthropometric Failure (CIAF), which is an aggregated single anthropometric measure providing an overall estimate of under- nourishment in children, has been proposed. The original model, proposed by Svedberg, comprised of 6 sub-groups of anthropometric failure (Groups A-F) to which Nandy et al. supplemented one more sub-group (Group Y). The CIAF includes those children who experience stunting, under-weight, wasting and multiple failures (Groups B-Y) and excludes those children who do not exhibit any anthropometric failure (Group A). These composite groups include children who have a height and weight appropriate for their age of reference and show data that are not considered as anthropometric failure (Sen et al., 2011). The disaggregation of CIAF has an adequate potential to enhance the efficacy of a nutritional intervention programme by identifying double or multiple failures (Sen & Mondal, 2012).

MALNUTRITION

World Health Organization defines malnutrition as the cellular imbalance between supply of nutrients and energy and body's demand to ensure growth, maintenance and specific function (WHO, 2000). Clinically, malnutrition is characterized by inadequate or excess intake of protein, energy and deficiency of micronutrients (Musa et al, 2013). Malnutrition is a public health significance among children all over the world (Hasan, 2010) and is one of the important cause of more than half of all child deaths worldwide. For nearly half

of the 2.2 billion children in the world, childhood is starkly and brutally different from what we all aspire (Khan, Bano, & Salam, 2006). Also longitudinal studies on the growth of school-age children are limited, despite the importance of this age group. The available studies indicate that the patterns of prevalence of undernutrition in school-age children are similar to the patterns seen in preschool children, which offer more robust data (Masibo & Labadarios, 2013). That might explain why most of the available studies on childhood malnutrition had focused on the pre-school age (Fetuga et al., 2011).

MALNUTRITION WORLD WIDE

Malnutrition remains the world's most serious health problem and the single biggest contributor to child mortality. More than one-half of the 9.7 million child deaths worldwide are linked to under nutrition. Globally, malnutrition among school age children is becoming a major public health concern. More than 200 million school age children are stunted and underweight and if no action is taken now, then at this rate, about one billion school children will be growing up by 2020 with impaired physical and mental development (Mekonnen, Tadesse, & Kisi, 2013; Sultan, 2014; Wolde, Berhan, & Chala, 2015).

Malnutrition permeates all aspects of health, growth, cognition, motor, and social development of young children in developing countries. Irreversible and lifelong sequelae prevent children from reaching their full potential (Abou-zeid et al., 2006).

Undernutrition is defined as the outcome of insufficient food intake and repeated infectious diseases. It includes being underweight for one's age, too short for one's age (stunted), dangerously thin for one's height (wasted) and deficient in vitamins and minerals (micronutrient malnutrition) (UNICEF 2006).

It has been estimated this approximately 70.00% of the world's undernourished children live in Asia, giving that region the highest concentration of worldwide childhood undernutrition (Singh & Mondal, 2013).

The prevalence of undernutrition among school children across the globe ranged from as low as 5% in Turkey to as high as 52% in Kuala Lumpur**,** stunting from 12% to 52% and wasting/thinness from 7% to 37% **(Table 2.1).** The table summarises the description of selected studies on the nutritional status of school children based on global setting, age group, references used and the prevalence.

Prevalence of Undernutrition in India

Child malnutrition has risen in recent years in India and Under-nutrition among children is prevalent in almost all the states in India (Manna et al., 2011)

Malnutrition in India is in a state of silent emergency as India ranks 2nd in child malnutrition, which is an alarming fact and thereby demands greater priority than ever before as child malnutrition has a long term negative impact on country's economic growth (Mehrotra, Arora, & Nagar, 2011).

Studies have reported a large section of children especially the urban and rural poor in India are suffering from varying grades of malnutrition. It has been estimated that about two third of children do not take adequate nutrition that leads to macro and micro nutrient deficiencies resulting in malnutrition, which affects the physical and mental health of the children (Alim, Khalil, Mirza, & Khan, 2012).

School children are at high risk of nutritional deficiency and have not received as much attention from health planners as their nutritional status is poorly documented. Because most of the studies in this country have been conducted on under five children. There is an also significant lack of systematic reviews of underweight problems in school age children and

Table 2.1: Prevalence of Undernutrition across the World

Sr. No.	Author	Year	Place	Age-Group	Standards Referred	Underweight (%)	Stunting (%)	Thinness (%)
1.	Shariff, Bond, and Johson	2000	Kuala Lumpur	6-10 years	NCHS/CDC	52	50	30
2.	Hettiarachchi et al	2005	Sri Lanka	12-16 years	CDC 2000	B-42.1, G-33.4	B-19.9 G-17.5	B-43.2 G-23.8
3.	Leenstra	2005	western Kenya	School girls 12–18y	CDC (2000)	-	12.1	15.6
4.	Abou-zeid, Alaa H et al	2006	Saudi Arabia	6-13 years	NCHS/WHO	14.2	12.2	13.8
5.	Groeneveld et al	2007	Guatemala	8-10 yrs	NCHS/CDC	L.SES–13.4 (B), 14.6 (G) H.SES – 4.3 (B), 4.8 (G)	L.SES– 27.7 (B), 26.3 (G) H.SES– 5.8 (B), 8.5 (G)	-
6.	Aboussaleh, Y. & Ahami, A	2009	Morocco	12-16 years	NCHS/WHO	-	25	8.36
7.	Özgüven I et al.	2010	Turkey	14-18 years	WHO criteria	5	4.4	-
8.	Joshi et al	2011	Nepal	4-14 years	Waterlow's	26	13	12
9.	Goon et al	2011	Nigeria	9-12 years	WHO 2007	43.4	52.7	87.4 Severe-3.8
10.	Fetunga et al	2011	Nigeria	6-10 years	WHO 2007	25.5	14.2	22.2

Sr. No.	Author	Year	Place	Age-Group	Standards Referred	Underweight (%)	Stunting (%)	Thinness (%)
11.	Bovet et al	2011	Seychelles	5-16 yrs	WHO	-		6.7 Severe-1.2
12.	Daboné, Delisle & Receveur	2011	Ouagadougou (Burkina Faso)	7-14 yrs	WHO	-	8.8	13.7
13.	Amare et al	2012	Ethiopia	10-14 yrs	WHO	21	23	11
14.	Bhandari	2012	Nepal	5-12 yrs	IAP	Grade I–43.7, Grade II–36.8, Grade III–4.3	-	-
15.	Fiorentino et al	2013	Dakar	5-17 yrs	WHO		4.9	18.4% thin Severe -5.6%
16.	Mekonnen H, Tadesse T & Kisi T	2013	Fogera district, Ethiopia	6-14 yrs	WHO	59.7	30.7	37.2
17.	Taha H. Musa & Elrasheed A. Ali	2013	Khartoum State, Sudan	5-15 yrs	WHO	-	In girls, Sev.–4.6 Mod.– 15.2 In boys, Sev. – 6.2 Mod.-17.4	In girls, Sev.- 6.9 Mod.-19.1 In boys, Sev.–6.7 Mod.-19.7
18.	Wolde et al	2015	Dale Woreda, S. Ethiopia	7-14 yrs	WHO	19	25.6 Sev.-10.3	14

adolescents, as reviews on weight status among children were mainly focused on obesity. The authors surmise that identifying the contributing factors for under-nutrition among schoolchildren is the basic step to set a sustainable and effective nutritional intervention (Wolde et al., 2015).

The prevalence of under nutrition tended to increase from about 63% among 6-9 year age group to 78% in 10-13 years and then decreased to 66% in 14-17 year age group of children. Though no significant gender differences in the prevalence of under nutrition were observed in 6-9 and 10-13 year age groups, a relatively higher proportion of boys (73%) in 14-17 year age group were found to be undernourished as compared to girls (60.4%). **Table 2.2** gives an overview of the prevalence of under nutrition in various parts of India. As can be seen, various studies substantiate the magnitude of the problem of undernutrition among school age group children.

Departmental Studies

Various studies were conducted in the department for assessing the prevalence of under nutrition among school children in different parts of Gujarat which are given in **Table 2.3**. The studies reveal that the prevalence of undernutrition ranges from 6% to 72% amongst the school children with fewer prevalence for stunting.

Causes of Malnutrition

According to the framework, developed by UNICEF in the year 1990, causes of malnutrition are complex, multi-factorial and multi-sectoral, embracing food, health and caring practices. They are also classified as immediate, underlying, and basic, whereby factors at one level influence other levels **(Figure 2.2)**. The immediate causes of the nutritional status at the level of the individual human being are dietary intake and health status. The two factors are interlinked and tend to create a vicious cycle. As an example of the interdependence, loss of appetite is a common consequence of infection and sickness which might further reduce dietary intake. At the household level, the

Table 2.2: Prevalence of Undernutrition in various parts of India

Sr. No	Author	Year	Place	Age-Group	Standards Referred	Under-weight (%)	Stunting (%)	Thinness (%)	Anemia (%)
1.	Panda et al	2000	Ludhiana	5-16 years	Waterlow'stunting	52.2	26.3	-	26.0
2.	Das & Biswas	2005	N-24 Parganas, WB	10-19 yrs adolescent girls	WHO/NCHS	-	37.8	14.7	44.8
3.	Semwal et al	2006	Dehradun	6-14 yrs	Waterlow'stunting	52.6	26.3	-	28.4
4.	Medhi et al	2006	Assam	6-14 yrs	NCHS	6-8 yrs – 51.7	6-8 yrs – 47.4 9-14 yrs – 53.6	6-8 yrs – 21.2 9-14 yrs – 53.9	-
5.	Das et al	2007	Hoogly, WB	10-19 yrs	NCHS	-	52.45	25.49	-
6.	Handa et al	2008	Allahabad	7-10 yrs	NCHS	25	17.3	3	65.33
7.	Mukherkee, Chaturvedi & Bhalwar	2008	Pune	5 – 11 yrs	NCHS/WHO	9.87	13.81	6.71	-
8.	Neelu et al	2010	Meerut	5 – 11 yrs	IAP	49.5	43.8	44.6	-
9.	Banik & Chatterjee	2010	Haldia, WB	9 -13 yrs	NCHS	8.3	14.6	2.80	-
10.	Dambhare et al.,	2010	Wardha	10-19 yrs	WHO	51.7	34.5	-	28.45

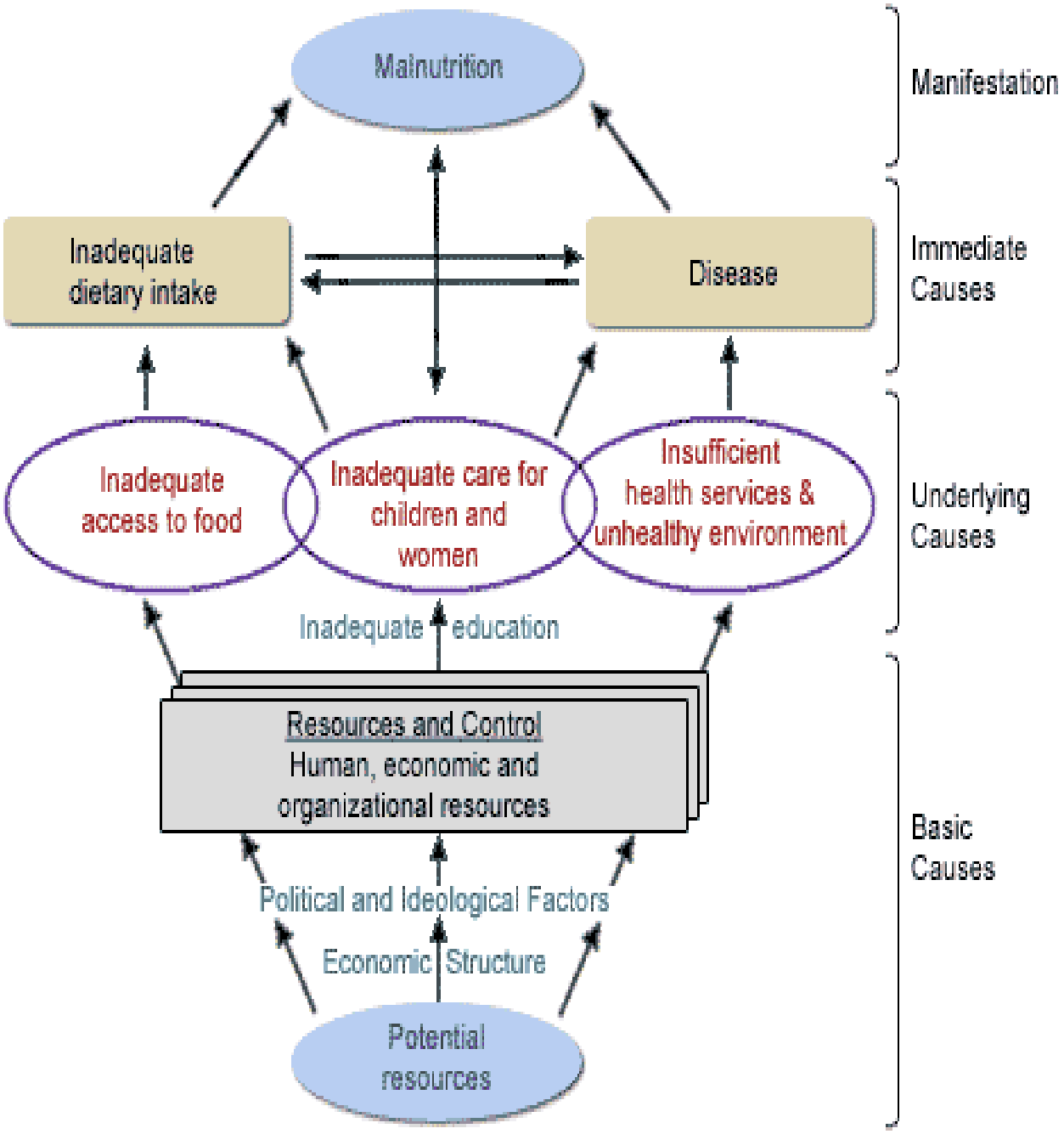
Sr. No	Author	Year	Place	Age-Group	Standards Referred	Under-weight (%)	Stunting (%)	Thinness (%)	Anemia (%)
11.	Hasan et al	2011	Bangalore	5-14 years	NCHS	58.2	40.4	-	-
12.	Sen, Dey & Mondal	2011	Darjeeling, WB	5-11 yrs	NCHS	47	38.5	17.4	-
13.	Bisai & Mallick	2011	Medinapur, WB	2-13 yrs	NCHS	52.9	49.6	22.7	-
14.	Anjum et al	2012	Kashmir	5-9 yrs	WHO	10.73	8.90	15.29	-
15.	Alim et al	2012	Aligarh	6-14 yrs	ICMR standards	-	42.83	44.83 Sev.-34.67	-
16.	Sen and Mondal	2012	Darjeeling, WB	1-12 yrs	NCHS	52.0	43.3	21.5	-
17.	Srivastava et al	2012	Bareilly, UP	5-15 years	CDC 2000	38.4	19.9	33.3	37.5
18.	Singh & Mondal	2013	Assam	6-18 yrs	Cole et al	-	-	25.99	-
19.	Kumaravel et al	2014	Madhurai	5-18yrs	Agarwal Standards Cole et al (IOTF)	-	-	12.2 15.3	-
20.	Sameena Sultan	2014	Aligarh	6-12 years	WHO	-	68	79.4	-

Table 2.3: Prevalence of Under Nutrition in Various Parts of Gujarat

Researcher	Place	Age (years)	Prevalence
Kuruvilla and Shah, 2007	Urban slums of Vadodara	10-19	Underweight 32.7%, Stunting 70.7%, Thinness 48.5%
Kanani and Nitya, 2008	Urban slums of Vadodara	9-16	Stunting 37.5% Thinness 63.2%
Sharma and Dave, 2009	Vadodara (rural)	Adolescent	Underweight 68.2% Stunting 42.8% Thinness 48.2%
Nambiar and Roy, 2010	Chotta udepur taluka	Adolescent School Children	Thinness 44.7% Stunting 29.2%
Kuruvilla and Mulchandani, 2010	Jhagadia Taluka	10-19	Stunting 42.6 % Underweight 63.4 %
Iyer and Dhaundiyal, 2010	Gandhinagar	5-11	Underweight 65.5-71.8% Stunting 35.1-59.5% Thinness 60.2-67.5%
Iyer and Jain, 2011	Vadodara Rural	5-18	Underweight 78.9% Stunting 47% Thinness 65.4%
Bhoite and Iyer, 2011	Vadodara Rural		Underweight 64% Stunting 31% Thinness 60%
Joshi & Nair, 2011	Vadodara Rural	5-15	Underweight 69% Stunting 47% Thinness 51%
Dhruv and Karbhari, 2012	Urban Vadodara	8-14	Underweight 58% Stunting 46% Thinness 42%

Iyer et al., 2013	Vadodara Rural	5-18	Underweight – 89% Stunting – 72% Thinness-74%
Sengar and Sharma, 2013	Urban Vadodara	10-19	Underweight – 5.7% Stunting – 14% Thinness-33%
Dhruv and Tripathi, 2014	Rural blocks of Vadodara	6- 13 yrs Girls	Severe Underweight=24%, Severe Stunting=7% Severe Thinness=20% Moderate Underweight- 37%, Moderate Stunting- 24% Moderate Thinness- 27%
Gandhi and Desai, 2014	Rural blocks of vadodara	6- 13 years Boys	Severe Underweight=27.9%, Severe Stunting=7% Severe Thinness=24% Moderate Underweight- 35%, Moderate Stunting- 23% Moderate Thinness- 29%

Figure 2.2: Conceptual Framework of Malnutrition



Source: UNICEF, 1990

dietary intake of specific individuals involves two major issues: household food demand and intra-household food distribution. Other aspects such as habits and knowledge about food processing and feeding practices (all of which are shared at the household level) influence the diet composition of the individuals as well as their biological utilization of the food. In addition to the immediate causes of the individual nutritional status, three other factors are at play. These are household food insecurity (in terms of availability and access), inadequate care, lack of (quality) health services, and an unhealthy environment (UNICEF, 1990).

These three factors result from the set of underlying causes of undernutrition, broadly labelled as income poverty. Household food security is a direct prerequisite for adequate dietary intake at the individual's level. The condition of sufficient intake which is adequate for physiological development supports the food utilization. These aforementioned factors emphasize the importance of caring practices such as child feeding and health seeking behaviours, support for mothers during pregnancy and lactation, and mothers' autonomy in household decision making, particularly in health and nutrition related issues. Women's capacity and autonomy in the households are frequently hampered by cultural and institutional aspects. The impact of unhealthy environment as underlying factors of the immediate causes of undernutrition are obvious. Infectious diseases such as diarrheal diseases and respiratory infections are the major nutrition-related health problems due to unhealthy household environments (UNICEF, 1990).

The basic causes, as outlined in the social, economic, and political context, imply that macroeconomic stability, economic growth and its distribution, public expenditure, and governance as well as quality of institutions are among the crucial factors (UNICEF, 1990).

Many poor and marginalized groups live in slums and informal settlements, where they are subjected to a multitude of health threats. Children from these communities are particularly vulnerable because of the stresses of their living conditions. As the prevalence of physical and social settings of extreme

deprivation increases, so does the risk of reversing the overall success of disease prevention and control efforts (UNICEF, 2012).

Consequences of Malnutrition

Millions of children living in developing countries are at risk of malnutrition. The effects of malnutrition are multiple and pose a serious threat. Undernutrition increases the risk for morbidity and mortality among school children resulting in increased school absence, lateness, and school delay. School-age children who suffered from early childhood malnutrition have been found to have reduced capability to study and poor IQ levels resulting in poor school achievement. The physical and mental developmental retardation is associated with undernutrition resulting in non-enrolment or late enrolment in school (Masibo & Labadarios, 2013).

Stunting in childhood, an indicator of chronic undernutrition, leads to reduced adult body size, causing deficits in productivity in adulthood and thus perpetuating the intergenerational cycle of poverty. It is also negatively correlated in cognitive test scores. Thinness in school-aged children can result in insufficient muscle strength, delayed maturation, and reduced work capacity, as well as reduced bone density later in life. Shorter women with smaller pelvic sizes have a higher risk for obstetric complications and are exposed to the possibility of delivering low-birth weight infants and likely to have smaller babies, the resulting intergenerational cycle of undernutrition perpetuates a generational transmission of undernutrition and poverty (Masibo & Labadarios, 2013).

Stunting is also associated with other long-term effects, such as metabolic alterations, which are risk factors for non-communicable diseases, including hypertension and other obesity-related disorders.

MICRONUTRIENT MALNUTRITION

The unified global efforts to mitigate the high burden of essential vitamin and mineral deficiencies, continues to be pervasive and overlaps with the problems of general undernutrition in populations around the world are crucial to the achievement of most of the Millennium Development Goals (MDGs). Globally, an estimated two billion lives are affected by a chronic deficiency of essential vitamins and minerals (micronutrients), collectively known as hidden hunger (Muthayya et al., 2013) and one third of about two billion people suffering from vitamin and micronutrient deficit are in India (Kotecha, 2008).

Micronutrients are essential to sustain life and for optimal physiological function. Iron, iodine, folate, vitamin A, and zinc deficiencies are the most widespread Micronutrient deficiencies, and all these Micronutrient deficiencies are common contributors to poor growth, intellectual impairments, peri-natal complications, and increased risk of morbidity and mortality leading to enormous health, economic and social costs (Bailey, West Jr, & Black, 2015). It has been estimated that micronutrient deficiencies account for about 7.3% of the global burden of disease, with iron and Vitamin A deficiency ranking among the 15 leading risk factors for morbidity and impaired quality of life. In South Asia, highest prevalence rates of Vitamin – A (69%) and a staggering 99% Iron deficiency is seen (WHO 2004).

Among South Asia, India has a high prevalence of micronutrient deficiencies and the available data from India published in 2006 suggest that nearly all school-aged children are deficient in vitamins [folic acid (99%), vitamin B-6 (66%), vitamin B-12 (67%), and vitamin A (44%)] (Thankachan, 2012).

Iron Deficiency

Nutritional anaemia is a recognized public health problem throughout the world. Anaemia refers to a condition in which the number of red blood cells (and consequently their oxygen-carrying capacity) is insufficient to meet the

body's physiologic needs (WHO, 2011). Its causes are multi-factorial, ranging from micronutrient deficiencies such as iron, folate and vitamin B12 to infectious diseases such as malaria and worm infections. Iron deficiency is the most common micronutrient deficiency worldwide and because anaemia is associated with peri-natal mortality, the priorities of most anaemia-control programmes are pregnant women and young children. Yet being anaemic has important consequences for all age groups because a low haemoglobin concentration can impair mental as well as physical performance (Hall et al., 2000) leading to decreased work capacity, as well as impaired immune and endocrine function (Bailey et al., 2015).

GLOBAL PREVALENCE OF IRON DEFICIENCY ANAEMIA

According to WHO (2008), an estimated 24.8% (1.62 billion) of the world's population is anaemic, with the global prevalence of anaemia among school children (6-12 yr old) to be 305 million (25.4%) as shown in **Table 2.4**. The estimated prevalence of anaemia among school children in developing countries is 48% (Alvarez-uria et al., 2014) and is classified as severe public health problem and warrants intervention strategies. These high rates of anaemia, especially in Southeast Asia, clearly indicate that it is likely that almost the entire population has some form of iron deficiency (Ramakrishnan, 2002).

A review of studies of school-age children, the vulnerable group to the effects of ill health during the growing and learning stages, shows that anaemia can affect cognitive performance, growth, motor performance and educational achievements (Abou-zeid et al., 2006).

But there are few data sources on the iron or anaemia status of school going children across the world. **Table 2.5** shows the prevalence ranging from 19% to 83%. It is unclear if children of school age have the same high levels of anaemia as seen in preschool children. Further, they are a neglected group in terms of micronutrient interventions, not reached by the intervention strategies aimed at preschool children or pregnant women (Muthayya et al., 2007).

Table 2.4: Global Prevalence of Anaemia

Population Group	Prevalence of Anaemia	
	Percent	**95% CI**
Preschool Age Children (0-4.99 yrs)	47.4	45.7-49.1
School Age Children (5-14.99 yrs)	25.4	19.9-30.9
Pregnant Women	41.8	39.9-43.8
Non Pregnant women	30.2	28.7-31.6
Men	12.7	8.6-16.9
Elderly	23.9	18.3-29.4
Total Population	24.8	22.9-26.7

Source: *de Benoist B et al., eds.* Worldwide prevalence of anaemia 1993-2005. WHO Global Database on Anaemia Geneva, World Health Organization, 2008.

Table 2.5: Prevalence of Anaemia across the World (%)

Author	Place	Age-Group	Anaemia	Boys/ Girls	Mild	Moderate	Severe
Hettiarachchi et al, 2005	Sri Lanka	12-16 years	54.8	B-49.5/G-58.1			
Keskin et al, 2005	Turkey	12-13 years	19.1	B-17.5/G-20.8			
Aboussaleh, Y. and Ahami, A, 2009	Morocco	12-16 years	32.5	B-33.3/G-32.1			
Onimawo et al., 2010	Nigeria (rural)	7-12 years	82.6		9.6	71.6	1.4
Selmi and Al-Hindi, 2011	Palestine	6-11 years	35.3	B-34/G-36.3			
Righetti et al., 2012	South Central Cote d Ivoire	6-8 years	46.8		94.6	5.4	0
Masibo and Labadarios, 2013	Kenya	6-13 years	70.2		28.1	37.4	4.7
Singh et al., 2013	Nepal	10-19 years	52	B-22.4/G-29.7	67.5	20	12.5

Turyashemererwa et al.,2013	Urban area of Central Uganda	5-11 years	37.7		36.9	0.8	0
Assefa S, Mossie A and Hamza L, 2014	Jimma Town, Southwest Ethiopia	6-14 years	37.6	B-41.2 G-34.6	48	52	
Desalegn A, Mossie A and Gedefaw L, 2014	Southwest Ethiopia	6-12 years	43.7		35.2	49.2	15.6
Mesfin, Berhane, and Worku, 2015	Kersa, Eastern Ethiopia	5-14 Years	27.1	B-27.3 G-26.8	13.8	10.8	2.3

A cross-sectional study carried out among adolescent school girls in the age group of 13-17 years in Chennai to estimate the prevalence of iron deficiency anaemia revealed the prevalence of anaemia to be 78.8% with varying degrees ranging from mild (37.5%), moderate (35%) and severe forms (6%). This study also reported that the prevalence of anaemia was more in government school children (43.5%) than that of private school (35%) (Premalatha et al, 2012).

Table 2.6 shows prevalence of iron deficiency anaemia amongst school children in various parts of India, which ranged from 13.6%-90.1%. A study done by Iyer and Jain in 2011 on 889 rural school children of Vadodara revealed an overall prevalence of anaemia as high as 98.3% of which 45.9% were mildly anaemic, 51.4% moderately anaemic and only 1% were found to be severely anaemic.

Studies conducted by the department to map the prevalence of iron deficiency anaemia in various parts of Gujarat reveal that anaemia ranges from 45% to 98% amongst the school children **(Table 2.7)**.

CAUSES OF ANAEMIA

The most common cause of anaemia worldwide is iron deficiency, resulting from prolonged negative iron balance, caused by inadequate dietary iron intake or absorption, increased needs for iron during pregnancy or growth periods, and increased iron losses as a result of menstruation and helminth (intestinal worms) infestation as shown in **Figure 2.3**. Other important causes of anaemia worldwide include infections, other nutritional deficiencies (especially folate and vitamins B12, A and C) and genetic conditions (including sickle cell disease, thalassaemia – an inherited blood disorder – and chronic inflammation)

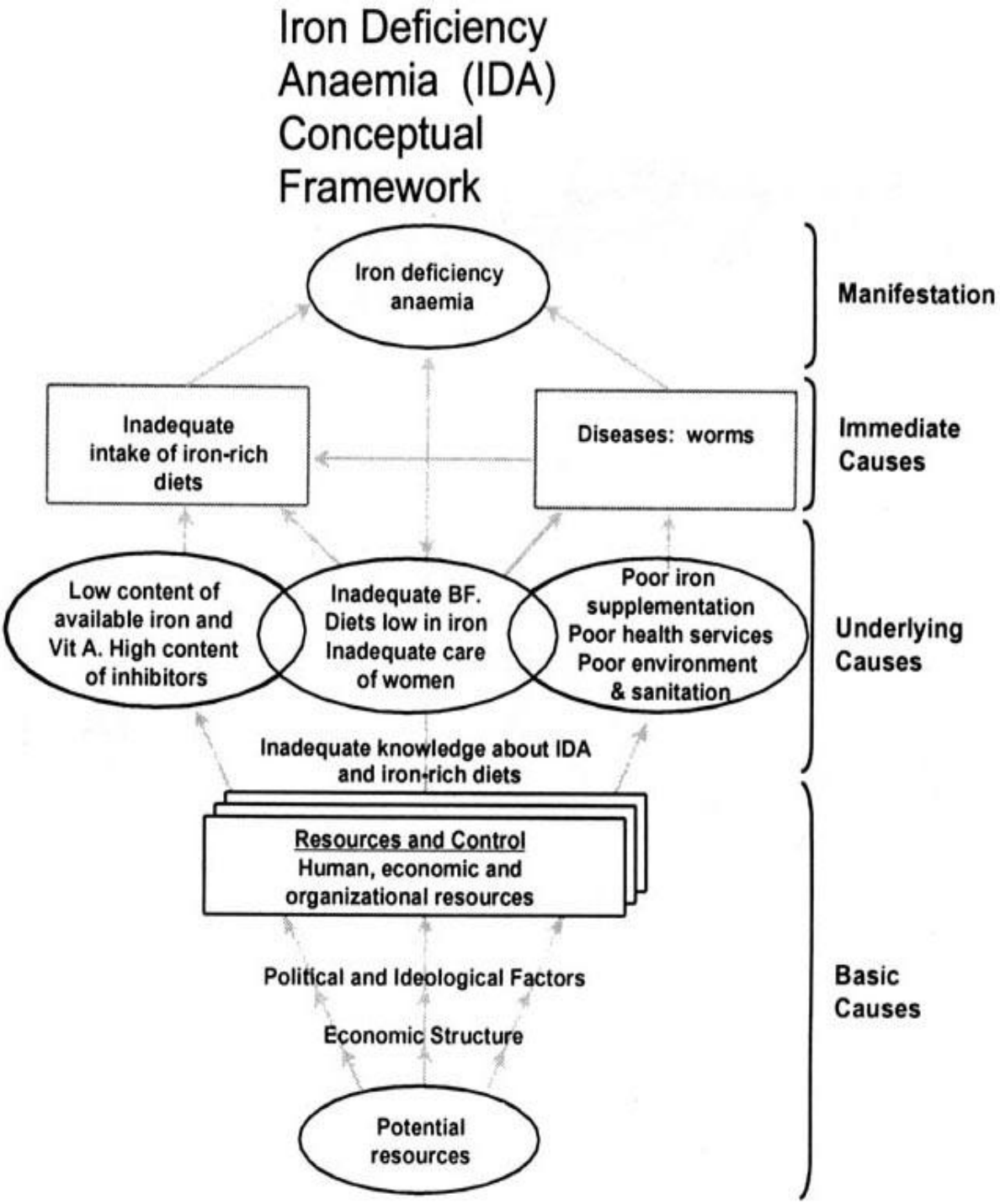
Table 2.6: Prevalence of Anaemia across India

Author	Place	Age-group (Years)	Anemia (%)	Boys/ Girls	Mild	Moderate	Severe
Toteja et al., 2006	16 districts of 11 states	11-18	90.1	Adolescent girls	32.1	50.9	7.1
Muttayya et al., 2007	Bangalore	5-15	13.6	B-12.0; G-15.3	11.2	2.1	0.3
Chaudhary and Dhage, 2008	Urban area of Nagpur	10-19	35.1	Adolescent girls	24.3	10.8	0
Handa et al., 2008	Allahabad	7-10	65.33		53.33	12	0
Sudhagandhi et al., 2011	Kattankulathur, Tamil Nadu	8-16	52.9	B-35.6;G-67.8	50.2	49.8	-
Premalatha et al, 2012	Chennai	13-17	78.75	Adolescent girls	37.5	35	6
Jain and Jain 2012	Rishikesh	5-16	56.5	B-33.4; G-66.6			
Sabale, Kowli and Chowdary 2013	Mumbai	9-19	53.2	B-50; G-56.5	21.6	30.9	0.8
Bhise, Wadekar, and Tarpe 2013	Ahmednagar	8-16	77.1	B-65.1; G-87.8	42.9	28.1	6.1
Koushik et al, 2014	Guntur, Andhra Pradesh		77.33	Adolescent girls	37.1	50.9	12.1
Senthamarai et al., 2014	Rural area of Salem	7-17	90	B-90.9; G-89.7	57	29	4

Table 2.7: Prevalence of Anaemia in Vadodara

Author	Location	Age Group	Anaemia Prevalence %	Mild	Moderate	Severe
Dhruv and Tripathi,2014	Rural Vadodara	6-14 years	(in girls) 55.22	23.91	29.57	1.74
Gandhi and Desai,2014	Rural Vadodara	6-14 years	(in boys) 53.7	28.2	24.7	0.9
Kuruvilla and Kotwal, 2014	Vadodara	9-18 years	17.23	13.10	4.13	-
Iyer and Mistry, 2013	Rural Vadodara	5-18 yrs	(in girls) 52.8	28.3	22.6	1.9
Gandhi and Patel, 2013	Rural Vadodara	5-18 yrs	In boys 49.4	26.5	22.8	0
Sengar and Sharma,2013	Urban Vadodara	10-19 years	42.6	27.9	13.1	1.6
Joshi K. and Nair, 2012	Rural Waghodiya	5-15 years	99.2	27.3	67.8	4.1
Dhruv and Karbhari,2012	Rural industrial Vadodara	7-16 years	45.7	41.9	2.5	1.3
Bhoite and Iyer, 2011	Rural Vadodara	6-14 years	72.2	57.6	14.2	0.4
Iyer and Jain,2011	Rural Vadodara	5-18 yrs	98.3	45.9	51.4	1
Nambiar and Roy,2010	Tribal Chotaudepur		65	55		
Iyer and Dhaundhiyal, 2010	Gandhinagar	4-18 years	72.8	87.3	11.3	1.4

Figure 2.3: Causes of Anaemia



Source: UNSSCN, 1997

CONSEQUENCES OF ANAEMIA

Anaemia has far reaching public health implications, such as inadequate growth and mental development in children, high maternal mortality and incidence of low birth weight infants and low productivity in adults. Anaemia also affects school performance among school children and adolescent due to impaired learning ability.

Anaemia among children result in impaired cognitive performance, behavioural and motor development, poor coordination and language development as well as increased morbidity from infectious diseases. Lowered attention span adversely affects mental concentration and such insufficiency in cognitive functions of anaemic children would further affect the overall performance of school children, which may ultimately result in school dropouts. Minimal work capacity, work output and endurance are impaired which reduces their physical work capacity leading to decreased work productivity.

Iron deficiency anaemia is a major factor contributing to maternal morbidity and mortality. Maternal anaemia may also lead to fetal growth retardation, low birth-weight infants and increased rates of early neonatal mortality.

The adverse functional effects of anaemia described above have major social, educational and economic implications.

STRATEGIES TO COMBAT MICRONUTRIENT MALNUTRITION

Clearly, there is an urgent need for programmes to alleviate micronutrient deficiencies in developing countries. The time-tested strategies universally promoted to combat micronutrient malnutrition are supplementation and food-based approaches, preferably in conjunction with public health interventions (Thompson & Amoroso, 2011).

The International Conference on Nutrition (ICN) Declaration (FAO, 1992) advocating a strategy to combat micronutrient malnutrition stated: **'… ensure that sustainable food-based strategies are given first priority particularly for populations deficient in vitamin A and iron, favouring locally available foods and taking into account local food habits'**. Food-based intervention strategies attempts to improve the nutrition of households by enabling families to have access to and to consume a diversified diet rich in micronutrients. Sustainable food-based approaches to enable adequate consumption of micronutrients include dietary diversification and bio-fortification (Thompson & Amoroso, 2011).

Diversification of Diet: Diet-based strategies are probably the most promising approach for a sustainable control of micronutrient deficiencies. Increasing dietary diversification through consumption of a broad variety of foods, preferably from home gardens and small livestock production, is effective. Households should be educated and supported to increase production of dark-green leafy vegetables, yellow and orange fruits, poultry, eggs, fish and milk (Müller & Krawinkel, 2005).

Supplementation: Micronutrient Supplementation refers to periodic administration of specific nutrients in the form of capsules, tablets or by injections to help to meet the immediate deficits of vulnerable groups. An example is the provision of iron and folate supplements. Fact for concern is the feasibility and sustainability of supplementation as a mode of delivery in poor resource settings (Thompson & Amoroso, 2011). Though micronutrient supplementation programmes can have an immediate effect on micronutrient deficiencies, these programmes have to be complemented with more sustainable food-based approaches (Masibo & Labadarios, 2013).

Bio-fortification: In the long term, bio-fortification of staple cereals, involving strategies to enhance both their micronutrient content and bioavailability, may become a feasible option for improving the micronutrient status of the entire household and across generations in poor resource settings. Unlike fortification at the national level, bio-fortification does not depend on a food

vehicle being centrally processed. Hence, bio-fortification has the potential to fill the gap in coverage left by mass fortification because it can be more accessible to the rural poor who consume staple foods from local or self-production. Bio-fortification can be achieved by three processes: (i) agronomic practices; (ii) conventional plant breeding; and (iii) genetic modifications involving gene insertions or induced mutations (Thompson & Amoroso, 2011).

Fortification: WHO defines food fortification as the practice of deliberately increasing the content of an essential micronutrient, i.e., vitamins and minerals (including trace elements) in a food, in order to improve the nutritional quality of the food supply and provide a public health benefit with minimal health risks. Micronutrient fortification involves the addition of one or more micronutrients to foods, mainly during industrial processing, so as to increase the intake of the specific micronutrients in order to correct or prevent a deficiency while providing a wider health benefit for a population (Masibo & Labadarios, 2013).

Food fortification is regarded at the present time as the safest and most cost effective approach for populations that consume significant quantities of industrially manufactured foods. Staple foods such as cereal flours and condiments are the most appropriate food vehicles for fortification (Hurrell et al., 2010). Fortification of wheat flour with iron is technically relatively simple and this has been successfully implemented in several countries in the Caribbean, South America, North America, and Great Britain (Stoltzfus, R. J., & Dreyfuss, M. L., 1998)

Fortification of a suitable food vehicle with multi-micronutrients for use in pre-existing lunch programs in day care centers and schools has the potential to combat co-existing micronutrient deficiencies among children (Winichagoon et al., 2006).

In response to concerns about coexisting micronutrient deficiencies among schoolchildren in developing countries, targeted multiple micronutrient

fortification strategies using biscuits or beverages have been investigated as shown in **Table 2.8**.

Van Stuijvenberg et al. were interested in determining the effects of providing schoolchildren with mineral-fortified biscuits on their micronutrient status. The researchers conducted their study in a rural school in South Africa located in an area with a high prevalence of micronutrient deficiencies. Anaemia, vitamin A, and iodine deficiencies were reduced by 13%, 28%, and 67%, respectively, in the study population (van Stuijvenberg et al., 1999)

Abrams et al. found a significant beneficial effect of the multiple micronutrient fortification of food on changes in weight, BMI, MUAC and weight-for-age z-scores, as well as changes in serum ferritin, folate, riboflavin, Hb and MCV among school children in Botswana (Abrams et al., 2003).

In India, Osei et al (2008) in a cross-sectional randomized controlled study assessed the social acceptability of micronutrient fortified cooked lunch meals (Fortified premix with 14 micronutrients) by schoolchildren studying in 1-5th standards in 4 government primary schools of rural Himalayan villages of India. They reported that addition of the multi-micronutrient premix to school meals did not significantly affect the mean amount of food consumed by the school children and did not affect the taste, smell, and the general acceptance of the micronutrient fortified school meals**.**

Bhagwat et al., (2014) tested the operational feasibility of fortifying the school meal in centralised kitchens of Naandi Foundation, as well as the acceptability of fortified meals by school children. She reported that fortification of hot cooked meals pre-pared and served from the centralized kitchens under the MDM scheme is feasible and acceptable to the beneficiary children, teachers and parents.

Table 2.8: Studies on Impact of Micronutrient Fortified Products on School Children

Author, Year	Place	Age Group	Fortificant	Impact
Ash et al; 2003	Tanzania	6-11 years (N=841) from 6 schools	Fortified Beverage with 10 micronutrients for 6 months	• Significant improved hematologic and anthropometric measurements • Significantly decreased the prevalence of anaemia and Vitamin-A deficiency
Solon et al;2003	Philippines	1-6th standard (N=808) from 4 schools	Multiple micronutrient fortified beverage with 11 micronutrients for a period of 16 weeks	• Significantly improved Hb and UIE levels • Physical fitness and cognitive performance among Iron and Iodine deficient improved significantly
Winichagoon et al; 2006	Rural NE Thailand	6-13 years (N=569) from 10 schools	Multiple micronutrient fortified powder with 4 micronutrients along with school lunch for a period of 31 weeks	• Significantly improved Iron, Iodine and Zinc status. • However, no effect on Anaemia, Vitamin – A deficiency and Zinc deficiency
Manger et al; 2008	Rural NE Thailand	6-13 years (N=569) from 10 schools	Multiple micronutrient fortified powder with 4 micronutrients along with school lunch for a period of 31 weeks	• No significant effect on anthropometric measurements. • Decreased incidence of morbidity

Nga et al; 2009	Rural Vietnam	6-8 years (N=510) from 2 schools	Multiple micronutrient fortified biscuits with 4 micronutrients for 4 months	• Significantly Decreased the risk of Anaemia, Zinc and Iodine deficiency by >40%.
Muthayya et al; 2009	Bangalore, India	6-10 years (N=598) from 2 schools		• significantly improved linear growth at 1 year • significantly improved short term memory at 6 months
Thankachan et al., 2012	Bangalore, India	6-12 years (N=258) from 4 primary schools	Fortified rice kernels with 8 micronutrients incorporated in school meals for 6 days in a week for 6 months	• Significantly improved plasma vitamin B-12, homocysteine and physical performance. • No difference seen in haemoglobin levels.
Sazawal et al; 2013	Bangladesh	6-9 years (N=1010) from 4 primary schools	Micronutrient Fortified Yoghurt with 4 micronutrients for 1 year	• significantly improved height gain • Zinc status improved but statistically not significant

Hb: Hemoglobin, UIE: Urinary Iodine Excretion

SCHOOL HEALTH PROGRAMME

World Health Organization (WHO) launched 'Global School Health Initiative', in 1995, to mobilize and strengthen health promotion and education activities at the local, national, regional and global levels. The Initiative is designed to improve the health of students, school personnel, families and other members of the community through schools (Bhise, Wadekar, & Tarpe, 2013).

Although the World Bank has included school health as one component of its essential public health package for cost effective health program, the nutrition and health of school-age children in the developing world has received little attention. (Singh et al., 2014)

School Health and Nutrition programs are cost-effective and complementary to save the children's early childhood development and basic education efforts, helping children, especially girls, be healthy to learn and learn to be healthy.

Save the Children's School Health and Nutrition intervention programme aims to

- Increase health and nutrition services at schools including: deworming (neglected tropical diseases), micronutrient supplementation, and control of malaria, as well as vision and hearing screening.
- Increase access to safe water, sanitation and hygiene (WASH) in schools.
- Promote lifelong health behaviors through skills-based health education, including HIV/AIDS prevention.
- Ensure basic health-related school policies and support from individual schools and communities to the national level (Bundy, 2005).

SCHOOL FEEDING PROGRAMME:

According to United Nations' World Food Program (WFP) (2009), in developing countries, almost 60 million children go to school hungry every

day. School feeding is defined as the provision of food to school children. There are as many types of programs as there are countries, but they can be classified into two main groups based on their modalities:

i) In-School feeding, where children are fed in the school, which can be divided into two categories namely;

(a) Program that provides meals:

The primary objective is to provide breakfast, mid-morning meals, lunch, or a combination (depending on the duration of the school day) to alleviate short-term hunger, increase attention span, facilitate learning, and obviate the need for children to leave the school to find food. In-school meals also act as an incentive to increase school access. School meals can be prepared in schools or in the community, or can be delivered from centralized kitchens. They can be an important source of micronutrients if prepared using fortified commodities, or if micronutrient powder is added during or after preparation.

(b) Program that provides high energy biscuits or snacks:

This program modality functions in a similar way to in-school meals, alleviating short-term hunger and micronutrient deficiencies, and improves learning. They can be part of a meals program, particularly in full-day schools, where they are given biscuits or snacks early in the day to alleviate short-term hunger. They are cheaper and easier to distribute than meals, and often aims to act as an incentive for increased school access, but they are less substantial and their financial value to families is lower. Biscuits are a compact source of nutrients produced off-site that is easy to pack, store, and transport. They are particularly used in emergency or crisis contexts for rapid scale-up or in situations of poor school infrastructure and storage facilities. Snacks require little preparation time and facilities, can be served early in the school day, and typically use fortified commodities such as blended foods. However, their use presumes the availability of safe drinking water because they are typically dry, and their nutritional content is lower than that of meals.

ii) Take home rations where families are given food if their children attend school.

Take-home rations functions in a similar manner to conditional cash transfers. They transfer food resources to families conditional upon school enrolment and regular attendance of children. Rations are given to families typically once a month or once a term. They increase school participation and probably learning. While they may require less school involvement than in-school modalities, they do demand an investment of school time in regular monitoring of the attendance condition. Their effect depends on whether the value of the ration offsets some of the costs of sending the child to school (Bundy, 2009).

Among the three options of school feeding as described in **Table 2.9**, SFP where children are served cooked meals on site has the greatest potential for supporting local community level agricultural activities through the procurement of fresh produce (and is thus most amenable to the 'home grown school feeding' model). In the case of Take Home Ration and High Energy Snacks at school based on pre-packaged snack or a beverage, the program may have to rely on a functional food processing sector at the regional or national level to meet the needs (Lawson, 2012).

What are the Benefits of School Feeding Programme?

A meal at school acts as an attraction to children into the classroom. The benefits of school feeding extend beyond the classroom:

Safety Nets: School meals help families to educate their children and protect them from food insecurity in times of crisis. School meals support development so children can become healthy and productive adults, breaking the cycle of hunger and poverty in the world's most vulnerable areas. The World Bank has highlighted school meals as an affordable, efficient and sustainable social safety net programme. The role of school feeding programmes as social safety nets has been enhanced due to recent and

Table 2.9: Different types of Food for Education programs and their pros and cons

	School Feeding Program (Pre-packaged)	School Feeding Program (Cooked Meals)	Take-Home Rations
Pros	• Children who are supposed to benefit are reached with daily attendance • Parents & students motivated to attend regularly • Food may be shared with younger siblings, who may be in greater need of nutritional support • Alleviates short term hunger so students may focus in classroom • Foods are often fortified	• Children who are supposed to benefit are reached with daily attendance • Parents & students motivated to attend regularly • Able to utilize local fresh produce from nearby farmers • Alleviates short term hunger so students may focus in classroom • Meals often include milk products or other nutritionally dense foods	• Children and families benefit when child attendance levels are fulfilled • Parents & students motivated to attend regularly • Food may be shared with younger siblings, who may be in greater need of nutritional support • Does not take away from teaching time • Able to target specific families and students (i.e. families with girls or younger children)
Cons	• Targeting is broad • May take away teaching time	• Costs may be higher (salaries for cooks, loss of economies of scale, etc.) • Targeting is broad • May take away teaching time	• Nutritional benefits may be diluted within household • Rations are often cereals and oils (might not be fortified)

Source: Lawson, 2012

persistent global food, fuel and financial crisis and high rates of food inflation in most parts of the world especially in country like India (Swaminathan Research Foundation, 2011)

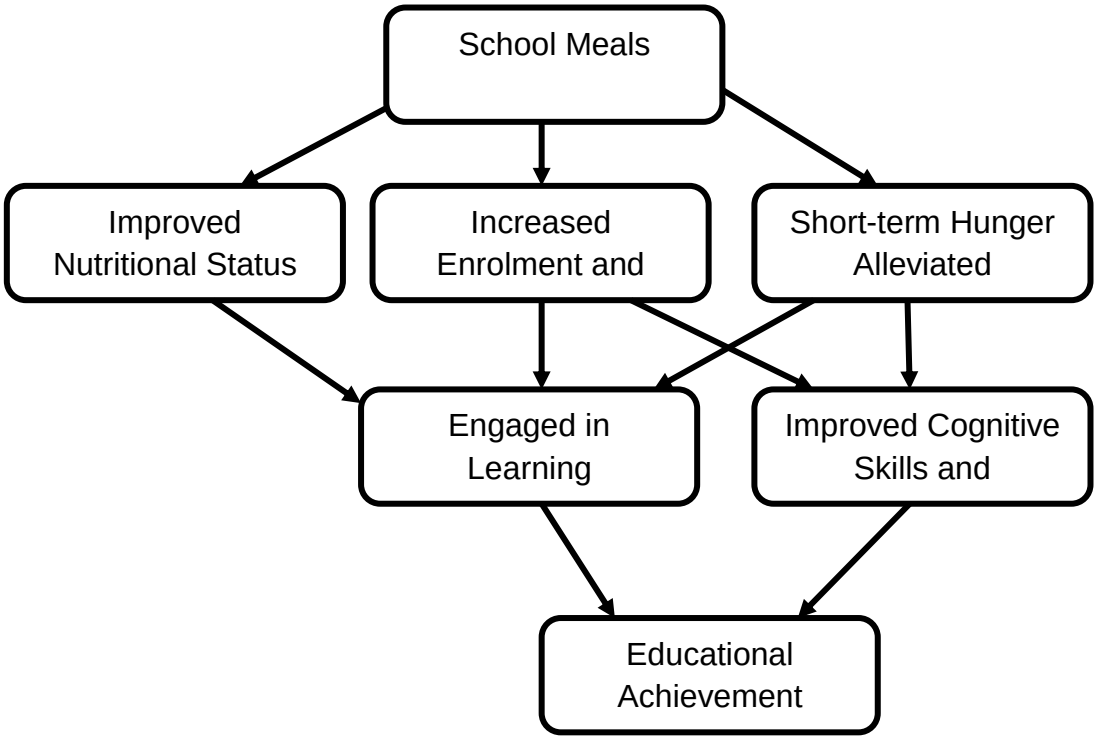
- **Nutrition:** School meals are a good way to channel vital nourishment of poor children. In many poor countries, school meals are often the only regular and nutritious meals a child receives in a day. The short-term impact of school meals is, it helps to alleviate hunger. While, in the long term, it helps to improve the nutritional status of school children.

- **Education:** A daily school meal provides a strong incentive to send children to school and keep them there. It allows children to focus on their studies and helps to increase school enrolment and attendance, decrease drop-out rates, and improve cognitive abilities. Improvement in educational achievement due to school feeding programmes is thought to occur through three pathways, as demonstrated in **Figure 2.4.**

- **Local Agriculture:** Linking programmes to the agriculture sector has direct economic benefits and can potentially benefit the entire community as well as the children. The link to local agricultural production can help the sustainability of the programmes and create predictable and structured markets for local produce due to community involvement. This approach has been identified as one of the critical elements in transitioning to sustainable programmes. Several better-off countries (e.g. Brazil, Chile and Scotland) have demonstrated the effectiveness of purchasing school food locally in order to feed children better and stimulate the local economy (World Food Programme, 2013)

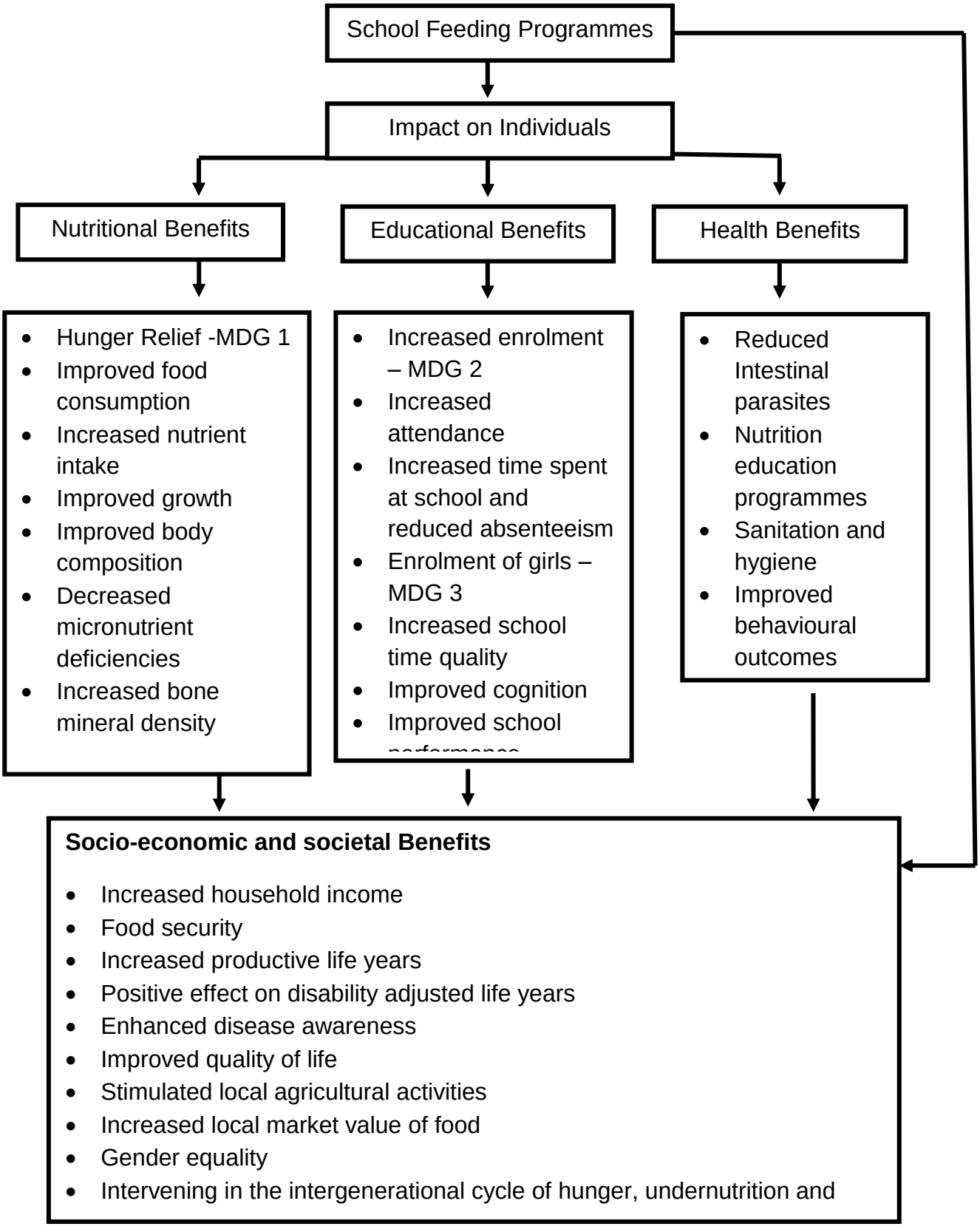
To summarise the school feeding programme contribute to at least three Millennium Development Goals (Goal 1, 2, and 3) and society directly or indirectly as shown in **Figure 2.5.**

Figure 2.4: Relationship between SFP and potential outcomes and impacts on school children



Source: Lawson, 2012

Figure 2.5: Potential Benefits of School Feeding Programme



Source: (Masibo & Labadarios, 2013)

School Feeding Programmes across the World

The coverage of school feeding programmes is lowest in countries where the need is the greatest. In high- and upper-middle income countries, generally all children have access to food through schools, and the most vulnerable children typically are entitled to subsidized or free meals. Current estimates on coverage suggest that while 49 percent of school children receive free meals in middle-income countries, the figure for low-income countries is 18 percent. This suggests that where the need is greatest in terms of hunger, poverty and poor social indicators, the coverage continues to be the lowest.

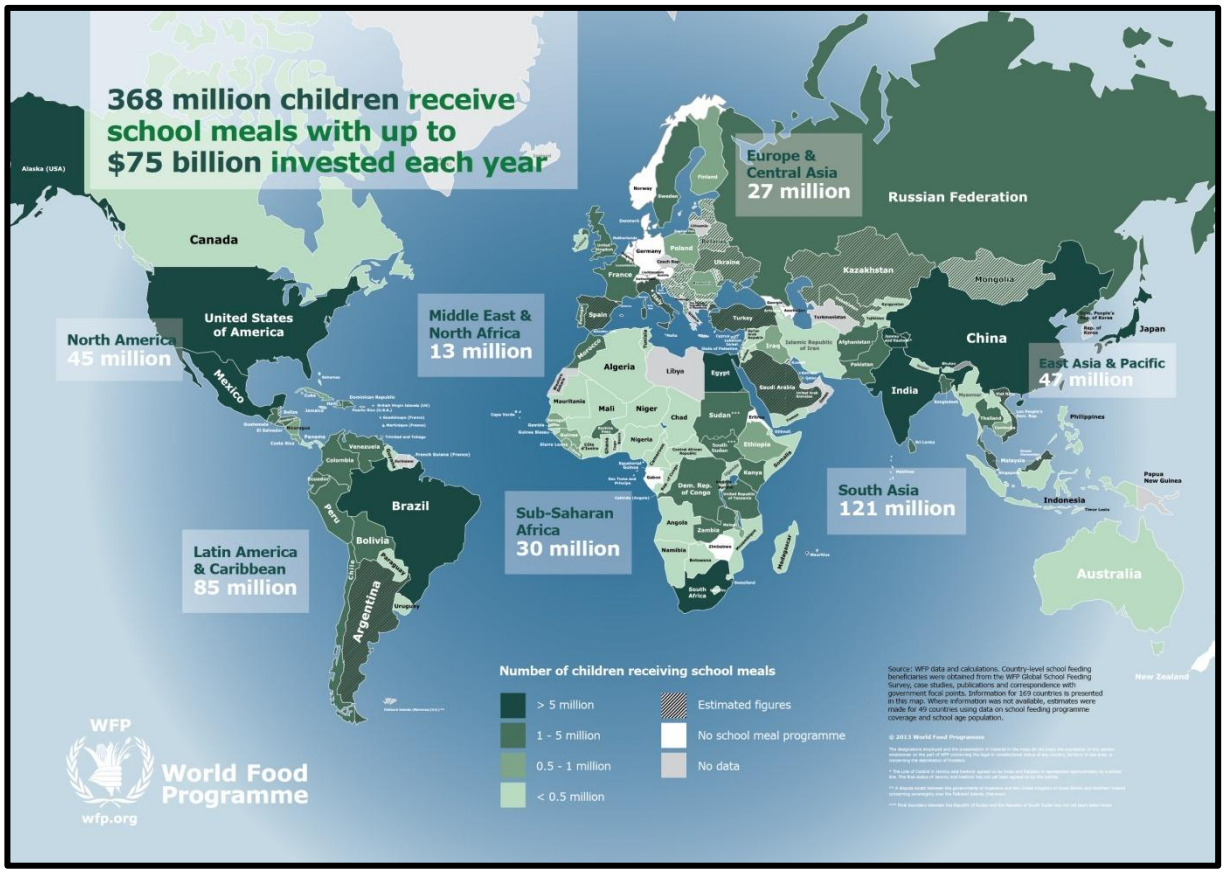
There are at least 368 million pre-primary-, primary- and secondary-school children receiving food through schools around the world based on a sample of 169 countries shown in **Figure 2.6**. The biggest programmes are in India (114 million), Brazil (47 million), the United States (45 million) and China (26 million). There are at least 43 countries with programmes of more than one million children. The region with the largest number of beneficiaries is South Asia, followed by Latin America and the Caribbean (World Food Programme, 2013).

In the last few years, there has been an increase in the level of participation and investment of partners at all levels in school feeding activities. This may be because partners are responding to countries' increased demand for support, and also because they have recognized the role that school feeding can play to achieve social protection and child development goals. Formalizing partner coordination seems to be a matter of priority, especially at the global level (World Food Programme, 2013).

Partnership and coordination at the global level

At global level, the partnership among WFP, WB and PCD has the objective of improving the quality of programmes in low-income countries by applying a more rigorous, evidence-based approach to school feeding and providing coordinated support to the countries that are in the process of transitioning to

Figure 2.6: School Feeding Beneficiaries Around the World



national ownership (i.e. Ghana, Haiti, Kenya, Malawi, Mali, Mozambique and Peru).

Partnership and coordination in Southeast Asia

In Southeast Asia, the Southeast Asian Ministers of Education Organization (SEAMEO) has been promoting cross-country learning and networks on school health, including school feeding, since 1965. SEAMEO is an international intergovernmental organization among Southeast Asian countries that promotes regional cooperation in education, science and culture in Southeast Asia. SEAMEO focuses on quality and equity in education; preventive health education; culture and tradition; information and communication technology; languages; poverty alleviation; and agriculture & natural resources.

Partnership and coordination at the country level

In many countries, it has been challenging to ensure effective mechanisms through which donors and partners can effectively coordinate their inputs and support. Despite this challenge, at the country level, local and international NGOs play a crucial role in implementing and expansion of school feeding. In India, many NGOs work towards countering hunger and malnutrition. The Public-Private Partnership (PPP) has proved instrumental in improving the quality and reach of the programme. There are many facets which the Government considers when selecting a non-profit to partner with. One of them is as in urban areas, space is a constraint, centralised kitchen should be setup if possible for a cluster of schools, cooking may be undertaken in a centralised kitchen and cooked hot meal may then be transported under hygienic conditions through a reliable transport system to various schools.

School Feeding Programme in High Income Countries:

School feeding programme in high income countries (England, France, Italy, Finland and USA) aims to ensure that essential and high quality food is supplied and consumed at schools. In England, France, Italy and Finland,

catering is provided either by local authority or via private catering services. Local authorities either offer an in-house catering service or use a centrally procured. Meals are usually served in canteen style. While in the United States of America (USA), the National School Breakfast Programme and the National School Lunch Programme is administered at the federal level and at the local level, state education agencies operate the programmes (Aliyar, Gelli, & Hamdani, 2012).

School Feeding Programmes in Middle and Low Income Countries

School feeding in middle and low-income countries have very different objectives and goals compared to the high-income countries. School meal provision in high-income countries is driven by evidence that the foods children consume in schools are very high in fat and lack adequate amounts of essential nutrients. SFPs in middle and low-income countries, in the short-term, aim to alleviate hunger, act as a social safety net for low-income households and increase enrolment of children into schools; and in the longer-term, it aims to improve the nutritional status, attendance, cognitive development and retention of schoolchildren (Aliyar, Gelli, & Hamdani, 2012).

Impact of School Meals

A prospective randomized trial was done to assess the impact of two school feeding schemes on educational and health outcomes of children in northern rural Burkina Faso. The study findings showed that school feeding schemes increased girls' enrolment by 6 percent but had mixed impacts on learning outcomes (Kazianga, Walque, & Alderman, 2009).

An observational longitudinal study was conducted in 38 primary schools of Bogota, Columbia to assess the impact of a school snack program (consisting of a beverage, a cereal and/or protein component and a sweet component) on the nutritional and health status of children (N=3202) aged 5-12 years. The result of the study showed that the provision of a mid morning snack at school was related to improved Vitamin B-12 and linear growth and to decreased reported morbidity (Arsenault et al., 2009).

A study conducted by Nkhoma et al (2013), among school children (N=226) aged 6-8years in 2 primary schools of eastern region of Malawi, Southern Africa showed an improvement in reversal learning and catch up growth in lean muscle mass in children receiving fortified porridge at the school.

In 2008, the impact of Ghana School Feeding Programme on nutritional and health status of Ghanaian children was studied by Berg & Brouwer. The cross sectional study reported no difference in the nutritional and health status of children receiving SFP and non SFP as the school lunch provided was replaced for their home lunch.

According to several reviews, the evidence for the impact of school feeding programmes on growth and nutritional status is weak as mixed results are obtained, mainly because there have been few published evaluations of large-scale school feeding programme (Hall et al., 2007; Kristjansson et al., 2009; Jomaa, McDonnell, & Probart, 2011; Lawson, 2012). **Table 2.10** depicts the impact of school feeding intervention on nutritional status, micronutrient status, morbidity, cognition and school enrolment and attendance of school children.

Evolution of SFPs in India:

School feeding programmes (SFP) are seen both as a social safety net for vulnerable sections of the population and as an educational intervention aimed at ensuring that children go to school and their learning is improved by elimination of class room hunger. The role of SFPs as social safety nets has been enhanced due to recent and persisting global food, fuel and financial crises and high rates of food inflation in most parts of the world. In this context, the experience of a large and populous developing country like India with respect to SFPs becomes relevant for other countries seeking to initiate or to strengthen and expand such programmes (Swaminathan Research Foundation, 2011).

Table 2.10: Impact of Intervention on Various Outcomes

Study	Location	Duration (Months)	Age Group	Treatment	Nutritional Status	Attendance & Enrolment	Cognition	Morbidity & Illness	Micro-nutrient Status
Ahmed, 2004	Bangladesh	12	6-12 years	SFP (Snack)	Significant positive impact on child nutritional status	Increases enrolment and attendance with significantly large reduction in drop out	Significant positive impact on learning, as measured by achievement test scores.	No impact	NS
Osendarp et al; 2007	Adelaide, Australia and Jakarta, Indonesia	12	6-10 years	SFP (Snack and Beverage)	NS	NS	Significant increase in score on test representing verbal learning & memory	NS	Significantly improved plasma micronutrient concentration
Kazianga et al; 2009	Burkina Faso	12	6-15 yrs	THR	No impact on nutritional status	Increased girl's enrolment by 6%	No impact on raw scores of Maths but slight improvement among girls.	NS	No impact on Hb levels
			Siblings (12-60months))	THR	WAZ Decreased by 13.4%, HAZ decreased by				

					6.7%, WHZ by 12.8%		Mixed impact on learning		
			6-15 yrs	SFP	No significant impact on BMI Marginal gain in WAZ for 6-10 years				
			Siblings (12-60months))	SFP	WAZ Decreased by 9.8%, HAZ decreased by 1%, WHZ decreased by 8.9%				
Lien et al; 2009	Vietnam	6	7-8 years	SFP Beverage (Milk)	Significant improvement in Underweight and Stunting status	NS	Significant higher work volume (speed) and higher work efficiency. Significantly higher recall of memorized words and numbers.	Decreased incidence of morbidity	Decreased Anaemia Increased protein, iron and Vitamin A Status

Arsenault et al; 2009	Bogota, Columbia	4	5-12 years	SFP (Meal)	Improved Linear Growth	NS	NS	Decreased reported Morbidity	Improved Vitamin- B12 status
Buttenheim et al; 2011	Phongsaly Province, Lao PDR	24	3-14 years	THR	Improvement in Underweight and stunting	Increase in enrolment by 7%	NS	NS	Significantly decreased anaemia among children 6-10 yr and 11-14 years girls
				SFP (Meal)	No significant improvement seen	Increase in Enrolment by 5%			Not significant
				SFP (Meal)+THR	Significant improvement seen in Underweight children	No increase seen in enrolment			Significantly decreased anaemia among 11-14 years girls
Rahmani et al; 2011	Tehran	3	6-8 years	SFP (Beverage)	Improved weight status among girls	NS	Significantly improved intelligence quotient, both verbal and non-verbal skills.	NS	NS
Nkhoma et al; 2013	Malawi, Southern Africa		6-8 years	SFP (Meal)	Catch up growth in lean muscle mass	NS	Significant decrease in IED and Pre ED errors	NS	NS

					Increase in MUAC				
Mhurchu et al; 2013	New Zealand	10	5-13 years	SBP	NS	No effect on attendance	No effect on academic achievement	NS	NS
Laursen et al; 2015	Danish	6	8-11 years	SFP (Meal)	NS	No effect on attendance	NS	Increased headache if meals taken in classrom m	NS

NS – Not Studied

School Feeding Programme in India is known as National Program of Nutritional Support to Primary Education (NP-NSPE) and is commonly known as the mid-day meal (MDM) programme. Its genesis is a long history of initiatives peppered across the subcontinent. The first venture in mid-day meals was several decades ago in 1925. At that time, an MDM programme was introduced for children of poor socioeconomic status in the Madras Corporation area in the state of Tamil Nadu (Chettiparambil-rajan, 2007).

Realizing the importance of education, both the central and state governments, launched National Programme of Nutritional Support to Primary Education (NP-NSPE) in August of 1995 covered all students in primary schools run or funded by the Government throughout the country to boost enrolment, retention, and attendance rates for children, while also improving nutrition and health outcomes (Bonds, 2012); (Hamid & Hamid, 2012). Currently, The Mid-Day Meal Programme is the world's biggest school lunch programme and is being implemented all over India for primary and upper primary school students (Shukla, 2014).

Historical perspective of mid day meal in India

1925: One of the pioneers of the Mid day Meal Programme is Madras city. It was introduced for underprivileged children by Madras municipal cooperation and provided cooked meals.

1928: Kesher Academy of Calcutta introduced compulsory mid day meal tiffin for school boys on payment basis at the rate of four *annas* per child per month.

1941: In parts of Kerala, the school lunch programme was started.

1942: Bombay started implementing a free Mid Day Meal Sche
me who with UNICEF assistance distributed skimmed milk powder to children aged between 6-13 years.

1946: Mid Day Meal Scheme was introduced in Bangalore city to provide cooked rice and *yoghurt*.

1950: Many States expressed willingness to introduce Mid Day Meal Programme with the assistance of different international agencies like UNICEF, FAO and WHO. International voluntary/charity organizations like CRS, CWS provided providing milk powder to Delhi and Madras Municipal Corporation, CARE provided Corn Soya Meal (CSM) Balahar, bulgar wheat and vegetable oils and USA"s Meal for Million also came forward to assist in these programmes.

1953: Uttar Pradesh government introduced a Scheme on voluntary basis to provide meals consisting of boiled or roasted or sprouted grains, ground nut, puffed rice, boiled potatoes or seasonal fruits.

1958-59: An Expanded Nutrition Programme (ENP) was introduced jointly by Food and Agriculture Organizations (FAO), WHO, UNICEF and Government of India, which was subsequently expanded into Applied Nutrition Programme (ANP). Under this, nutritious food was cooked by the women groups and fed to the school children under the nutrition education component.

1982: The idea of a National Mid Day Meal Programme had been considered for over a decade. In 1982, the idea of "Food for Learning" with FAO commodity assistance was mooted. Scheduled Caste and Scheduled Tribe children especially girls were to be covered under this programme.

1983: Department of Education in the Central Government after inter ministerial consultations, prepared a scheme as per the guidelines of the World Food Programme (WFP). The proposal was circulated among States and UTs. Many States were willing to implement the programme. However, some States expressed certain difficulties.

1984-85: A central government Mid Day Meal Programme for children in primary schools throughout the country was again considered during the year

1984-85. The programme was conceived as an antipoverty programme as well as an educational one.

1988: In December 1988, the Department of Education formulated a proposal for covering 994 Integrated Child Development Scheme (ICDS) blocks with concentration of SC/ST children.

1990-91: The number of States implementing the Mid Day Meal Programme with their own resources on a universal or a large scale had increased to twelve, namely, Goa, Gujarat, Kerala, Madhya Pradesh, Maharashtra, Meghalaya, Mizoram, Nagaland, Sikkim, Tamil Nadu, Tripura and Uttar Pradesh. In another three states, namely Karnataka, Orissa and West Bengal, the programme was being implemented with State resources in combination with international assistance. Another two states, namely Andhra Pradesh and Rajasthan were implementing the programme entirely with international assistance. As reported by Ministry of Human Resource and Development, thirteen States and five Union Territories were administering mid day meal programme as of December 1994.

1995-96: A centrally sponsored scheme "National Programme of Nutritional Support to Primary Education" was launched on 15th August, 1995. Universalization of primary education being national goal, MDMP was launched with the objectives to increase enrolment, improve school attendance as well as retention, promote social integration, improve nutritional status of the primary school children and inculcate good food habits in children. Summary of the brief history of MDM is shown in **(Table 2.11)**

After 15th August, 1995 it was implemented in 2408 blocks in the first year and covered the whole country in a phased manner by 1997-98. For the mode of delivery of nutritional support three basic choices were:

(i) Supply of hot meal,

(ii) Pre-cooked food and

(iii) Food grains.

Table 2.11: Mid day meals in India-A historical perspective

Year	State / UT	Implementing Agency	Meal / Food provided	Target Group(s)
1925	Tamil Nadu	Madras Corporation (Dept. of Edu.)	Rice, sambar and egg	500 elementary school children
1928	West Bengal	Kesav Academy of Calcutta	Compulsory tiffin 25 p/child per month	School Boys
1941	Kerala	State Govt of Education	Rice/wheat kanji and side dish	-
1942	Maharashtra	State Govt. and Rural Development Department	UNICEF skim milk powder	Children below 14 years
1946	Karnataka	Bangalore Govt. & village school Betterment committee	Cooked rice and curds	Pregnant women
1947	Pondicherry	Directorate of Education	Rice	Children 6-11 years
1953	Uttar Pradesh	State govt. on Voluntary basis	Boiled, roasted, sprouted, grains, groundnut, puffed rice, boiled potato, fruit	1,20,000 children
1956	Lakshadweep	Department of Education	130 g rice and curry	Children from 1 to 8th class
1959	Orissa	Applied nutrition programmes, department of Education	Wheat, balahar and vegetable oil	-
1961	Haryana	Department of Education	*Kheer* using wheat, rice, milk, jaggery	-
1962	Andhra Pradesh	Village council and education department assisted by CARE	Corn soya milk (CSM), veg oil, milk powder	Children 6-11 years
1962	Punjab	Department of Education	80 g grains 7 g of veg. oil + CSM	Children 6-11 years
1962	Rajasthan	State Govt. of Tribal and *Harijan* Welfare	Cereal – pulse combination *vada*	-
1962	Gujarat	Assisted by	80 g of bulgar grain	Primary

		CARE + City bread programmes	and 7 g of veg oil + CSM	school children
1965	Madhya Pradesh	Department of Education	80 g of bulgar wheat and 75 g of bread	Primary school children
1965	West Bengal	Assisted By CARE	Biscuit, bread, cake and bananas	Primary school children
1966	Goa, Daman and Diu	Directorate of Education	85 g of wheat, bananas / (CSM and 14 g veg. oil)	Poor school children from backward classes
1968	Bihar	Dept. Of Health & Family Welfare	Roasted grains	Children between 6-11 years
1974	Himachal Pradesh	Assisted By CARE	Biscuits and buns	School children
1976	Sikkim	District and State Govt.	50 g of CMS and 7 g of oil	Children from 1 to 5th class
1979	Haryana	Assisted By CARE	Bread, biscuit, seasonal fruits, *khichri*	300 primary school children
1979	Tripura	Assisted By CARE and Planning Department	Only milk	81 community development block

Source: (Bellary, 2009); (Chauhan, 2011)

2001: A public interest petition was filed by a civil society organization in the Supreme Court, the highest court in India, against distributing uncooked grains to school children and against states not implementing MDM programme. In an interim order dated 28 November 2001, the Supreme Court ordered that cooked meals had to be given to children and asked all states to implement the programme of MDM.

2004: In 22 States and 7 Union Territories, all children were covered under cooked Mid Day Meal Programme or atleast decision for full coverage was taken by State Governments. However, in 6 States partial implementation of the programme was done due to their poor economic conditions, only food grains i.e. (wheat/rice) were distributed to primary school students at the rate of 3 kg per month per student having attendance more than 80%. (Chettiparambil-rajan, 2007; Kumar & Sharma, 2011; Chauhan, 2011; Swaminathan Research Foundation, 2011).

Revision of the Programme

National Programme of Nutritional Support to Primary Education (Mid Day Meal Scheme), 1995 was revised firstly in the year 2004 and secondly in the year 2006. The revised Schemes are given below:

i. In September 2004, the programme was revised to provide cooked mid day meal with 300 calories and 8-12 grams of protein to all children studying in classes I – V in Government and aided schools and EGS/ AIE centres. In addition to free supply of food grains, the revised scheme provided Central Assistance for the following items:

i) Cooking cost @ Re 1 per child per school day
ii) Transport subsidy was raised from the earlier maximum of Rs 50 per quintal to Rs. 100 per quintal for special category states, and Rs 75 per quintal for other states
iii) Management, monitoring and evaluation costs @ 2% of the cost of food grains, transport subsidy and cooking assistance

iv) Provision of mid day meal during summer vacation in drought affected areas.

The main difficulties experienced in the implementation of NP-NSPE, 2004 were

i) The existing rate of Re. 1 towards cooking cost was found to be inadequate for meeting the cost of nutritious meal as per prescribed norms

ii) Absence of kitchen sheds in schools had emerged as a critical factor impacting the quality of the programme.

iii) The existing nutritional norm of 300 calories and 8-12 grams of protein was felt to be inadequate to meet the growing needs of young children, necessitating therefore, the need to review and enhance the norm, and also provide for essential micronutrients and de-worming medicines.

ii. With effect from June'2006, the cooked mid day meal should provide 450 kcal and 12 g of protein along with adequate quantities of micronutrients like iron, folic acid and vitamin – A. Central Government provided assistance to state Governments/UT administrations by supplying free food grains (Wheat/Rice) @ 100 grams per child per school days from the nearest FCI godown (*National Programme of Nutritional Support to Primary Education [Mid-Day Meal Scheme] GUIDELINES*, 2006).

iii. In October 2007, the programme expanded to cover children in upper primary classes (Classes VI to VIII) in 3479 educationally backward blocks and from April 2008 in all blocks of the country. The calorific value of a mid day meal for upper primary school children was minimum 700 kcal and 20 grams of protein by providing 150 grams of food grains per child/ school day

iv. In November 2009, Revision of the food norms for Upper Primary children was changed by increasing the quantity of pulses from 25 to 30 grams. Vegetable from 65 to 75 grams and by decreasing the quantity of oil and

fat from 10 grams to 7.5 grams for upper primary and 5 grams for primary student.

Impact on Enrolment:

An article by Dreze & Goyal, (2003) reported that provision of mid day school meals increased enrolment of children especially girls in primary schools of Chattisgarh, Rajasthan and Karnataka. Similar findings were also reported by Narula (2009) in Jharkhand, and the results reported by Neilson Survey, (2006) also gave similar results when mid day meals were provided by centralised kitchen i.e. The Akshay Patra Foundation.

Si & Sharma, (2008) reported that the rate of increase in enrolment during the cooked meal scheme (3.8 per cent per annum) was much higher compared to the rate of growth of enrolment when the dry ration scheme (1.5 per cent per annum) was in operation in Orissa.

A study conducted in the Union Territory of Chandigarh on the impact of MDM programme in enrolment of elementary school children over a period of three years found 20.2% increase in enrolment of children at primary level and slightly higher increase (23.8%) at upper primary level (Nangia & Poonam, 2011)

According to Bonds (2012), the educational impact of the Mid-Day Meal program is both economically and statistically significant as average enrolment rates of Mid-Day Meal program beneficiaries are 22.7% higher or else equal than those of non-beneficiaries. When restricted to public school children only, the program effect rises to a 29.5% enrolment increase.

An evidence based impact assessment of Mid day meals on enrolment reports large and statistically significant increase in primary school enrolment (6.6%), amounting to almost 19 additional students in primary school. The enrolment response to midday meals, although positive across all grades, is driven by large and statistically significant responses in early primary school,

namely grades 1, 2. In grade 1, enrolment increased by approximately 18%; in grade 2, this increase is about half as large (approximately 9%); and in grade 3 the increase is typically two percentage points lower than that in grade 2. The response remains positive, with smaller point estimates and statistically insignificant coefficients across all specifications in grades 4 and 5 (Jayaraman & Simroth, 2015).

Contrary to above studies, the analysis of the study done by Afridi (2011) reports that implementation of the new programme did not lead to higher enrolments. But he also mentioned that the result does not necessarily imply that school meal programme is not substantially effective in increasing enrolments.

Impact on Attendance:

The Pratichi Trust evaluated the impact of the cooked Mid-day Meal programme in the selected primary schools of West Bengal and found to be impressive with regard to the enhancement of attendance of the children in schools (Rana, 2005).

National Institute of Public Cooperation & Child Development (2006) conducted a study on Mid Day Meal Scheme in Karnataka. The study report indicated that the Mid Day Meal programme improved the school attendance in majority of the schools and reduced absenteeism, reduced dropout rate especially among the primary school children. In addition, the mid day meal scheme has also fostered a sense of sharing and fraternity and paved the way for social equity.

Significant increase in the school attendance was observed in a survey done to assess the impact of mid day meal provided by TAPF in 10 cities namely Bagalore, Hubli-Dharwad, Mysore, Hasan and Mangalore in Karnataka; Vrindavan in Uttar Pradesh; Puri in Orissa and Jaipur, Baran and Nathdwara in Rajasthan. In Jaipur, 6.9% increase in school attendance was seen after 3 months TAPF had started providing midday meal (A.C. Neilson, 2006).

Teachers, parents, administrators, and community members of Madhya Pradesh all testified that the mid-day meal scheme increased attendance. The greatest effect in attendance was seemed to be in rural areas, with urban areas had only marginal if any effect on attendance (Robinson, 2007; Paul & Mondal, 2012) .

Similar impact have also been reported by Hamid & Hamid, (2012) in Anantnag district of Jammu & Kashmir.

Impact of Nutritional Status

Laxmaiah et al., (1999) stated that the mean anthropometric measurements of children (6-11 years) from 60 schools in Karnataka were similar whether they were receiving mid-day meal (1361) or non receiving mid day meal (1333). The percent of normal children, according to NCHS standards were marginally and significantly higher in children receiving mid-day meal (3.00%) as compared to those not receiving mid-day meal (1.30%). According to Waterlow's classification, the percentage of children in the three groups viz., wasted, underweight and stunted was lower in mid-day meal schools (3.60, 50.80 and 4.40% respectively) as compared to non-mid day meal schools (4.80, 54.10 and 4.60%, respectively).

Sarma et al., (2006) conducted a study on to evaluate the effect of a micronutrient-fortified beverage supplemented for 14 months on growth and morbidity in apparently healthy schoolchildren. Anthropometric (height and weight), clinical symptoms of deficiency, and morbidity data were collected from 869 children. The results indicated, after 14 months of supplementation, there was a significant increase in mean increments of height and weight scores in the supplemented group compared with the placebo group, Velocity of weight (3.56 kg versus 3.00 kg) was significantly ($P < 0.01$) higher with supplementation.

Sumithra Muthayya et al., (2009) in a 2-by-2 factorial, double-blind, randomized controlled trial, tested the effects of omega-3 fatty acids amongst treatment groups of 598 children (6-10 years of age) in Bangalore, India. The children were allotted to one of four intervention groups that received different variations of an omega-3 enriched beverage over a twelve month period. Children in the high micronutrient treatment group showed significant gains of 0.19 cm in height after the intervention, although there were no differences seen in weight gain or MUAC.

A comparative study conducted by Dhaudhiyal and Iyer (2010) to assess the MDM Programme with and without NGO intervention on growth and hemoglobin levels of rural children of Gandhinagar, revealed that the overall execution of MDM Programme with the partnership of TAPF – NGO helped to improve the nutritional status of school children. The results from anthropometric indices showed that the mean rise in weight (1.19 kg Vs. 590 g) and height (1.26 Vs. 1.15 cm) was significantly higher in TAPF than non-TAPF group. The prevalence of WAZ, HAZ and BMIZ reduced marginally by 1.9%, 0.46% and 5.33% in the TAPF group.

(Shalini et al., 2014) compared the nutritional status of rural and urban school children (aged 5 to 15 years) receiving mid-day meals prepared by the Sri Sai Mandali Trust in schools of Bengaluru, India. They reported that in spite of the children receiving mid-day meals their observed weight and height in both urban and rural were below the expected standards. They also believed that the magnitude of the burden of undernourished students as seen in this study would have been much greater in the absence of the midday meal program.

Introduction of the MDM programme improved nutritional status of children in a rural area of South Karnataka, India. Nearly 10% reduction in the prevalence of stunting was seen among boys, while among girls, the percent reduction was 13.2%. Similarly, a positive shift was seen in the prevalence of underweight among both boys and girls. Overall, the impact of MDM programme was more among girls as compared to the boys (Minj et al., 2014).

Mixed results for impacts on anthropometric measurements were found in review from other studies. Elayath and Kanani (2008) conducted an evaluation of the mid-day meal programme in ten municipal schools of urban Vadodara, wherein 973 children were studied for nutritional status. Results revealed that the prevalence of stunting (37.00%) and thinness (63.00%) was similar in mid-day meal beneficiaries and non beneficiaries.

Another study conducted to assess the impact of wholesome mid day meal (MDM) program run by an NGO on the growth of the primary school students in rural area of Mathura district reported no better impact on growth of the primary school children (Sharma et al., 2010).

Impact on Scholastic Performance

Laxmaiah et al., (1999) also reported marginally higher scholastic performance among children receiving MDM as compared to those not receiving. The study was concluded that MDM program is associated with a better educational and nutritional status of school children in Karnataka.

The study done by Elayath and Kanani (2008) revealed that MDM was serving as an incentive to not only to attend school, but also helping them to benefit more from education. The impact was more among underprivileged girls.

Afridi, (2011) studied the effect of school meal program on children's attention in class. The study was conducted on 400 children from 16 poor performing public schools in Delhi. The results showed that school meals led to an improvement in classroom attention and the improvement was significant in sessions held after meals consumed.

Another study conducted by Paul & Mondal, (2012) to assess the impact of MDM programme on academic performance of upper primary school children

of Burdwan district of West Bengal reported significant association between school meals and academic performance of children.

However, another study observed that Mid day meal showed a mixed impact on the class wise achievement of the secondary school children (VIth to Xth standard) of Anantapuram district (Ramanjaneyulu, 2014). The observations made by Alim, Khalil, Mirz, & Khan, (2012) also suggested that the mid day meal did not make any significant impact on the nutritional status and academic achievement of school children receiving MDM in 6 schools of Aligarh city.

KAP of Teachers, Parents and Children

Kumar & Sharma, (2011) conducted an evaluative study on teacher's perceptions about Mid Day Meal Scheme in Himachal Pradesh (465 teachers). He found that majority of teachers viewed that MDM is helping to achieve the goals of Universalization of Elementary Education, but there is no increase in the enrolment of students because of this Scheme. However, they felt that there is much increase in the attendance of students studying in government primary schools of Himachal Pradesh. According to them, there is no problem of school drop-outs in the State and a large majority of teachers(76.34%) admitted that there is no improvement in the learning levels of students belonging to disadvantaged section of society (SC, ST and Others). Teachers also felt that the Mid Day Meal Scheme is also impacting positively on the nutritional status of students.

In a descriptive study were 50 school teachers' from 20 primary schools of Jagadhary block of district Yamunanagar were interviewed. Only 34% of teachers responded that the government has introduced Mid day meal to save children from malnutrition, Universalization of primary education and to stop wastage and stagnation as the objectives of the scheme (Bhargav & Bhargav, 2011).

Naik (2005) evaluated the MDM (Akshara Dasoha) Programme of Karnataka wherein a total of 6,400 children, five children from each school studying either in class V, VI and VII standard were interviewed individually and their opinion on the meal served in the school was elicited from 1,280 schools of Karnataka. About 95 percent of children felt that the Akshara Dasoha programme had improved their concentration. About 76.2 per cent of children perceived and acknowledged that school lunch helped them to get better marks in examination and 94.8 per cent of children opined could memorize what they read and learn in the class and 87.4 per cent of children reported that they were regular to school because of school food.

According to Afridi (2005) parents in Madhya Pradesh were more satisfied with Suruchi Bhojan Programme (80.00%) as compared to Dalia Programme (60.00%). Only 30 percent preferred distribution of dry ration to Suruchi Bhojan programme. In Karnataka 60 percent of parents felt that the meal served through Akshara Dasoha was good or very good. Very few parents felt that the meal was not satisfactory (10.00%).

A study conducted by Kumar & Rani, (2006) in 31 elementary schools of Vishakhapatnam district where interview of the heads of the school and Focus Group Discussion (FGD) with parents and children was done. The result revealed that majority of the heads (68.6%) opined that there was increase in enrolment as well as regular attendance after introduction of MDM programme. They also felt (91.4%) that the quantity of food was sufficient. However, in terms of quality, 50% of them responded that the quality of food was good. Nearly 3/4th of the principal opined that there was improvement in the standard of education, while majority of them stated that the health of the children is also improved after introduction of MDM. In a series of FGD with parents, positive as well as negative feedback about MDM was revealed, Parents felt that MDM helped in reducing short term hunger which in turn increased the attendance of school children. They also expressed the food was insufficient due to pilferage, and of poor quality in term of food not cooked properly or presence of worms in rice and vegetables.

Samson, Noronha, & De, (2008) evaluated the mid-day meal scheme in 12 schools of Delhi. Results revealed that about two third of the parents interviewed wanted the programme to be continued.

Knowledge, Attitude and practices of 35 school teachers and 140 children of urban vadodara were assessed regarding the implementation of the programme and revealed that teachers felt additional responsibility while the children were not contented with the monotonous menu and the quality of food (Nambiar & Desai, 2013).

Spot observations

Over the past decades an extensive amount of research has been conducted to examine the implementation Mid-day-Meal Scheme. (Dreze & Goyal, 2003) pointed out that the main purpose of a recent survey initiated by the Centre for Equity Studies was to check the quality of school meal programme in Karnataka, Chattisgarh and Rajasthan. It points out that the quality of school meal programme is significantly better in Karnataka than in Chattisgarh or Rajasthan.

Various studies have shown that children's food intakes are not sufficient to meet the dietary recommendations. Meal offered through Mid Day Meal Programme make substantial contribution to their diets. So it is important to assess their meal consumption at schools.

Due to the limitations of most dietary assessment methods, especially in young children, exactly what and how much food children are consuming in the schools is unclear. Most dietary assessment methods for this age group rely on retrospective reports from parents in the form of 24-hour recalls, diet records, or food frequency questionnaires. This poses a problem for children in schools because most parents are unaware of what foods are being served during the day at their school and what or how much their specific child is eating. Although many schools post a weekly menu, a recent study showed

that menus may be an unreliable source of information. Therefore, the most accurate method of determining dietary intake may be direct observations (Ball, Benjamin, & Ward, 2007).

Several dietary assessment methods (eg, pictorial 24-hour recall, food frequency questionnaires, and diet records) have been developed for use in elementary school–aged children with varying levels of parental and teacher engagement; however, they pose challenges because they are dependent on a child's literacy and cognitive recall abilities and on parental awareness and bias. These methods have been reported to both under- and overestimate intake, and may be unreliable in some situations. Alternatively, direct observation is not dependent on the child's memory and can provide unbiased information about a child's actual intake. Direct observation is more likely to be feasible when conducted in a defined environment for a specific period of time, such as a school lunch period. Direct observation has been used successfully to assess children's intake of school-prepared lunches (Richter et al., 2012).

Contemporary research practice recommends process evaluation alongside empirical trials of complex interventions so as to identify how the intervention was implemented in practice, the mechanism by which it achieved its impact, and any local contextual issues that may have influenced outcome (Kristjansson et al., 2009).

Process evaluation can assess where, when, and why variations in implementation occur. Variations can be measured by the degree to which the intervention was conducted as planned (fidelity), including adherence to protocol, quality of delivery, and participant response (acceptability). The amount of intervention delivered (dose), and proportion of intended target population receiving it (reach) can also be used to assess implementation. Such data can shed light on why an intervention may or may not be effective and indicate how sustainable the delivery model might be if rolled out into routine practice (Chittleborough et al., 2013).

The success of the mid day meal programme revolves around the manner in which it is implemented at the school. Safety and hygiene standards must be set and practiced with rigour. Teachers should, however, be involved in ensuring that (a) good quality, wholesome food is served to children, and (b) the actual serving and eating is undertaken in a spirit of togetherness, under hygienic conditions, and in an orderly manner so that the entire process is completed in 30-40 minutes. It should however, be ensured that the food prepared is tasted by 2 – 3 adults including at least one teacher before it is served to children (National Programme of Nutritional Support to Primary Education [Mid-Day Meal Scheme] GUIDELINES, 2006)

The government's vision was reflected in the mid-day meal guidelines of the National Programme of Nutritional Support to Primary Education (NP-NSPE) in 2006. It says, "**The MDMS does not merely aim to provide a cooked meal, but one satisfying prescribed nutritional norms".** As per the nutrition and quantity parameters of the MDMS, a primary school student must get a minimum of 12 grams of protein and 450 calories per meal, while an upper primary student must get 20 gm of protein and 700 calories per meal. A meal should have 100 gm of grains (rice/wheat), 20 gm pulses, 50 gm vegetables, and 5 gm oil for primary students, and 150 gm grains (rice/wheat), 30 gm pulses, 75 gm vegetables, and 7.5 gm oil for upper primary students (Shukla, 2014).

The net impact of a MDM on the child's health is ultimately determined by whether the meal is a supplement (a net addition or a substitute for food intake at home, in terms of both quality and quantity (Khera, 2006).

Unfortunately the diets commonly offered to young children are of low quality and often lack variety, which is the key to specific nutrient adequacy. They are usually of low energy and nutrient density and as a result, multiple nutrient deficiencies are common in this age group (Yunusa, 2012). A study done by (Mehta, 2013) revealed that the energy and protein content of six days menu varied from 350-386 kcal and 10.9-11.9 g of protein per day which was below the recommended norms of 450kcal and 12 g of protein.

Still it is an incontrovertible fact that Mid Day Meal Programme exerts a positive influence on the enrolment and attendance in schools. But the question remained answered is: Does the Mid Day Meal improve the nutritional status of children too? Therefore, the present study has been undertaken to assess the nutritional contribution of mid day meal to the dietary intake of school children (Mehta, 2013).

Bottlenecks of the MDM Programme

Inconsistent food quality, occasional food poisoning, poor hygiene, and operational concerns were among the complications to the provision of government-sponsored mid day meals. The meals were prepared by teachers, who cooked the same meal every day and children reported that that they grew tired of eating the same food daily, they did not like the taste, and it often made them feel sick. In 2004, a fire accidentally started by a teacher cooking the midday meal killed 90 children in Tamil Nadu, an event which underscored the safety issues inherent in meals prepared in makeshift kitchens based on school sites (Upton et al., 2007). Thus, in order to improve the efficiency and effectiveness of delivery of MDM in schools, the government has strengthened the mid day meal programme with the interventions of private and corporate partnerships in the year 2006.

Public-Private-Partnership (PPP) provides an opportunity for private sector Participation in financing, designing, construction and operation & maintenance of Public sector programmes and projects. The time has come to forge a greater interface between the public and the private sector in a wide range of activities in the country (Josephine & Raju, 2008).

CENTRALISED KITCHEN

In urban areas where a centralized kitchen setup is possible for a cluster of schools, cooking may wherever appropriate, be undertaken in a centralized kitchen and cooked hot meal may then be transported under hygienic

conditions through a reliable transport system to various schools (National Programme of Nutritional Support to Primary Education [Mid-Day Meal Scheme] GUIDELINES, 2006).

A centralized model refers to system where a few service providers produce and distribute meals to the schools in a town/city, with coverage ranging up to over a lakhs of children. While smaller scale Non Profit Organisations(NPOs)/Government Organisations (GOs) also operate, non-governmental organizations (NGOs) such as the Naandi Foundation (coverage of 7,40,790 children in Ganjam district, Orissa) and ISKCON's Akshay Patra (coverage of over a million children10 all over the country) have received great attention in recent times. The centralized model is usually found only in urban areas as distribution of centrally cooked food in rural areas is not feasible, given the distances between the villages and their poor connectivity. The centralized model is lauded for efficiency because of its minimization of labour costs; use of mechanization reducing human contact with the food with lower chances of contamination; less need for space; and economies of scale (Shankar & Natasha, 2013) .

9.43 lakh children in more than 8107 schools were being supplied hot cooked meals prepared under hygienic conditions from 26 mechanized centralized kitchens, set up by charitable trusts and NGOs in Rajasthan (Savita Kaushal, 2009).

2.24 lakh children in 1164 schools were being supplied hot cooked meals prepared under hygienic conditions from centralized kitchens by various NGOs such as Naandi Foundation, ISKCON, The Bhagavathula Charitable Trust and Sri Narayana Reddy (A philanthropist) of Andhra Pradesh (Josephine & Raju, 2008).

AKSHAYA PATRA FOUNDATION

In 2000, a year before the People's Union for Civil Liberties case was brought to the Supreme Court, an Indian non-profit organisation, The Akshay Patra

Foundation (TAPF), was founded with the vision that “No child in India should be deprived of education because of hunger”. The organization began a school feeding operation that served 1500 children in five schools in Bangalore (Winch, 2009). It was one of the first organizations in the region to provide freshly cooked, hot and nutritious, balanced meals, and within six months of starting the program, it had requests from 3,000 schools. Akshaya Patra soon scaled up services to feed 30,000 children. When the Foundation’s growth caught the attention of local government officials, the organization began receiving government financial support. By April 2003, it was feeding 43,000 children in Bangalore daily.

The organization provided nutrition-rich mid day meals to extremely underprivileged children in India with the aim of increasing school enrolment, reducing drop-out rates, and improving academic performance. One of the most unique aspects of TAPF is its use of innovative technology to produce massive quantities of food in short period of time.

Currently TAPF reaches out to 1.3 million children in 2013 in 20 locations across 9 states of India providing fresh cooked meal on all school days and hopes to feed over 20 million children by 2020. They are Vishakhpatnam and Hyderabad in Andhra Pradesh, Bangalore, Hubli, Bellary, Malgalore, and Mysore in Karnataka, Gandhinagar, Vadodara and Surat in Gujarat, Jaipur, Nathdwara and Baran in Rajasthan, Chennai in Tamil Nadu, Vrindavan in Uttar Pradesh, Puri and Nayagarh in Orissa, Guwahati in Assam and Bhilai in Chattisgarh. **Table 2.12** shows the state wise coverage of TAPF.

Mid Day Meal in Gujarat

Concerned at low literacy levels (43.7% according to 1981 census) of the 6-14 yr age group in Gujarat, the state government followed the Tamil Nadu Scheme and in 1984 introduced a Mid Day Meal scheme for children in primary schools in 68 talukas, in order to improve school attendance (Mehan and Sharma, 2008)

Table 2.12: State Wise Coverage of the Akshay Patra Foundation

State/Location	Type of Kitchen	Year of Establishment	Number of Children	Number of Schools
Andhra Pradesh			**60,098**	**461**
Vishakhapatnam	Centralised	October'2008	5,249	7
Hyderabad	Centralised	October'2008	54,849	454
Assam			**53,649**	**592**
Guwahati	Centralised	February'2010	53,649	592
Chattisgarh			**23,674**	**160**
Bhilai	Centralised	January'2009	23,674	160
Gujarat			**4,00,158**	**1653**
Gandhinagar	Centralised	June'2007	1,21,508	666
Vadodara	Centralised	November'2009	1,13,593	616
Surat	Centralised	June'2012	1,65,057	371
Karnataka			**4,60,046**	**2627**
Bangalore-HK Hill	Centralised	June'2000	85,204	487
Bellary	Centralised	July'2006	1,15,945	575
Hubli	Centralised	July'2004	1,26,693	789
Mangalore	Centralised	December'2004	19,043	145
Mysore	Centralised	August'2004	13,835	63
Bangalore-Vasanthapura	Centralised	July'2007	99,326	568
Orissa			**80,415**	**1000**
Puri	Centralised	June'2006	55,835	648
Navagarh	Decentralised	March'2007	24,580	
Rajasthan			**1,29,493**	**1682**
Jaipur	Centralised	February'2004	92,763	1081
Nathdwara	Centralised	June'2006	25,274	435
Baran	Decentralised	April'2005	11,456	166
Uttar Pradesh			**1,39,262**	**1874**
Vrindavan	Centralised	August'2004	1,39,262	1874
Tamil Nadu			**718**	**1**
Chennai	Centralised	July'2011	718	1
TOTAL			**1,3,47,513**	**10,050**

Source: Annual Report of Akshay Patra Foundation, 2012-13

The Govt. of Gujarat started providing cooked meal to all the students of Primary classes in Govt. schools, Government-Aided Schools with effect from September, 2004. Subsequently, it was extended to children enrolled under Education Guarantee Scheme (EGS) and Alternative Innovative Education (AIE) centres working under Sarva Shiksha Abhiyan Programme.

Government of Gujarat substituted fortified wheat flour for wheat grains in programmes which acts as social safety net programs namely ICDS, PDS and MDM. Fortified wheat flour contained nine micronutrients. The nutritive value of 50 grams of fortified wheat flour is given in **Table 2.13**.

Public–private partnership in the MDM Scheme was launched by the Government of Gujarat in the year 2006. Laudable achievements have been made in attracting such partnerships in the programme. Akshyapatra Foundation, Stri Shakti and Nayak Foundation are examples which have partnered with the Government in successful implementation of the MDM in the State.

AKSHAYA PATRA FOUNDATION IN GUJARAT

The Government of Gujarat initiated the public private partnership with The Akshaya Patra Foundation for better implementation of the MDM programme in Gandhinagar block and in West Zone of Ahmedabad from June'2007. While the Vadodara Municipal Corporation and Kalol and Mansa talukas of Gandhinagar district assigned TAPF to provide school meals to children in October – November'2009.

As a result, a need was felt to assess the impact of multiple micronutrient fortified school meals provided by an NGO – TAPF on growth of children in municipal schools of urban vadodara.

Table 2.13: Nutritive Value of 50g of Fortified Flour

Nutrients	**Amounts**
Iron	7.5 mg
Vitamin A	150 µg
Calcium	250 mg
Thiamine	0.30 mg
Niacin	3.5 mg
Riboflavin	0.33 mg
Vitamin C	10 mg
Folic Acid	50 µg

Source: Government of Gujarat, 2010