



**Consortium for Research on
Educational Access,
Transitions and Equity**

Malnourishment Among Children in India: Linkages with Cognitive Development and School Participation

Neelam Sood

**CREATE PATHWAYS TO ACCESS
Research Monograph No. 25**

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**National University of Educational
Planning and Administration
NUEPA**



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Educational Access, Transitions & Equity

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Preface

There is mounting evidence to indicate that malnutrition and poor health in early childhood create a predisposition among children which negatively influences their capacity to effectively participate in schooling and benefit from the teaching-learning process. It is in this context that this paper by Neelam Sood presents a comprehensive overview of the status of malnutrition among young children in India. Based on a review of empirical evidence, the paper explores the relationship between malnutrition and the cognitive functioning of children in the first six years, analysing the effect of malnutrition and poor health on access, participation and performance of school-age children. The paper highlights that despite overall improvements in the nutritional status of children, the gender difference in malnutrition continues to remain important and it is more pronounced among disadvantaged social groups such as Scheduled Castes and Scheduled Tribes. The paper also reviews two major nutrition intervention programmes in the country, namely, Integrated Child Development Services (ICDS) and the National Programme on Nutritional Support to Primary Education (NPNSPE), popularly known as the Mid-Day Meal Programme. The paper identifies gaps in knowledge for further research and enhances understanding of the issue, keeping in view the socio-cultural milieu in which children in India grow and participate in schooling. The paper is part of the larger exercise by CREATE to develop a comprehensive analytical review of Elementary Education in India.

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Summary

In education, children's poor nutrition and health status is rarely recognised as a significant factor for school enrolment, participation and achievement. However, there has been ever growing empirical evidence from global research pointing out that malnourishment among young children influences schooling in several direct and indirect ways. Malnutrition is a wide-spread problem that results from a complex interaction between environmental deprivation and undernutrition. Malnourished children typically experience a range of other environmental difficulties associated with poverty, such as poor housing, poor health-care, weak family and community support systems. There is a need to understand the way child malnutrition and poor health influence access and school participation of children.

In this paper, an attempt is made to draw broad contours for developing such an understanding of the issue rooted in the Indian context. A general overview of the research evidence on the linkage between malnutrition and cognitive development has been presented. The scale and nature of malnourishment among young children in India has been detailed, highlighting the distribution across population groups and states in the country. The paper also presents a discussion of the research evidence in India that correlates malnutrition and other factors related to school participation. Further, two major national intervention programmes aimed at early stimulation and improvement of nutritional status of children have been discussed. Based on the analysis presented in the paper, the last section of the paper identifies areas that need further exploration.

Malnourishment Among Children in India: Linkages with Cognitive Development and School Participation

1. Introduction

The agenda for any educational reform usually has a major focus on teacher education, curriculum and educational resources, whilst ignoring, for the most part, 'the child' and the context and conditions of learning for the child. A child's poor nutritional and health status does not figure prominently in educational discourses. Similarly, the importance of nutrition and health in explaining poor school enrolment, high drop-out rates and low achievement is rarely recognized. The problem, in part, emanates from the fact that the available empirical research grounded in the Indian context has remained less than convincing for educational planners.

Malnutrition is a fairly wide-spread and complex problem that poses a serious threat to life in some parts of the world. Recent estimates point out that one in every four children under-five (including 146 million children in the developing world) is underweight (UNICEF, 2006). Of the 146 million, 78 million children are in South Asia. According to another estimate that used two indicators (the prevalence of early childhood stunting and the number of people living in absolute poverty), there are more than 200 million children under 5 years in developing countries, mostly in South Asia and Sub-Saharan Africa who are not fulfilling their developmental potential (Grantham-McGregor et al, 2007). Poor nutrition contributes to about 5.6 million child deaths per year and more than half of the total deaths take place in India. A more serious concern is the fact that the number of children under-five who are underweight has remained almost unchanged since 1990 (UNICEF, 2006). This is particularly true for India where the number of malnourished children has not changed significantly as seen from the National Health and Family Survey data in all the three surveys. The percentage of underweight children in the country was 53.4 in 1992; it decreased to 45.8 in 1998 and again rose to 47 in 2006 (IIPS, 1995, 2000, 2007).

The 1989 Convention on the Rights of the Child (CRC) is a universally agreed standard for the care and protection of children, with 99 percent of world's children living in countries where governments have endorsed it. India ratified the CRC in 1992. Article 24 of the convention recognizes the right of children to enjoy the 'highest attainable standard of health' and states that no child be deprived of access to such health-care services. The same article also enjoins the state to take appropriate measures to combat malnutrition within the framework of primary health care and through the provision of nutritious food. This directly relates to a child's right to food and also affects his/her access to education and school participation. There is, obviously, a need to broaden our understanding about the way child malnutrition and poor health influence access and school participation of children in different socio-cultural contexts. The present review intends to draw the broad contours for developing such an understanding of the issue specifically in the Indian context. Malnutrition can influence all of the CREATE zones of exclusion (Lewin, 2007), leading to children being admitted to school late, dropping out of school, or being silently excluded by illness and poor cognitive development.

Section two of this paper gives a general overview of research observations on the linkage between malnutrition and cognitive development. Sections three, four and five deal more specifically with the Indian context. Section three gives an overview of the problem and nature of malnourishment in India. Section four is a discussion of research findings in India

that correlate malnutrition and other related factors to school participation. Section five presents a discussion of two major national efforts in India aimed at improving the nutritional status of children in the country alongside educational inputs through formal institutions. The concluding section identifies the major areas that need further empirical explorations based on the analysis presented in the paper.

2. Malnutrition and Cognitive Development

Children are vulnerable to malnutrition from conception. Pregnant women who are undernourished are more likely to have low birth weight babies who, in turn, are susceptible to developmental delays. These early deficits sustained with post-natal malnutrition often result in diminished cognitive functioning. Malnourished children are also more prone to illness. By the time they reach school-age, they have a much lower potential to learn compared to their well-nourished peers. Deficiency of micronutrients, such as iron, iodine, zinc and vitamin A, in a child's early years may result in a lower attention span, decreased ability to concentrate and poor memory. Anaemia resulting from deficiency of iron is known to have a severe impact on the cognitive development of children (Grantham-McGregor, 1995).

Our understanding of child malnutrition and its relationship with cognitive functioning has grown in the last few decades. Research suggests that malnutrition alone does not cause irreversible damage to the brain but is believed to result from a complex interaction between environmental deprivation and undernutrition (Grantham-McGregor, 1995). Studies indicate that adequate nutrition can help prevent some of these undesirable outcomes. However, current research does not establish a causal relationship between malnutrition and mental development that could facilitate more direct action (Behrman, 1996). Methodological problems also constrain our understanding. Based on a review of studies of the effects of severe malnutrition on mental development, Grantham-McGregor (1995) concludes that:

There is no consistent evidence of a specific cognitive deficit. The evidence of a causal relationship is strong but not unequivocal because of difficulties in interpreting retrospective case control studies. (Grantham-McGregor 1995:2233)

A brief review of global research that explains the nature and type of the impact of ill health and poor nutrition on cognitive functioning of children is presented here. It is evident from a large number of studies that there is a linkage between the health and nutritional status of children and educational outcomes (Behrman, 1996; Pollitt, 1990). This association however is far from a simple relationship. Alderman et al. (1997) argue that nutrition and health result from personal choices and are not pre-determined. They caution that most literature ignores the fact that children's health and access to schooling reflect behavioural choices. As a result the estimated impact of health and nutrition on a child's schooling may be biased in some studies.

In this context, a recently developed analytical framework is useful for understanding the relationship between health and education outcomes (see Glewwe, 2005). Three different time periods corresponding to infancy (up to 2 years), early childhood (up to 6 years) and primary school stage (up to 11 years) are identified and an equation for each relationship is developed. These relationships described as *production function*, *conditional demand* and *reduced form*, are useful for assessing the linkage between child health/nutrition and educational access and participation of the children. Glewwe (2005) emphasizes that investigations must clarify which of the three relationships is being estimated. Research in this field uses three different types of data: longitudinal, cross-sectional and randomized controlled trials (RCTs). Although each type of data presents its own problems and limitations, it is only through RCTs (using an experimental design) that causal relationships can be established, he cautions.

A review of such studies examining the relationship between mental development and severe malnutrition concluded that school-age children who suffered from early childhood malnutrition generally have poorer IQ levels, cognitive function, school achievement and greater behavioural problems than matched controls, and to lesser extent siblings. The disadvantage was found to last at least until adolescence (Grantham-McGregor, 1995). Malnutrition in early stages has been found to have a long term effect on the growth and development of children, particularly on cognitive development. Chronic malnutrition in infancy resulting in stunting, for example has been associated with poor cognitive function reflected in the reduction of 10 points on Wechsler Intelligence Scale (WISC-R) scores (Berkman et al, 2002).

Research in this area further indicates how exactly these children are harmed by malnutrition and the role that the environment plays. While inadequate or faulty dietary intake in early childhood affects cognitive development, overall development and learning capacities of children will not improve merely by addressing their nutritional needs. Children who suffer from poor nutrition also typically suffer from a range of other environmental difficulties associated with poverty, such as poor housing, poor health-care, weak family and community support systems. Undernourished children typically are fatigued and uninterested in their social environment. Compared with their well-nourished peers, they are less likely to establish relationships or explore and learn from their surroundings. This consequently affects their overall cognitive development (Grantham-McGregor, 1995).

Multiple risk factors may interact to produce greater harm to children. Studies were reviewed to examine the relationship of mild-to-moderate malnutrition on human development by integrating previous research findings with current findings from correlation studies conducted over the past decade. The review concluded that chronic mild malnutrition is embedded in a host of other biological and psycho-social risk factors (Wachs, 1995). The salience of chronic mild malnutrition as a risk factor is accentuated when other psycho-social-contextual risk factors are also present or when multiple low-level nutrient deficits interact (Simeon & Grantham-McGregor, 1990). Four key risk factors have been identified that include stunting, inadequate cognitive stimulation, iodine deficiency and iron deficiency anaemia (Walker et al, 2007). It is argued that the risks often occur together or cumulatively, with concomitant increased adverse effects on the development of poor children. Iron deficiency can have an immediate effect on a child's ability to concentrate on and perform complex tasks. Hidden hunger defined by the deficient nutrient intake during early years can lead to life-long impairments. Anaemia due to iron deficiency has been found to have an adverse effect on a child's ability to learn as it impedes attention span and memory. This is one of the most prevalent nutritional disorders and has a severe impact on cognitive development (Walker et al, 2007; Lozoff et al, 2006). Early childhood anaemia has been shown to be associated with mild or moderate mental retardation through a study conducted to examine the link between early childhood anaemia and mental retardation at the age of 10 years (Hurtado, 1999). Studies carried out to understand the impact of zinc supplementation on cognitive performance have found that it has a beneficial impact on the growth of children and neuro-psychological processes, especially reasoning (Black, 2003; Sandstead et al, 1998; Simeon & Grantham-McGregor, 1990). There are well established associations between poor development and iron deficiency and similarly with iodine deficiency but since these deficiencies usually occur in disadvantaged communities where other risk factors may be present, it is difficult to establish causal relationships.

Iodine deficiency during intra-uterine life causing cretinism and impaired cognitive and motor development is a clear-cut conclusion drawn from research (Grantham-McGregor and Ani, 1999). Cao et al (1994) also noted that cretinism which can be avoided by giving iodised salt to the mother is the most common preventable cause of mental retardation. However, the role of iodine supplementation in the development of school-age children in iodine deficient areas is less clear.

Recent research shows that the period from pregnancy to 24 months is the most critical period and hence offers a window of opportunity for the delivery of nutrition interventions. If proper nutrition interventions are not delivered to children before the age of 24 months, they could suffer irreversible damage into their adult life and to subsequent generations (The Lancet, 2008). Research evidence from a variety of studies in different countries establishes that malnutrition in the early stages of development produces a detrimental effect on the mental development of children and thus negatively impacts their learning capacities, which in turn are likely to affect school performance in late childhood. Different types of malnutrition interact with one another as well as other environmental and social factors to have a powerful detrimental effect on children's cognitive development and ability to learn. In the next section I will examine childhood malnutrition in India.

3. Overview of malnourishment among children in India

India has made a significant progress in economic growth in recent years, but the country's performance in terms of human development indicators remains unsatisfactory. Rates of poverty reduced to 21.8 percent in 2004-05, from 26.1 percent, 1999-2000 (GoI, 2007a). In 2001 census data revealed that absolute numbers of illiterate people had declined in India for the first time (Kapur and Murthi, 2009:2). Health, however, remains an area of concern. Though infant mortality rates have fallen and life expectancy has been rising, health indicators still point to high rates of malnutrition and mortality especially among women and children and a widespread lack of access to health-care.

An assessment of the progress made in Asian countries towards the Millennium Development Goals (MDGs) in 2007 conveys a similar picture of mixed progress (ADB, 2007). The MDGs were adopted in 1990 and designed to achieve prescribed quantitative targets by 2015. While India is rated as an early achiever on primary school enrolment, the progress relating to income, poverty and malnutrition presents a dismal picture. India with 48.5 percent and Bangladesh with 47.5 percent have the highest proportion of under-five children who are underweight in the country. Excluding India, the average underweight prevalence rate in South Asia is 37 percent, indicating a reverse scenario to what was seen in primary education. While in primary education, India with 95 percent enrolment actually increased the regional progress towards the MDG target, for malnutrition, India's high rate of underweight and malnourished children slowed progress. Although Bangladesh has made significant recent progress, India and Bangladesh along with four other countries: Lao PDR, Myanmar, Pakistan and the Philippines are unlikely to achieve the nutrition MDG (ADB, 2007:8).

In another estimate, Gragnolati et al (2005) conclude that taking into account all likely economic growth scenarios; India will not reach the nutrition MDG without direct nutrition interventions. Their analysis is based on data from NFHS-2 (National Family Health Survey) and indicates that in 1998-99 even the wealthiest quintile had a prevalence of malnutrition (33 percent) that far exceeded the MDG goal. Projections indicate that economic growth alone is unlikely to be a sufficient factor to lower the prevalence of malnutrition (see also Bhalotra, 2006). Therefore, a rapid scaling up of health, nutrition, education and infrastructure is needed if the MDG is to be met.

3.1 The Extent and Distribution of Child Malnutrition in India

Although malnutrition among children is clearly a significant issue in India, national data on levels and determinants of malnutrition only became available from 1992 when the first National Family Health Survey (NFHS) began collecting anthropometric data on height and weight of children from a representative sample of households in the country. NFHS provides estimates for the country as a whole and for all states; it also gives information on social groups namely scheduled castes, scheduled tribes and other 'backward' classes¹.

Disaggregating data from NFHS-3 on stunting, wasting and underweight children under-three indicate that six states in India account for a majority of the underweight children in the country. These include Bihar, Chhattisgarh, Gujarat, Jharkhand, Meghalaya, and Uttar Pradesh. The percentage of underweight children in these states is more than the national

¹ The Government of India classifies some of its citizens based on their social and economic condition as Scheduled Caste (SC), Scheduled Tribe (ST) and Other Backward Class (OBC). These groups have quotas reserved for them in government jobs and can receive various types of government welfare.

average. Children under three who are stunted are also concentrated mainly in these states (Table 1). Around forty percent of children in Bihar, Chhattisgarh, Gujarat, Jharkhand, Madhya Pradesh, Meghalaya and Orissa are stunted. More than twenty percent of children in Bihar, Jharkhand, Meghalaya and Tamil Nadu are in the category of 'wasted'. Most of the states have more than sixty percent anaemic children.

Table 1: Nutritional status of children in India by state (%)

State	Stunted	Wasted	Underweight	Anaemia
Andhra Pradesh	33.9	12.7	36.5	79
Arunachal Pradesh	34.2	16.5	36.9	66.3
Assam	34.8	13.1	40.4	76.7
Bihar	42.3	27.7	58.4	87.6
Chhattisgarh	45.4	17.9	52.1	81
Delhi	35.4	15.5	33.1	63.2
Goa	21.3	12.1	29.3	49.3
Gujarat	42.4	17	47.4	80.1
Haryana	35.9	16.7	41.9	82.5
Himachal Pradesh	26.6	18.8	36.2	58.8
J& K	27.6	15.4	29.4	68.1
Jharkhand	41	31.1	59.2	77.7
Karnataka	38	17.9	41.1	82.7
Kerala	21.1	16.1	28.8	55.7
Madhya Pradesh	39.9	33.3	60.3	82.6
Meghalaya	41.7	28.2	46.3	68.7
Maharashtra	37.9	14.6	39.7	71.9
Manipur	24.7	8.3	23.8	52.8
Mizoram	30.1	9.2	21.6	51.7
Nagaland	30.3	14.6	29.7	na
Orissa	38.3	18.5	44	74.2
Punjab	27.9	9	27	80.2
Rajasthan	33.7	19.7	44	79.6
Sikkim	28.9	13.1	22.6	56.9
Tamil Nadu	25.1	21.5	33.2	72.5
Tripura	30	19.9	39	67.9
Uttaranchal	31.9	16.2	38	61.5
Uttar Pradesh	46	13.5	47.3	85.1
West Bengal	33	19	43.5	69.4
India	38.4	19.1	45.9	79.2

Source: IIPS, 2007.

Another source of information on nutritional status of populations is the National Nutrition Monitoring Bureau (NNMB). Reviewing the trends of the nutritional status of children in rural areas using the NNMB data and analyzing the determinants of malnutrition using NFHS-2 data showed that eight states combined accounted for 77 percent of the severely malnourished children of India in 1998-99 and 75 percent of the undernourished children (moderate and severe). These states included Andhra Pradesh, Bihar, Madhya Pradesh, Maharashtra, Rajasthan, Uttar Pradesh and West Bengal. Uttar Pradesh alone accounted for 24 percent and Bihar for 11 percent of undernourished children (Radhakrishna and Ravi, 2004a). This analysis also showed that malnourished children were concentrated in these seven states and Orissa. These trends indicate that the main problems are concentrated in some states, and some of these states are not making much improvement.

Table 2: Malnourished children according to social group in six major states in India (%)

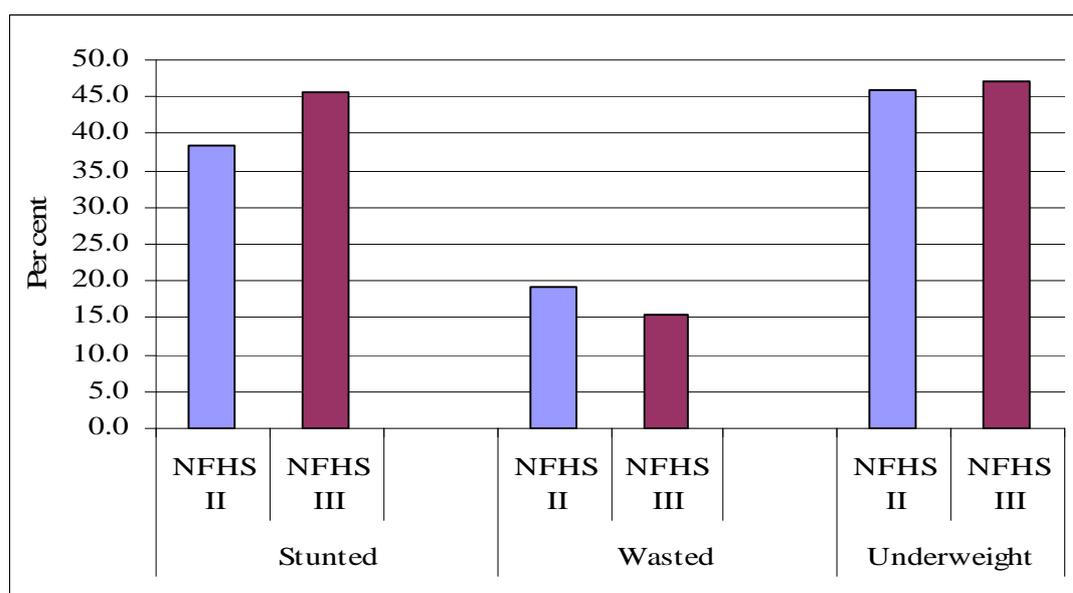
States	Under weight	Severely Malnourished				
		Scheduled Castes	Scheduled Tribes	Other Backward Castes	Others	Total
Bihar	54.1	28.3	36.1	25.5	18.5	25.5
Madhya Pradesh	55.1	30.0	31.4	22.4	14.5	24.3
Uttar Pradesh	51.7	24.1	33.5	25.6	17.6	21.9
Orissa	54.4	24.2	26.5	20.7	12.2	20.7
Rajasthan	50.6	26.1	27.6	19.2	17.0	20.8
Chhattisgarh	60.8	36.5	32.4	21.0	NA	25.90

Source: IIPS, 2000.

Data presented in Table 2 shows that children belonging to specific social groups such as scheduled tribes and scheduled castes have a very high proportion of severely malnourished children in six major states.

Looking at the change in malnutrition levels in India between the period 1998 and 2005 i.e. between NFHS-2 to NFHS-3, one finds that the percentage of stunted children increased from 38.4 to 45.5 (Figure 1). There has been a marginal worsening in underweight children where the prevalence increased from 45.9 percent to 47 percent. In the case of the ‘wasted’ category, the prevalence improved from 19.1 to 15.5 percent. Preliminary results from NFHS-3 data confirm the continuing neglect of health as well as the inadequate reach and efficacy of health and child-care services (Shiva Kumar, 2007). NFHS-1 and 2 also showed that health services either did not reach the disadvantaged communities or were not accessed by them (Roy et al, 2004).

Figure 1: Stunted, wasted and underweight children (%): comparing NFHS-2 and NFHS-3

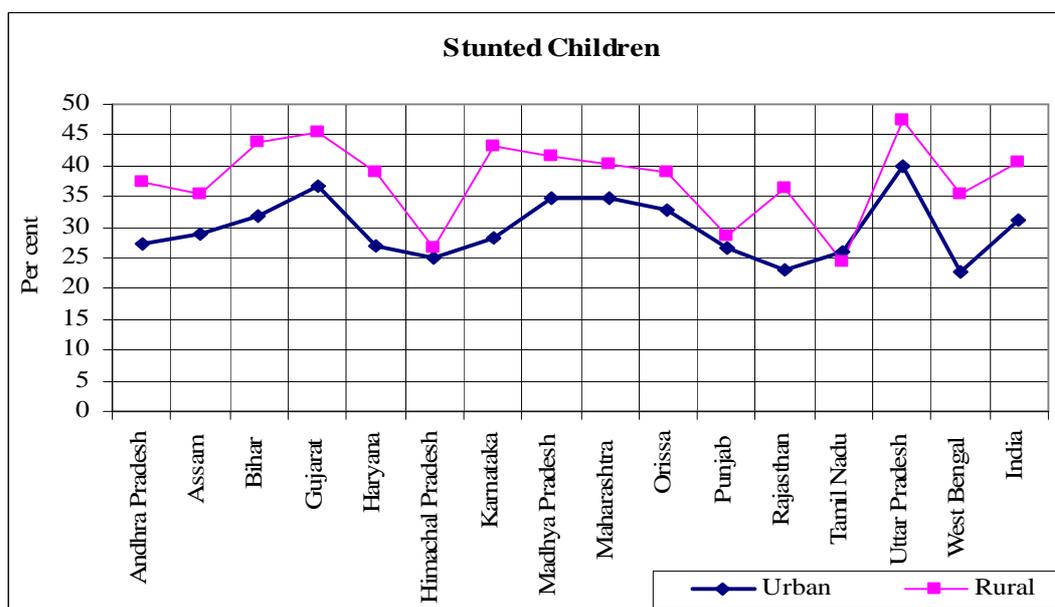


Source: Data from IIPS, 2000 & 2007.

3.1.1 Rural-urban difference

NFHS-2 data showed large rural–urban differences in rates of childhood malnutrition. Except for Sikkim, all states had a high prevalence of child undernutrition in rural areas (IIPS, 2000). NFHS-3 data also shows fairly large differences among children in rural and urban areas in malnutrition among stunted, wasted and underweight children. A large rural-urban differential was seen in stunted children in Karnataka (14.9 percent), Rajasthan (13.5 percent), West Bengal (12.7 percent), Haryana (12 percent), Bihar (11.8 percent) and Andhra Pradesh (9.9 percent), which was higher than the nation’s average of 9.6 percent (see Figure 2).

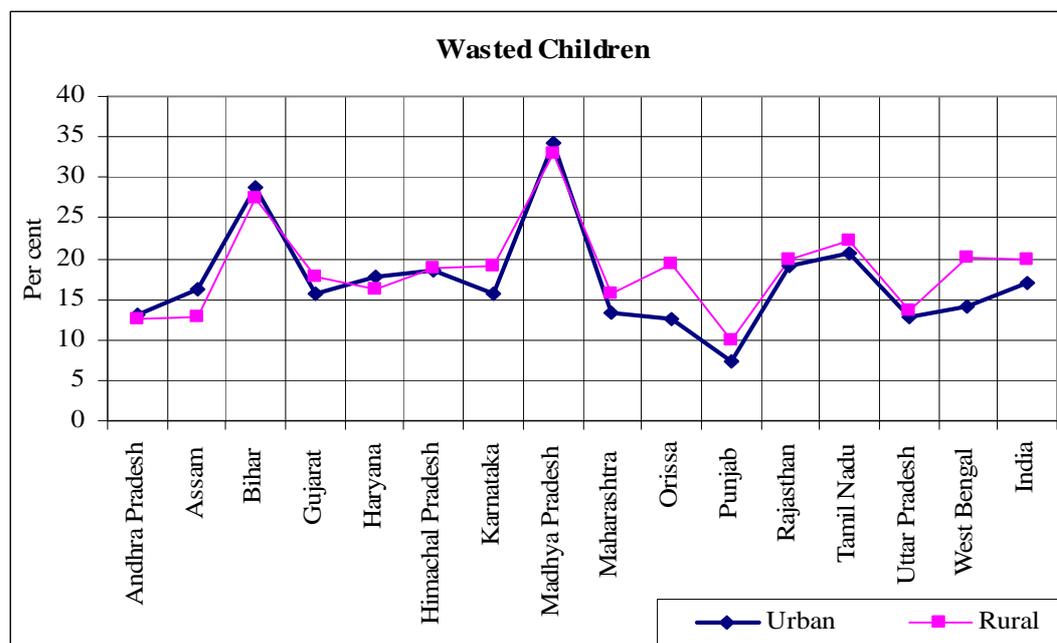
Figure 2: Percentage of stunted children: rural-urban differences, 2005-06



Source: IIPS, 2007.

More rural children in the ‘wasted’ category were seen in all states except Andhra Pradesh, Bihar, Madhya Pradesh, Haryana and Assam, though the differences observed were quite small. Two states with the largest rural-urban difference in wasted children were Orissa and West Bengal where the prevalence was higher in rural areas and the rural-urban differential was more than the country’s average (see: Figure 3).

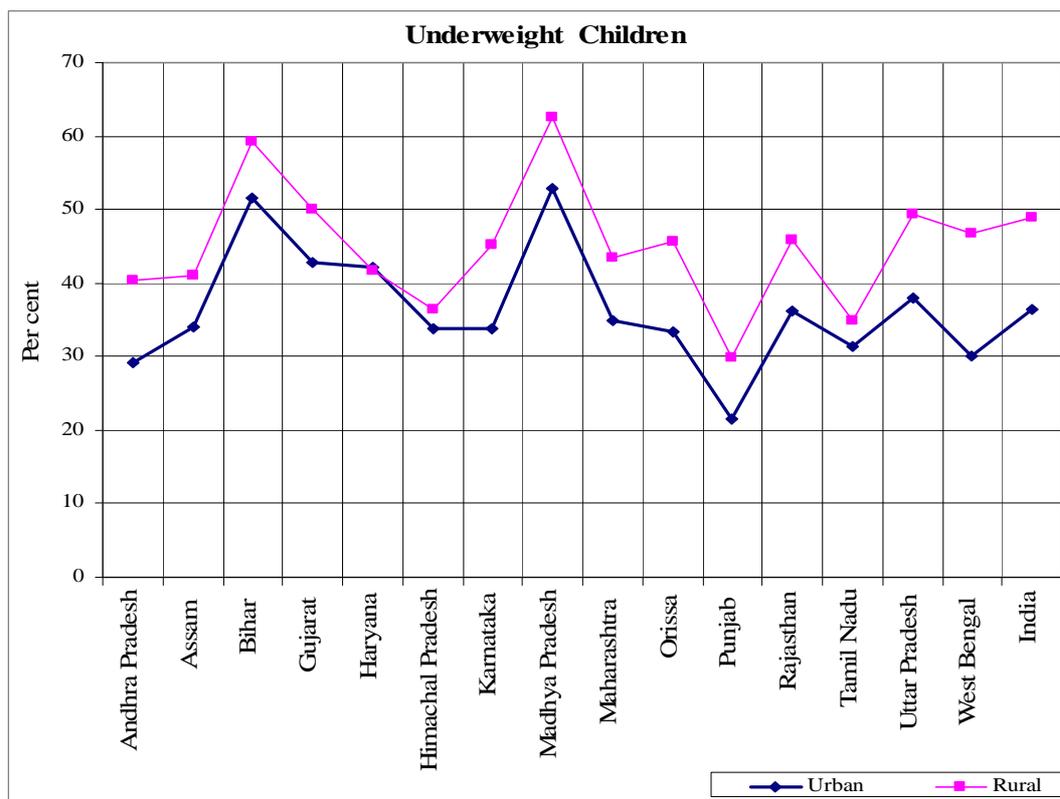
Figure 3: Percentage of ‘wasted’ children: rural-urban differences, 2005-06



Source: IIPS, 2007.

The rural-urban differential in the proportion of underweight children (with an excess of rural over urban) was found to be the largest in West Bengal (16.7 percent), Orissa (12.4 percent), Uttar Pradesh (11.5 percent), Andhra Pradesh (11.3 percent) and Karnataka (11.3 percent).

Figure 4: Percentage of underweight children: rural-urban differences, 2005-06

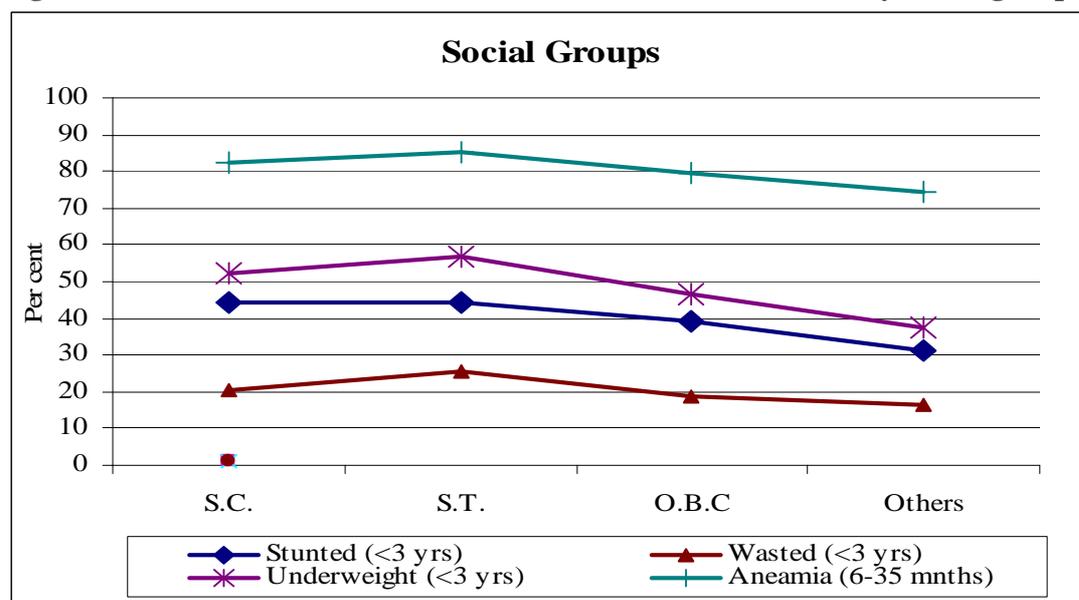


Source: IIPS, 2007.

3.1.2 Social group difference

The Prevalence of malnutrition as seen from NFHS-3 data shows that the highest proportion of children who are stunted, ‘wasted’ and underweight is found among scheduled castes and scheduled tribes (Figure 5).

Figure 5: Prevalence of malnutrition and anaemia in children: by social groups, 2005-06



Source: Data from IIPS, 2007.

A higher proportion of scheduled tribe children were malnourished than scheduled caste children. The same trend was also true for anaemia. A significantly high proportion of malnourished children among scheduled tribes was also observed in the year 1998-1999 (Table 2). This again confirms that during the period from 1998-1999 to 2005-06, the condition of scheduled caste and scheduled tribe children has not improved much.

3.1.3 Gender difference

A marked gender difference in malnutrition has been reported in many studies, with higher numbers of girls being malnourished (Tarozzi and Mahajan, 2005, Sen and Sengupta, 1983). A study aimed at understanding the change in child nutrition and gender difference during the nineties when India made rapid progress in economic growth, shows that gender difference in nutritional status actually increased owing to a substantial improvement in nutritional status of boys as compared to that of girls. However, changes in nutritional status were found to be similar among boys and girls in the south of India (Tarozzi and Mahajan, 2005). This conforms to a general trend of gender discrimination being more prevalent in the north of India compared to the south. In another investigation of the nutritional condition of under-five children from two villages in West Bengal, Sen and Sengupta (1983) found that a village with a better over-all nutritional record had much sharper sex discrimination. The economic benefits accruing to the children through land reform seem to have primarily benefited boys rather than girls.

A gender bias in nutrient intake was reported in some states in India, though this was true for higher age groups as well as children. Lancaster et al (2006) found major differences between states and age groups. While Kerala and Maharashtra recorded a significant gender bias in the intra-household allocation of nutrients for adults in the age group of 18-60 years, the bias was reported in the younger age group, 11-17 years in Haryana (Lancaster et al, 2006). Examining the global figures, among the causes that are found to result in malnutrition, high rates of illiteracy among women and high prevalence of gender inequality are understood to play a significant role in the country (UNICEF, 2006).

3.2 Micronutrients

Deficiency of essential micronutrients such as vitamin A, iron, iodine, folic acid and zinc, constitutes a major health threat for a large number of children in India. Estimates suggest that every day, more than 6,000 under-fives die in India and more than half of these deaths are caused by malnutrition, mainly due to micronutrient deficiency. About 57 percent of preschoolers and their mothers have sub-clinical vitamin A deficiency. Twenty six percent of the country's population is zinc deficient which contributes directly to stunting. Nearly 50,000 children are deformed every year due to folic acid deficiency. The loss on account of micronutrient deficiencies costs the nation 1 percent of GDP which amounts to Rs. 277.2 billion or more in terms of loss of productivity, illness, increased health care costs and death (Micronutrient Initiative, 2006).

The average dietary intake of micronutrients estimated by the M. S. Swaminathan Research Foundation (cited in Micronutrient Initiative, 2006) suggests that the low-income population in rural areas is able to meet 48 percent of the recommended daily allowance of iron. Iron deficiency anaemia in the country is high because of low dietary intake, poor iron, and other nutrient intake; poor bio-availability of iron; and infections such as malaria and hook-worm infestations.

Table 3: Vitamin and mineral deficiencies in India

Nutrient	Current Estimated Status of Deficiency in India	Current Status of Protection
Iron	Estimated prevalence of IDA in children under 5 years of age: 75% Estimated prevalence of IDA in women of age 15-49: 51% Estimated annual deaths from severe anaemia: 22,000	Pregnant women consuming at least 60 iron-folate tablets: 30% Adolescent girls receiving weekly iron-folate supplement: 10% Consumption of iron-fortified foods (wheat flour/cereal flour/salt): <1%
Iodine	Estimated annual number of children born unprotected from mental impairment due to iodine deficiency: 66,00,000	Estimated houses using iodised salt: 37%
Vitamin A	Estimated percentage of children under 5 with sub-clinical vitamin A deficiency: 57% Estimated number of child deaths precipitated annually: 3,30,000	Children under 5 receiving two doses of vitamin A per year: 34% Consumption of vitamin A fortified foods (oils/fats/others): <1%
Zinc	Population at risk of inadequate zinc intake: 26% Stunting in children under 5 years of age: 43%	No significant intervention
Folic Acid	Estimated annual number of neural tube birth defects: 50,000	No significant intervention

Source: Micronutrient Initiative, 2006.

A review (Srihari et al, 2007) based on eleven studies on the nutritional status of school children (6-18 years) from middle and high socio-economic families found high levels of anaemia. Anaemia prevalence ranged between 19-88 percent across five Indian cities. The problem of overweight children was reported to range from 8.5 percent to 29 percent and obesity, though not a common problem yet, was seen among 7.4 percent to 15 percent of school-age children. The problem of anaemia is much more common among girls in low income families. A study of 15 urban slums of Ahmedabad city reported 81.8 percent of girls in the age group 6-18 years as being anaemic (Verma et al, 2004). Sen and Kanani (2006) estimated the prevalence of anaemia in 9-14 year old school-going girls in Vadodara to be 67 percent and found it to be affecting physical work capacity and cognition. Research on preschool children has also shown that iron deficient children performed less well on psychomotor tests than non-anaemic children (Bhatia and Seshadri, 1993).

The number of children born with iodine deficiency per year is estimated to be 6.6 million in the country. A simple, safe, effective and acceptable means of eliminating iodine deficiency disorder (IDD) is through Universal Salt Iodization (USI). However, the proportion of households consuming adequately iodized salt in the country declined from 50 percent in 1999 to about 37 percent in 2003 (Table 3). In areas where iodine deficiency is endemic, the average child loses 13 IQ points (Micronutrient Initiative, 2006). In Bangladesh and Bhutan, 95 and 70 percent households consume iodized salt, respectively. A general perception that the prevalence of IDD is confined to the sub-Himalayan region is not true. Of the 312 districts surveyed, prevalence of IDD was seen in 254 districts (Micronutrient Initiative, 2006).

India has the largest percentage as well as the largest absolute numbers of vitamin A deficient children in the world. In 1990, the country had about 60 percent of children in the age group of 0-72 months with sub-clinical vitamin A deficiency. There has been only a minimal decline since with 57 percent of children below 6 years of age at potential risk from sub-clinical vitamin A deficiency (Mason et al, 2004). This deficiency precipitates the death of 330,000 children every year in the country (Micronutrient Initiative, 2006). According to estimates available from the M. S. Swaminathan Research Foundation, a large proportion of the Indian population receives less than 50 percent of the recommended dietary intake of vitamin A from dietary sources (Micronutrient Initiative, 2006). An investigation of the dietary intake of vitamin A of preschool children in southern India reported significantly lower intakes for case of girls compared to boys (Ramakrishnan et al, 1999). A positive association was found with the socio-economic status of the family as well as level of maternal education. In this context, the state government of Karnataka in collaboration with an NGO and Micronutrient Initiative, has launched a state-wide campaign to ensure that every child receives 9 doses of vitamin A by age 5 with a 6-month interval between each dose, under the Vitamin A Supplementation (VAS) programme.

3.3 Determinants of Malnutrition

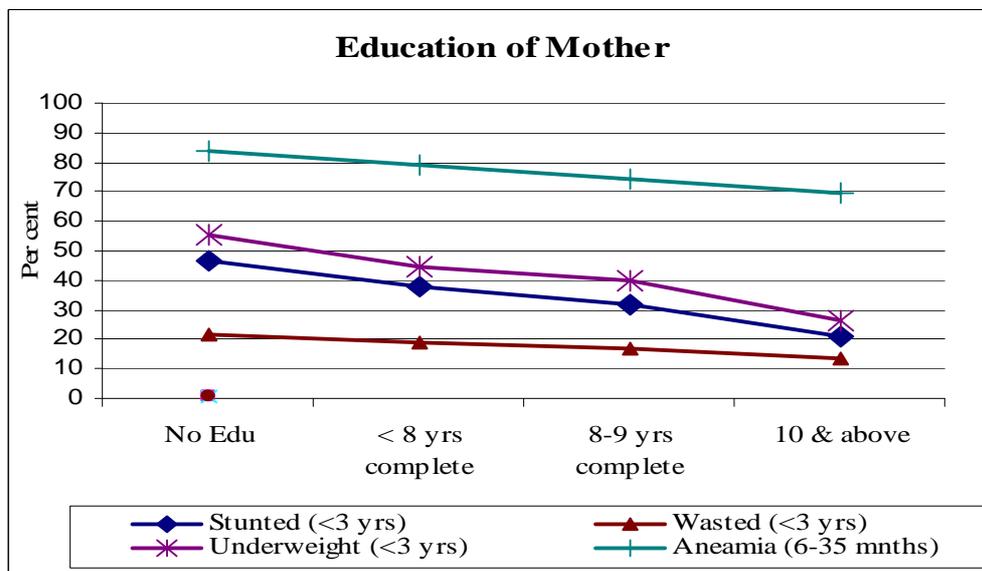
While a child's nutritional status is the immediate outcome of child's dietary intake and child's health status, the underlying and basic determinants of malnutrition are far more complex (for a theoretical framework, see Mosley and Chen, 1984). Three types of resources: household food security; resources for care of mothers and children and; resources for health-related issues make up the underlying determinants of malnutrition in children.

A number of investigators have analyzed the NFHS data on child malnutrition to understand the determinants of malnutrition (Radhakrishnan & Ravi, 2004a; Ramakrishnan et al, 1999; Mishra & Retherford, 2000; Nair, 2007). Using NFHS-2 data, a multivariate analysis of the effects of selected demographic and socio-economic factors on child malnutrition by Mishra et al (1999) indicates that the strongest predictors of child malnutrition are a child's age, the child's birth order, the mother's education and the household's standard of living.

3.3.1 Education of Mother

Lack of education of mothers is a significant underlying cause of malnutrition in children (UNICEF, 2006). Data from NFHS-3 were analysed to see whether there was an association between the level of maternal schooling and prevalence of malnutrition in children. A clear-cut negative relationship between underweight and stunting in children with the level of education of mother is discernible as depicted in Figure 6. Incidence of malnutrition is seen to be much higher among children of illiterate mothers. Completed education of more than 8-9 years is positively associated with malnutrition. Other than wasting, all forms of malnutrition including anaemia seem to reduce with increase in education of mother.

Figure 6: Prevalence of malnutrition and anaemia in children in India by maternal schooling



Source: Data from IIPS, 2007.

In order to identify explanatory variables of malnutrition in India, Nair (2007) examined the relationship of malnutrition among children under-three with other variables. These included the education level of the mother, age at marriage, exposure to media, pattern of feeding children, age at the birth of the first child and the mother’s own health. From the analysis, Nair (2007) found:

The highest value of the co-efficient of correlation was not for BPL at all the three points considered. One set of variables that was considered indicative of awareness among women of factors affecting health included three dimensions, viz. complete absence of education in women, completion of primary education by women, and non-exposure of women to media. Among these, the first dimension i.e. complete absence of education in women was the only one that had a significant co-efficient of correlation with malnutrition at all the three points of time (Nair, 2007:3800)

It is amply clear from field data that mother’s education has the strongest independent influence on child nutrition levels. Children whose mothers have little or no education tend to have lower nutritional status than children of more educated mothers, even after controlling potentially confounding demographic and socio-economic variables (Mishra & Retherford, 2000). A longitudinal study conducted in West Bengal (Pandey, 2007) also found that educated mothers (primary level education) made a significant difference as they ‘took better care’ of their children as reflected in the children’s nutritional status.

4. Links between Malnutrition and School Participation

What follows here is a cross-national review of studies that show the linkage between malnutrition and school participation of children. Given the close-knit relationship between nutrition and health factors, some studies on health have also been included. School participation has been broadly viewed to include enrolment, attendance and achievement at school.

Delayed school enrolment as a consequence of early childhood stunting due to malnutrition has been reported in a number of studies across different countries. For instance, short stature was reported to be associated to late enrolment for primary school children in Tanzania and Ghana (Rosso, 1999). The adverse effect of child malnutrition on school enrolment, attendance and performance was also found in the Terai region of Nepal (Moock and Leslie, 1986) and in China (Jamison, 1986).

A recent study that employed a more comprehensive methodological design, used longitudinal data collected from three regions of the Philippines, on 1,251 school-age children, their families and early childhood education providers (Ghuman et al, 2006). This investigation examined the influence of children's health and nutrition, family background, teachers, characteristics of primary schools on school enrolment levels.

The study also looked at whether the importance of children's health and nutrition on enrolment is greater in communities where families have access to better schools. It emerged that children's haemoglobin levels have significant positive effects on school enrolment. These are generally understated in models that take child health and nutrition as pre-determined. Secondly, the study brought out important interactions between family background on the one hand and the quality and accessibility of schools on the other hand, suggesting important complementarities in their effect on grade one enrolment. No important interactions were seen between children's nutrition and the quality of schools and teachers in their relationship with enrolment (Ghuman et al, 2006).

Another longitudinal analysis looked at the relationship between early childhood health and delayed school enrolment in Pakistan (Alderman et al, 1997, 2001). It was found that children's health and nutrition is three times more important for enrolment than is suggested by "naive estimates" that assume that children's health and nutrition is predetermined rather than determined by household choices. Not only does improved nutrition increase enrolments, it does so more for girls, thus partly reducing the gender gap. Private behaviour and public policies that affect the health and nutrition of children have much greater effect on school enrolment and on eventual productivity than was suggested by earlier literature (Alderman et al, 1997).

Improving early childhood nutrition has far reaching influence on the education of children and may increase the likelihood of high school completion in developing countries, according to data from Cebu in the Philippines. An association between height-for-age Z-score (HAZ) at 2 years and schooling trajectory among 2,198 children from the Cebu Longitudinal Health and Nutrition Survey and schooling outcomes was explored. It was found that greater height for age protected against late enrolment among both boys and girls and predicted early enrolment among boys. Absolute probability of late enrolment dropped substantially, from 6 percent for both boys and girls to 2 percent for boys and 1 percent for girls. Absolute grade repetition dropped ~7 percent for boys and 9 percent for girls (Daniels & Adair, 2004).

Similar results have been recorded in studies in Africa. Glewwe & Jacoby's (1995) research in Ghana firmly supported the hypothesis that early childhood malnutrition causes delayed enrolment. A cross national study on the haemoglobin concentrations and prevalence of anaemia in rural school children in eight countries in Africa and Asia (Ghana, Indonesia, Kenya, Vietnam, Tanzania, Mali, Malawi, and Mozambique) covered 14,000 children enrolled in basic education. This research showed that more boys than girls were anaemic, and children who enrolled late in school were more likely to be anaemic than children who enrolled closer to the correct age (Hall et al, 2001).

School enrolments may be delayed for health reasons, including infections. A study was conducted on 520 households to identify reasons for non-enrolment and to evaluate differences in the occurrence of helminth infection between enrolled and non-enrolled children in Zanzibar, Tanzania. One school-age child was randomly selected in each household and investigated for soil-transmitted helminth infection. Among non-enrolled school-age children, the proportion of heavy intensity infections was twice that of enrolled school-age children (Montresor et al, 2001).

Early childhood nutrition programmes have been visualized as a way to increase students' academic achievement. The nutrition-learning nexus was investigated using a unique longitudinal dataset that followed a large sample of Filipino children from birth until the end of their primary education. Results indicate that the better nourished children performed significantly better in school, partly because they entered school earlier and thus had more time to learn. Also, because of their better nutritional levels, they had better capacity to learn (Glewwe, Jacoby & King, 2001).

In another study, the relationship between the nutritional status and educational achievement among 399 primary school children from low-income households in Malaysia was examined (Shariff et al, 2000). Height for age was found to be significantly related to household income, implying that stunting may be a consequence of prolonged socio-economic deprivation. Educational achievement of these children was measured based on test-scores for Malay, English and Arithmetic. Most of the children scored less than 50 for English. Their total score for the three subjects was significantly associated with socio-economic status of the family, height-for-age, gender and birth order. The study, therefore, corroborates the findings from other investigations, indicating that stunting is related negatively to educational achievement. In another investigation, the performance of Brazilian school-age children in arithmetic was found to be hampered by growth impairment leading to the conclusion that growth status of children is positively correlated with competency in arithmetic (Brito and de Onis, 2006).

Deficiency of micronutrients such as iron, iodine, vitamin A and zinc has also been found to have a negative influence on school participation. Bobonis et al (2004) examined the relationship between school participation and iron deficiency in children in New Delhi. The investigators evaluated the impact of a health intervention delivering iron supplementation and deworming drugs in 2-6 year-old children through an existing network of preschool programme in slums of Delhi. Sample schools were randomly divided into groups and gradually phased into treatment. Weight increased among assisted children, and preschool participation rates rose by 5.8 percentage points, reducing absenteeism by one-fifth in the first five months of the programme. Gains were especially pronounced for those most likely to be anaemic at the beginning. These results contribute to a growing view that school-based

health programmes are an effective way of promoting school attendance (Bobonis et al, 2004).

Iron supplementation has been seen to have a beneficial effect on iron nutritional status and cognitive functions in children. A study examined the effect of iron supplementation on cognitive functions in children by a double-blind intervention trial in nine-year-old mildly anaemic school children (Buzina-Suboticaneć et al, 1998). After completion of the baseline examination, one group of children was given a supplement containing 100 mg of iron for 10 weeks while the other group received a placebo.

The cognitive development was assessed using an abbreviated Wechsler Intelligence Scale for Children-Revised (WISC-R). There were highly significant correlations of the WISC-R scores with initial height-for-age, haemoglobin, haematocrit, and transferrin saturation. The effects of iron supplementation were more pronounced in children with initially lower haemoglobin values. The study concluded that iron supplementation in nine-year-old schoolchildren with haemoglobin levels between 110 and 119 g/L would result in an improvement of cognitive functioning, even though the children were not otherwise malnourished.

A study by Huda et al (1999) found that in Bangladesh, iodine deficiency in children was found to be associated with poor school achievement and cognition. Cognitive function and school achievement were compared for a matched group of 170 children from iodine deficient regions in rural Bangladesh. The study found that after controlling for other variables, children with iodine deficiency performed worse than the other group on reading, spelling and general cognitive factors.

Does food insecurity at home have any long-term effects on the school performance of children? The first ever study that investigated a longitudinal relationship between household food insecurity and social skills in children found that food insecurity at kindergarten predicted impaired academic performance in reading and mathematics for both boys and girls (Jyoti et al, 2005). A greater decline in social skills for boys was noted. Food insecurity thus serves as an important marker for identifying children with delayed trajectories for development.

Bleakley (2003) found that parasitic worm diseases, which are commonly found in school-age children, can affect their school attendance. Other research has also shown that health interventions such as deworming and malaria prevention can boost school participation of children. Deworming was found to be a cost-effective strategy that can reduce school absenteeism substantially. This was seen in Kenyan project in which school-based mass treatment with deworming drugs was randomly phased into schools rather than giving it to individuals (Miguel & Kremer, 2004).

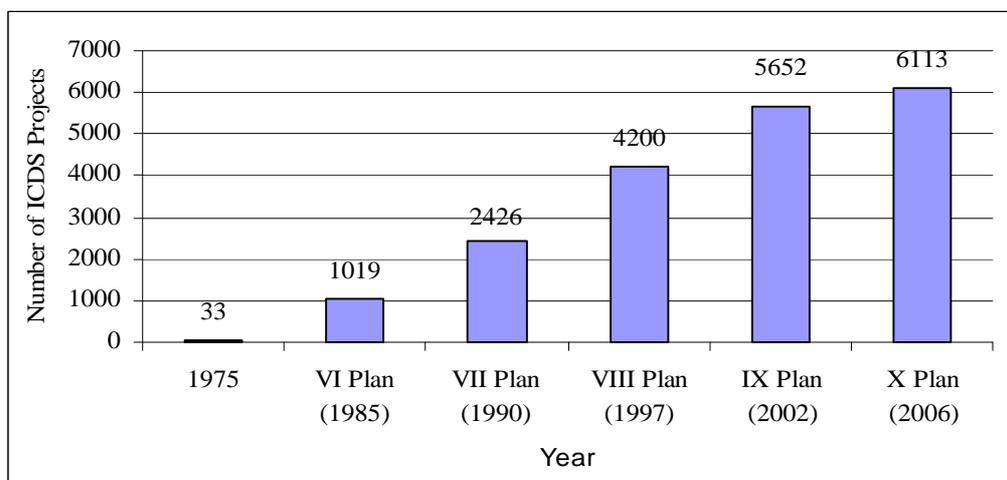
5. Current efforts to address malnutrition in India

Malnutrition strikes children as early as the prenatal period. Therefore, nutrition interventions targeted at expectant women are the best way to prevent malnutrition in children. From the prenatal stage through the early childhood period and right up to late childhood, children must receive comprehensive care that brings about the synergistic effects of health, nutrition and education inputs. As seen in sections 2 and 4, malnutrition affects cognitive development of children as well as school participation in direct and indirect ways. Efforts to combat malnutrition in India have addressed both these aspects. The Government of India proclaimed a National Policy for Children (GoI, 1974) declaring children as a "supremely important asset". The policy provided the required framework for assigning priority to different needs of children. While there are separate schemes targeted at young girls and mothers, namely Nutritional Programme for Adolescent Girls, National Maternity Benefit Scheme etc., two major child development and nutrition programmes that are in operation include the Integrated Child Development Services (ICDS), and the National Programme of Nutritional Support to Primary Education, 2004, commonly known as Mid-Day Meal Programme (MDM).

5.1 Integrated Child Development Services

Launched in 1975, the ICDS is a national child development programme in India that targets children in the 0 to 6 age group and mothers. The programme uses a multi-pronged strategy to address all health and nutritional needs of women and children from poor households. Six services are delivered at the focal point in a village called the "anganwadi centre" (AWC), literally meaning the courtyard (this implies the services are offered at the doorsteps of the families in need). Supplementary nutrition and healthcare for younger children and their mothers; nutrition education for women; and preschool education for 3-6 year old children are the key components of the programme. Children up to 6 are given supplementary nutrition with the nutritive value of 300 kcalories and 8-10 grams of protein. In the case of malnourished children, double the amount of supplementary nutrition is provided (GoI, 2004b).

Figure 7: ICDS Projects 1975 – 2006

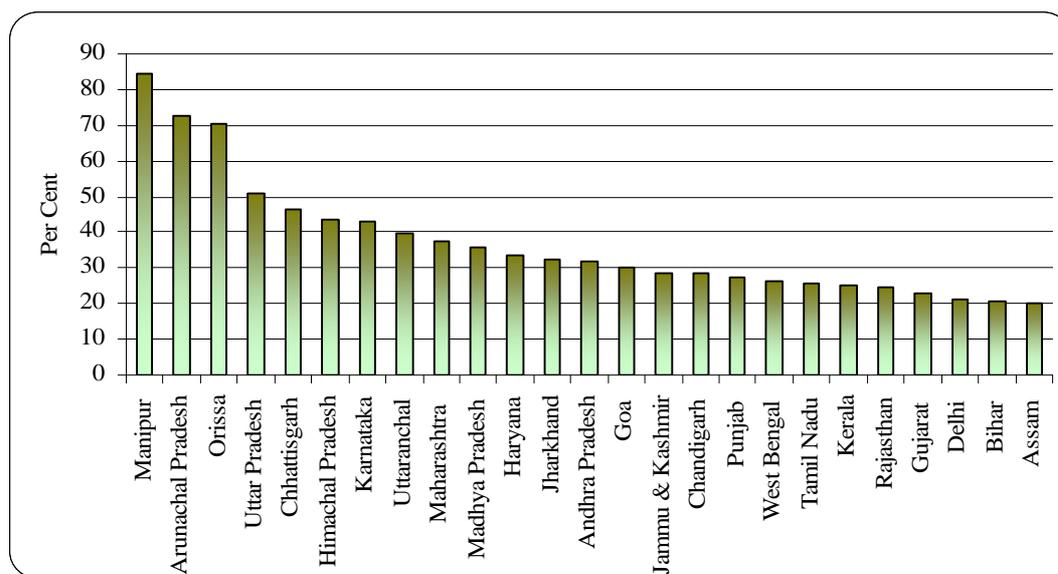


Source: Data from GoI, 2006a & 2007b.

Outreach of ICDS has gradually increased over the years. It initiated with 33 projects in 1975 and now has 6,113 projects. Figure 7 shows the expansion in successive Five-Year Plan periods. The Government of India plans to make it a universal programme, after the Supreme Court gave directions in 2006 to have an ICDS centre in every habitation. However, progress towards this has been slow due to budgetary constraints. For example, only 44 percent of centres sanctioned in 2005-06 were operationalised by March 2007 (GoI, 2007b). Poor performance in operationalisation of centres is observed in Bihar, Himachal Pradesh, Jharkhand, West Bengal, Punjab, Dadra & Nagar Haveli, Nagaland and Lakshadweep.

According to an estimate from the 2001 Census, about 35.5 percent of children in the age group of 0-6 years in India received supplementary nutrition in 2006-07 (GoI, 2007b). Using per day per beneficiary expenditure as an indicator, estimates suggest that in 2005-06, only Rupees (Rs.) 1.27 was spent as a national average against the norm of Rs. 2 per day per beneficiary stipulated for supplementary nutrition. The cost of Rs. 2 per day is shared by the Government of India and the state-governments on fifty-fifty basis. Some states have been unable to meet this requirement. In 2005-06, states that spent less than one rupee on supplementary nutrition included Andhra Pradesh, West Bengal, Delhi, Orissa and Arunachal Pradesh.

Figure 8: Percentage of children taking part in the SNP (2006)



Source: Data from GoI, 2007b.

Large variations in states have been observed with regard to the number of children who are given supplementary nutrition. While Orissa and Uttar Pradesh have a considerably higher percentage of children receiving supplementary nutrition, almost all other states, including Rajasthan, Gujarat, Delhi, Bihar and Assam, cover less than seventy percent of children (Figure 8). This estimate is based on the Census population data and the number of enrolled children in the age group, 6 months to 6 years, taken from records at the Child Development Centre.

Some researchers have also looked at the nature and extent of utilization of health services delivered as part of the ICDS. A recent study that looked at health services for children, their families and the community, and explored the continuous and cumulative nature of social

exclusion faced by poor children in three states in India, reported the poor utilization of health and nutrition services of the ICDS (Ramachandran et al, 2003). The authors confirmed that there was no system for identifying severely malnourished children in the '*anganwadi*' in order to provide double rations. They found low levels of awareness about health, including antenatal care, immunization and nutrition during pregnancy. Moreover, nutrition and health education activities were non-existent for the poorest women in the surveyed villages and urban slums. In all the three states - Karnataka, Andhra Pradesh and Rajasthan - few women took any special nutritional supplements during pregnancy. The poor performance of supplementary nutritional programmes for children (despite being a pivotal activity of the ICDS) was also reported in the national evaluation of ICDS (NIPCCD, 1992).

Preschool education activities for psycho-social stimulation are organized for children between 3-6 years old. Though an improvement in enrolment and attendance of girls has been reported over the years, the trend has not been confirmed for girls from disadvantaged sections of society. The preschool education component continues to be a weak-link in general. However, an inducement effect on enrolment and participation at the primary stage has been reported for children graduating from '*anganwadi* centres' (AWC's) where workers were identified as 'better performers' (Sood, 1987, 1992). The effect of preschool education / health inputs on school enrolment was evident in another evaluation, with more impact on girls than boys (Alderman et al, 1997). It was concluded that improvements in child preschool health / nutrition, whether resulting from changes in private behaviour due to the process of development, better information or the results of policy changes, are likely to have important long-term productivity effects through greater schooling in general. They will also help reduce the substantial gender gaps in schooling and subsequent productivity gains in particular.

Examining the reach of ICDS for malnourished children, lower coverage is seen in five large states as compared to other states. States with lower coverage include Bihar, Uttar Pradesh, Madhya Pradesh, Rajasthan and Orissa, where the majority of malnourished children are concentrated. A recent analysis showed that all these states rank among the bottom 10 in terms of ICDS coverage. In Bihar, where 55 percent of children are underweight, only 1.5 percent of children benefit from the ICDS programme (Gragnotati et al, 2004). Poorer states, measured by per capita net state domestic product, had lower levels of ICDS programme coverage than the richer states (Gragnotati et al, 2004). The analysis showed that states, which are likely to have a greater proportion of malnourished children, cover a smaller percentage of children under the ICDS; the children left out are likely to be the ones who need these services the most.

In conclusion, it can be stated that although the ICDS is a well-conceptualized programme with a potential to reach the disadvantaged population, it leaves a lot to be desired. After being on the ground for more than three decades, notwithstanding the expansion that took place in the last three decades, the programme remains ineffectively targeted as revealed by the research, leaving out those who need it the most. One of the most appropriate intervention efforts to address the health, nutrition and psycho-social needs of young children and health needs of women, the programme remains the only hope for the country to combat the problem of malnutrition in early years.

5.2 National Programme of Nutritional Support to Primary Education

To boost enrolment in schools, and simultaneously address the problem of malnourishment among school children, the Government of India launched the National Programme of Nutritional Support to Primary Education, popularly known as Mid-Day Meal Programme (MDM) in August 1995. It was thought that supplementary nutrition offered to primary stage school children, apart from improving the nutritional status of children would increase enrolment, attendance and retention, thus bringing all children into primary education. Initially, the scheme distributed 'dry rations' with the expectation that states would move to serve a cooked meal within a period of two years. However, most states continued the same way and the implementation of the scheme largely remained a low-key concern until 2001, when the Supreme Court directed all states to provide a cooked meal for children. This led to major changes on the ground and generated a lot of action among all concerned and resulted in the widening of implementation. With the present reach of 120 million primary school children, MDM is one of the largest school feeding programmes in the world (Afridi, 2005).

The programme provides for a cooked meal with a minimum of 300 kcalories and 8-12 grams of protein content, to be given to all primary stage children in government, local body and government-aided schools, and alternative education centres (GoI, 2004a). In other words, all primary stage children in the public system are expected to receive the meal. In 2006, norms were revised to provide food with nutritive value of 450 kcalories. Another welcome addition has been to incorporate adequate quantities of micronutrients, like iron, folic acid and vitamin A in some states on an experimental basis.

The programme stipulates shared responsibility between the central and state governments. Central assistance is given to the states in terms of supply of free food grains (100 grams of wheat or rice per child per school day) from the nearest grain store; reimbursement of the costs incurred on transportation from the store to the school; cooking costs (1 Rupee per child per school day) and some assistance for the management, monitoring and evaluation of the programme. Thus, the average monetary value of central assistance works out to be 2.21 Rupees per child per school day. While the central government arranges the supply of food grains via the Food Corporation of India up to the school, states are expected to meet the additional cost of cooking the meal, which pre-supposes some physical infrastructure needed for cooking. States are also expected to hire cooks for this purpose and thus, the states' share includes the salaries to be paid to the cooks. The cost of creating the infrastructure for cooking however can be managed from other centrally-sponsored schemes (GoI, 2004a).

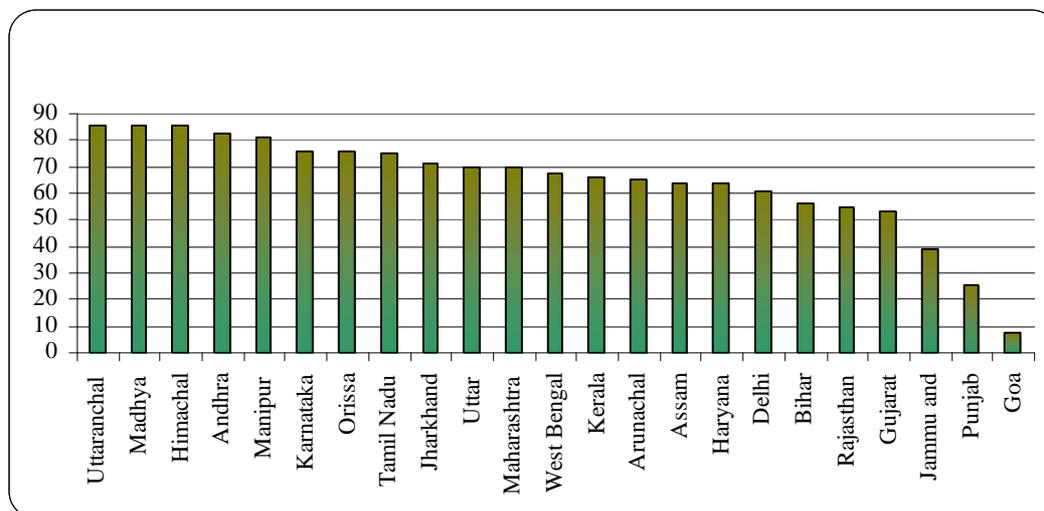
The overall responsibility of administration is vested in the state government. This includes making arrangements for infrastructure; all logistic arrangements for regular serving of wholesome, cooked mid-day meals of satisfactory quality and nutritive value; and contributing financial and other inputs over and above the central assistance. Every state is required to designate a nodal department for implementing this programme effectively. One nodal officer or agency is designated at the district level, e.g. District Collector / District Panchayat. At the local level, the state government is expected to assign responsibility for implementation and supervision to an appropriate body, which could be Gram Panchayat, Municipality, Village Education Committee (VEC), Parent-Teacher Association (PTA) or School Management-cum-Development Committee. Responsibility for cooking is to be, as far as possible, assigned to local women's Self-Help Groups (SHGs), youth clubs affiliated to Nehru Yuvak Kendras, VECs, SMDC, PTA/ MTA, or an NGO (GoI, 2004a).

Implementation of the MDM varies across the states in India. Tamil Nadu has been an exception in that it started the scheme in 1950. Gujarat began to implement the programme in 1980s. Kerala, Madhya Pradesh and Orissa were also among the early starters where a cooked meal has been provided since 1995. States that started providing cooked meal rather late for a variety of reasons include Bihar, Punjab and West Bengal. Although the programme is nearly universal, the coverage remains uneven across states.

Based on the up-take of food grains in the year 2005-06, an estimate made for the number of children who could benefit if 100 grams of food grain a day was provided for 220 days a year (the average number of working days in a year accounting for school holidays etc.) indicates that 65.7 percent of children enrolled in primary schools were covered by the MDM programme 2005-06. Considering all other factors, it can be stated that the states are not providing enough food grain to provide an adequate meal to the children as per the enrolment records. Therefore, it is possible that fewer children are getting mid-day meals than is claimed in official reports (such as GoI, 2005 cited below) or children are getting the meal but in smaller quantities.

As evident in Figure 9, most major states, like Uttaranchal, Madhya Pradesh, Andhra Pradesh, Manipur, Karnataka, Orissa and Tamil Nadu provide mid-day meals to more than 70 percent of the enrolled children. These estimates also suggest that in Bihar, Rajasthan, Gujarat, Jammu & Kashmir, and Punjab, less than 60 percent of enrolled children were given mid-day meals in 2005-06, the latest year for which data was available at the Commissioner’s office (GoI, 2005).

Figure 9: Percentage of enrolled children receiving food as part of MDM programme



Source: Calculated from data of GoI, 2005.

With increased activity generated in the last few years, the programme now covers a greater ground. This has led to greater interest among researchers to understand the effectiveness of the programme. Studies such as Afridi (2005), Pratiche India Trust, (2002) and De et al (2005) have documented the impact of MDM on enrolment and school participation of children, especially girls and marginalized groups; health and nutritional gains; and socialization benefits. A brief review of research on these dimensions is presented below.

5.2.1 Enrolment of Children:

A survey conducted by the Centre of Equity Studies (CES) in three states- Chhattisgarh, Rajasthan and North Karnataka compared school enrolment in July 2002 with the corresponding figures of the previous year before midday meals were introduced. Class I enrolment in a sample of 81 schools was found to be higher by 14.5 percent between 2001 and 2002. This clear diversion from the trend increase in school enrolment of about 2 percent in the nineties, for India as a whole, the authors believed, was likely to be a reflection of the impact of MDM (Drèze & Goyal, 2003).

An increase in enrolment as a result of the MDM has also been reported in many small-scale studies. A study in Barmer (Rajasthan) on 63 schools indicated an increase in enrolment by 23 percent (Khera, 2002). Another survey showed a rise of 36 percent in class I in Madhya Pradesh (Jain & Shah, 2005). An evaluation of the MDM scheme conducted by the National Institute of Nutrition (NIN) in Andhra Pradesh, Karnataka, Orissa, Tamil Nadu, Kerala and Gujarat, also reported a small increase in enrolment. Orissa registered a higher increase in enrolment as compared to Andhra Pradesh and Karnataka (Brahmam, 2003; cited in NIEPA, 2006).

As the MDM has been implemented for several years in Tamil Nadu², the effect of the programme on the increase in enrolment and continuation of education beyond elementary stage has been clearly established (Babu & Hallam, 1989; Rajan & Jayakumar, 1992). The state provides a free meal to 2-15 year-olds (for households below the poverty line) for seven days a week round the year. The Pratichi Trust found a 10 percent increase in the rate of attendance after the launch of the MDM. The rate of increase varied according to social group. An increase of 2 percent was observed among Hindus, 12 percent among Dalits and Muslims, and 19 percent among Adivasis (Pratichi India Trust, 2002). Increases in enrolment, in various investigations, have been reported to range from 5 to 43 percent as revealed in the synthesis studies by Khera (2006). Although most of the micro studies have reported an increase in enrolment as a result of the MDM, Dreze (2006) finds that these estimates may be on the high side.

5.2.2 School Participation of Girls and Marginalized Social Groups:

Experience shows that MDM implementation has led to an increase in the enrolment of girls and SC / ST children in villages. A study that looked at school participation in rural areas reported that the provision of a mid-day meal in local schools is associated with a 50 percent reduction in the proportion of out-of-school girls (Drèze & Kingdon, 2001). In a survey of 63 schools in Barmer district, enrolment of girls at the primary level was found to be 36 percent higher in 2002, as compared to that of the previous year (Khera, 2002). The CES survey also noted an annual increase of 19 percent in the enrolment of girls. A study conducted on 280 households and 70 schools in seven districts of Madhya Pradesh reported an increase in enrolment by 38 percent in the case of girls and 43 percent for dalit children (Samaj Pragati Sansthan, cited in Jain and Shah 2005).

Although evidence in support of enhanced school participation in schools where children are given mid-day meals is growing, it is still difficult to establish whether it is entirely due to

² Tamil Nadu started providing mid-day meals in 1950, significantly earlier than in many other states.

this incentive. In some cases, instances of children being excluded from receiving meals or segregating them on the basis of caste have been reported (Thorat & Lee, 2005).

5.2.3 Cognitive Abilities, School Performance and Retention:

As noted earlier, the two most common deficiencies that have been shown to have a direct effect on cognitive abilities of children are iron and iodine. Iron deficiency renders children listless, inattentive and uninterested in learning. Poor performance on a wide range of achievement tests among iron deficient children in school has been noted. Remediation of iron deficiency through supplementation can eliminate the differences in school performance and IQ scores between school children previously deficient in iron and those without iron deficiencies (Seshadri & Gopaldas, 1989).

An increase in academic performance and a reduction in the dropout rate were observed in a study carried out in rural schools in Uttar Pradesh (Agarwal et al, 1987). Although the school meal was found to be inadequate to overcome malnutrition and ill health, the study concluded that the meal's nutritional status appeared to be the most important determinant of scholastic performance.

Fortification of school meals is the most efficient and effective route to alleviating micronutrient deficiencies in school children. MDM's potential in this regard remains largely untapped. Fortified beverages or baked grain products fortified with iron are used in several countries as mid-morning snacks or supplementary drinks.

Further, there is a need to systematically document the long-term effect of the MDM Programme on cognitive development, school performance, and retention, though limited evidence has been reported for better retention at the primary stage in some studies on MDM. For example, a study in Ryagada district in Orissa where the practice of cooked mid-day meals has been followed since 1995, found an increase in class I enrolment and an improved retention throughout the primary cycle (Sethi, 2003). A study at the National Institute of Nutrition (NIN) also showed a limited effect of MDM on dropout, retention rates and the scholastic performance of children (Brahmam, 2003).

5.2.4 Health and Nutritional Needs:

The school meal is meant to supplement children's diet and make up the deficiency in calories and proteins. Therefore children must receive an adequate quantity of food. A study by NIN showed that the MDM could bridge only 50 percent of the energy gap. This finding has also been corroborated by other studies (Jain & Shah, 2005; De et al, 2005 2006; Afridi, 2005).

The meals provided to children have been found to be deficient in terms of nutritive content. Afridi (2005) calculated the caloric and protein content of the school meal in samples collected from 63 schools in Madhya Pradesh. He found that variety in meals served the purpose of meeting the requirement of recommended allowance rather than serving the same menu on all days. A programme which serves a varied menu was found to meet 22 percent of the daily recommended allowance for children, whereas wheat porridge (the same menu every day) met only 11 percent of the daily recommended allowance of energy intake. One common problem with meeting the nutritional requirements of children was found to be the

substitute nature of the meal. Most studies reported that the MDM actually serves as a substitute for home food rather than a supplement (Blue, 2005).

Only a few states in the country cater to the need for micronutrients and address health needs by providing de-worming tablets. With the renewed emphasis on the provision of micronutrients, this aspect is likely to receive a boost and will go a long way in addressing the health and nutritional needs of children.

While these interventions have merit, greater attention could be paid to the following concerns. Firstly, since most of the growth disturbances occur in the first two years of life, nutrition interventions to be effective should be targeted early in life. For those children who are not covered in ICDS, primary school is generally the first stage for accessing nutritional interventions. Yet, the school entry age of 6 years is often too late to attempt modifications / reversals of malnutrition (Sood, 2006). Secondly, as MDM covers primary school children who attend school, many children who drop out or who have never enrolled (often girls) do not receive the benefits. Interventions are not reaching these children.

6. Conclusions

Empirical evidence shows that malnutrition in early childhood is linked to deficits in the cognitive development of children. These effects have been found to persist through school and result in impaired learning capacities. Stunting in children delays school enrolment and is found to be associated with grade repetition and a higher dropout in primary school children. Children who suffered from early malnutrition were also found to have greater behavioural problems. Deficiency of micronutrients such as iron, iodine and zinc is associated with a lower attention span, poor memory, mental retardation and poor school achievement.

Continuous low nutritional intake combined with poor access to healthcare is likely to impact on children's psychological development in terms of attentiveness, emotional expression, motivation, learning ability and school performance. Nutrition is interconnected with the environment, psychological health, health and education. Considering these issues separately results in an incomplete understanding of poverty and a reduced ability to ameliorate problems.

Malnutrition must be considered alongside other factors in childhood development. Psycho-social stimulation received by the children seems to make a significant contribution in alleviating the effects of malnutrition. Several studies show that nutritional supplementation when combined with stimulation has substantial benefits for cognitive development (Grantham-McGregor et al, 1991; Walker et al, 2000; McKay & McKay, 1983). In other investigations, interventions begun in pregnancy produced greater effects (Walker et al, 2000).

Children who experience undernutrition are also likely to grow up in an under-stimulated social and psychological environment and it is the complex interaction between these factors that causes cognitive deficits. Since it is difficult to unravel the complexity of the mechanisms and sift out the effect of psycho-social stimulation, it is difficult to establish the existence of a causal relationship between under-nutrition alone and cognitive development of children. As Glewwe (2005) has argued it is only through randomized controlled trials (using experimental designs) that causal relationships can be established.

While research in this field does clearly establish that malnutrition is associated with reduced learning potential and poor cognitive and emotional development in children, consequently affecting their school enrolment, participation and retention, there are other issues around timing, severity and reversibility that remain unclear. For example, does the age at which malnutrition occur matter? How does deficiency of more than one nutrient create complications? Earlier research showed that malnutrition occurring in the first six months was the most critical for cognitive development or that malnutrition in the second year also may have a large impact (Glewwe & King, 2001). Recent research however shows that the whole period from pregnancy to 24 months is the most critical period (The Lancet, 2008).

Another issue that remains inconclusive from the literature review is the degree of reversibility of malnutrition. In other words, are the effects of malnutrition on learning abilities of children permanent or can they be mitigated with adequate supplementation? Nutritional interventions as reported in some of these studies have in many cases been found to bring about significant improvements. For example, high-quality protein diet led to improved knowledge, numeracy, reading and vocabulary. Arithmetic skills and IQ were also

seen to improve as a result of supplementation with high-protein dietary intake. Yet the evidence does not unequivocally support the idea of malnutrition being fully reversible.

It would be worthwhile to explore some research questions to understand malnutrition and its effect on the educational access and participation of children. These can be looked at two levels - the house-hold and the school level.

At the household level, for example, some of these questions can be:

- What is the effect of incorporating micronutrients in dietary intake of expectant mothers and children in early years on school performance across different socio-economic groups?
- What health-care practices before birth and within six months of age help prevent stunting in children?
- What is the maternal knowledge about health and nutritional needs of children across socio-economic groups?
- What is the role of psycho-social stimulation in early years in reducing malnutrition and improving school enrolment, participation and achievement?
- Does the role of mothers in decision-making about school enrolment and participation vary across socio-economic groups?
- What are the different factors in a family that lead to decision-making about school enrolment and the role of mother?

Secondly, at the school level, pertinent research questions might be:

- Does access to a school health programme improve school participation of children?
- How do mass deworming strategies in schools help mitigate the occurrence of malnutrition in children and improve school participation?
- What is the relationship between malnutrition, school quality and school enrolment?

While there has been rapid economic growth in India, this has not been accompanied by a corresponding reduction in child malnutrition. This continues to puzzle policy makers and experts. Child malnutrition is a complex problem and several factors such as dietary intake of expectant mothers, feeding practices, immunization to water quality and access to health services are involved. While these issues require local level interventions, macro scale institutional structural policy programmes also have a role to play in tackling malnutrition. Given the specifics of the Indian context and the policy programmes that are already in place to combat malnutrition, new research could focus on evaluating and improving current policy programmes:

- What is the school performance of children whose mothers have been enrolled in public nutrition intervention programmes such as ICDS (before birth of the child)?
- Is the school performance of children who benefited from ICDS in the first six years and also receive mid-day meal programme in primary school any better compared to those who entered primary school without any exposure to ICDS at the preschool stage?
- How does breast feeding moderate the effect of stunting?
- What is the role of traditional health practices including indigenous treatments in improving health and school participation?

- What is the effectiveness of the MDM Programme in terms of its appropriateness in addressing specific local needs of children (quantity, quality of nutrition, timing etc.) and in improving school participation?
- Is the cooked meal an appropriate option for all regions, irrespective of local contexts or problems or is a take-home option better in certain contexts?

This paper and review of data and literature on malnutrition and its effects on cognitive development show that a more holistic approach is necessary for protecting children's welfare. In order to enable greater access to education, enrolment, continuation and attainment in education in India, the poor nutrition of the country's children must be addressed. Children's needs are multi-dimensional and therefore programmes for young children should cater to all their needs and seek integration, combining their health, nutrition, education and psycho-social well-being. Quite contrary to this, children's needs are often visualized and divided along sectoral lines, such as health, education, nutrition and welfare and often create competition between these sectors.

Focusing on malnutrition and addressing it through policy interventions such as the Mid Day Meals Programme and the ICDS could go a long way towards solving of the problems encountered by education policy makers and covered in CREATE's zones of educational exclusion (Lewin, 2007).

Using the CREATE zones of exclusion it is possible to see how nutrition and nutrition based policies could address many of the problems of access to education. For zone 0 – children who are excluded from pre-school, and zone 1 -children who have never been to school, and are unlikely to attend school, the evidence in India shows that the MDM Programme encouraged parents from disadvantaged backgrounds, who might otherwise have been excluded, to enrol their children in school (Drèze & Goyal, 2003, Samaj Pragati Sansthan, cited in Jain and Shah, 2005). Evidence also suggests that stunting results in late enrolment of children.

Studies such as Agarwal et al, (1987) and Sethi, (2003) show that the MDM programme and resulting increased nutritional health of children helped to increase performance and reduce dropout rates – the focus of zones 2 - children who enter primary schooling, but who drop out before completing the primary cycle, and zone 3 -children who enter primary schooling and are enrolled but are “at risk” of dropping out before completion as a result of irregular attendance, low achievement, and silent exclusion from worthwhile learning. Children who are attentive, have better attention spans and behaviour are less likely to be low achievers or be silently excluded.

Research from India and elsewhere indicates strong, deep and complex links between nutrition and access to education. Policy in both these areas needs to recognise and capitalise on these facts to achieve the MDGs.

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Report summary:

In education, children's poor nutrition and health status is rarely recognised as a significant factor for school enrolment, participation and achievement. However, there has been ever growing empirical evidence from global research pointing out that malnourishment among young children influences schooling in several direct and indirect ways. Malnutrition is a wide-spread problem that results from a complex interaction between environmental deprivation and undernutrition. Malnourished children typically experience a range of other environmental difficulties associated with poverty, such as poor housing, poor health-care, weak family and community support systems. There is a need to understand the way child malnutrition and poor health influence access and school participation of children. In this paper, an attempt is made to draw broad contours for developing such an understanding of the issue rooted in the Indian context. A general overview of the research evidence on the linkage between malnutrition and cognitive development has been presented. The scale and nature of malnourishment among young children in India has been detailed, highlighting the distribution across population groups and states in the country. The paper also presents a discussion of the research evidence in India that correlates malnutrition and other factors related to school participation. Further, two major national intervention programmes aimed at early stimulation and improvement of nutritional status of children have been discussed. Based on the analysis presented in the paper, the last section of the paper identifies areas that need further exploration.

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