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Nutrition requirement for children to protect them from pendemic diseases

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ABSTRACT

Malnutrition in early childhood is linked to deficits in the cognitive development of children. 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 behavioral 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. Psychosocial 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 Children who experience under nutrition 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. The present Article Reviews the role of Malnutrition among childrens in India & its impact on their cognitive development.

Keywords: childhood

INTRODUCTION

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).

Malnutrition and Cognitive Development in children

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.

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.

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.

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 average. Children under three who are stunted are also concentrated mainly in these states.

Table 1: The percentage of underweight children in these states is more than the national average.

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

Around forty percent of children in Bihar, Chhattisgarh, Gujarat, Jharkhand, Madhya Pradesh, Meghalaya and Orissa are stunted. More than twenty percent of children inBihar, Jharkhand, Meghalaya and Tamil Nadu are in the category of 'wasted'. Most of the states have more than sixty percent anaemic children.

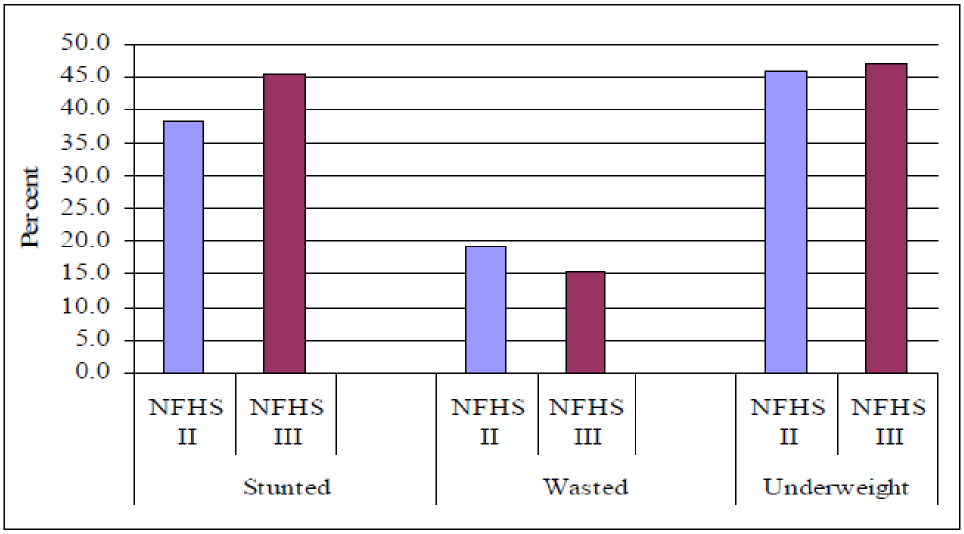


Fig 1: Stunted, wasted and underweight children (%): comparing NFHS-2 and NFHS-3

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).

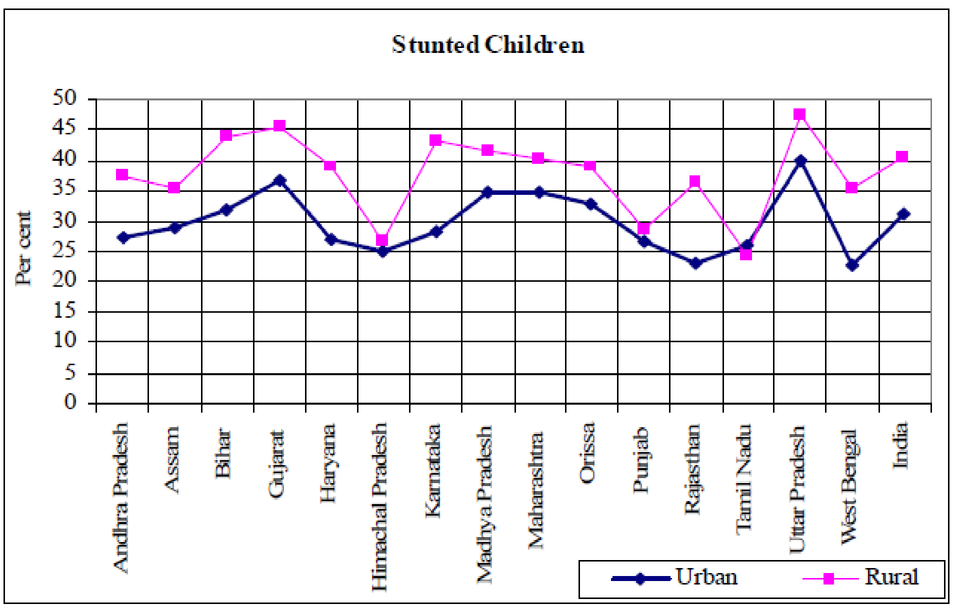


Fig 2: Percentage of stunted children: rural-urban differences, 2005-06

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.

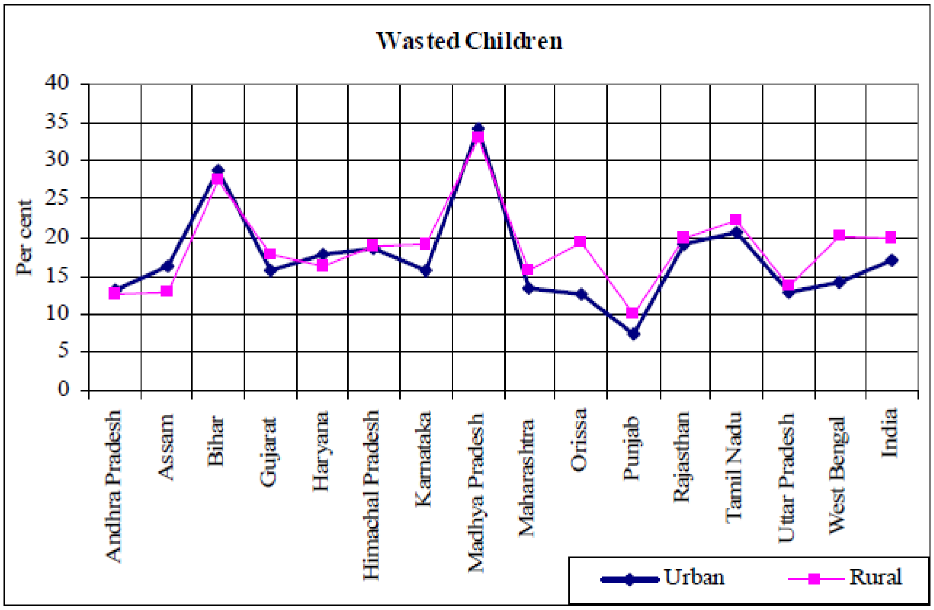


Fig 3: Percentage of 'wasted' children: rural-urban differences, 2005-06

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).

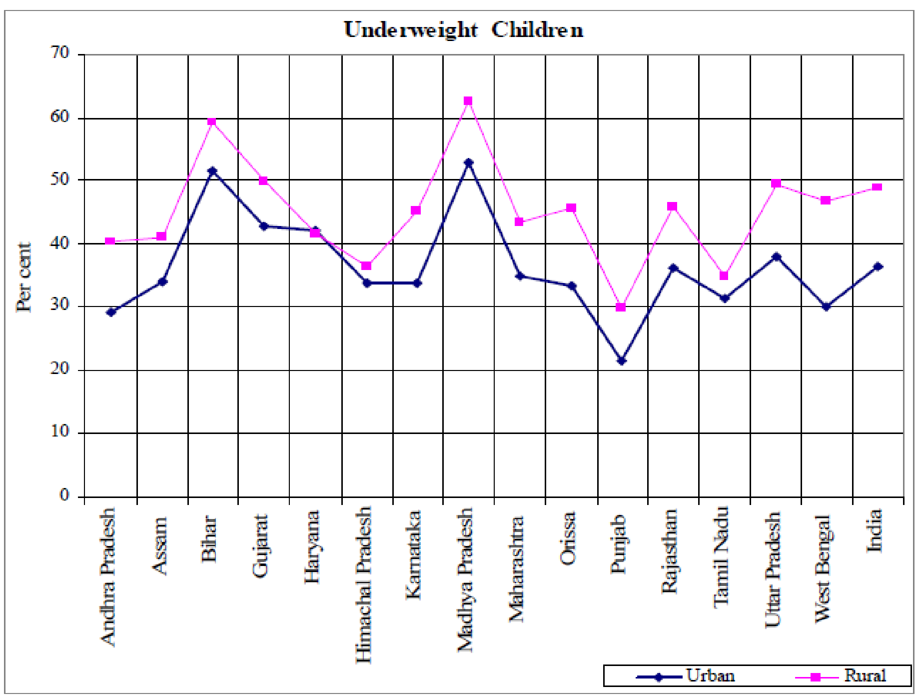


Fig 4: Percentage of underweight children: rural-urban differences, 2005-06

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).

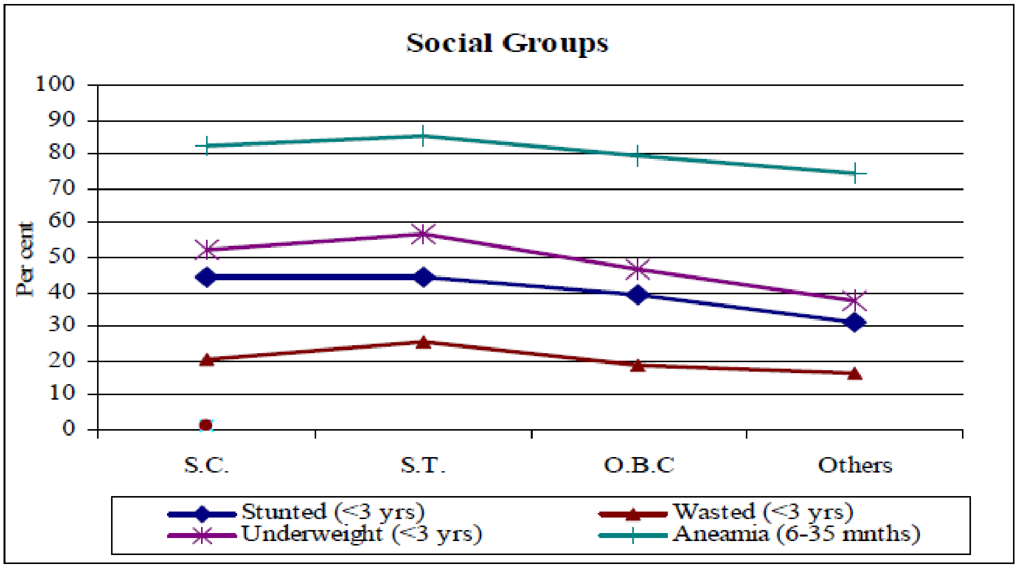


Fig 5: Prevalence of malnutrition and anaemia in children: by social groups, 2005-06

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.

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

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 subclinical 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.

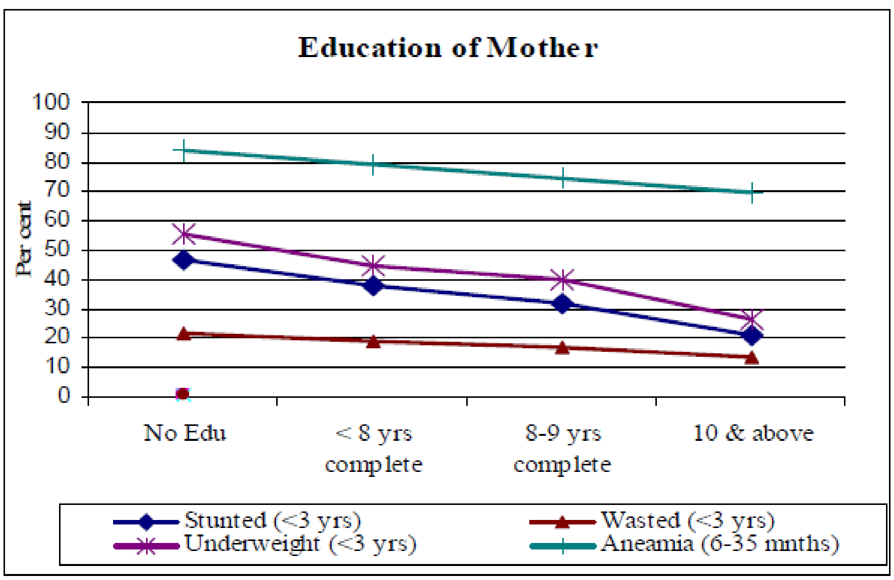
Determinants of Malnutrition

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, 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 (Radhakrishan & 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.

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 clearcut 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.



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.

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 needsof 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).

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).

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.

Health and Nutritional Needs

The school meal is meant to supplement children's diet and make up the deficiency in kcalories 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.

CONCLUSION

Malnutrition must be considered alongside other factors in childhood development. Psychosocial 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 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.

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