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Foetal Growth Restriction: Nutritional Determinants, Consequences in Children, and Interventions

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The important role that optimum foetal growth plays in survival, growth and development after birth has long been recognized[1]. The estimated 20 million newborns globally weighing less than 2500g (Figure 1), the most commonly used definition of low birth weight, are said to be at risk of poor outcomes as a consequence of being born prematurely, having foetal growth restriction or both. While this definition of an at-risk population has been useful for planning nutrition programmes, it may underestimate the size of a population of newborns at risk because it does not include babies who have foetal growth restriction but weigh 2500g or more[1] (Text Box 1). The comparison of weight at birth with foetal growth references by week of gestation permits the identification of newborns who are small for their gestational age (SGA) for both preterm and full-term births (Figure 2). A variety of foetal growth references are available and a large international study is underway to create global foetal growth standards.

There are myriad interacting causes of foetal growth restriction, but it is clear that maternal nutritional factors have important roles and these will be considered here as determinants of being born SGA[1,2]. New analyses provide estimates of the number of SGA births annually, and their global distribution. The consequences of being SGA in preterm and full-term births as regards survival in the first month of life and in the post-neonatal period of infancy have been quantified recently,[3,4] as has the relationship between being SGA and stunting of linear growth in early childhood[4]. Finally, the evidence that specific nutritional interventions can reduce the prevalence of SGA will be reviewed.

Child Health Epidemiology Reference Group

In the past decade, the Child Health Epidemiology Reference Group (CHERG) of the World Health Organization and UNICEF has undertaken analyses of global levels and causes of child death, numbers of preterm births and stillbirths, prevalence and consequences of nutritional risk factors, and maternal, neonatal and child morbidity. In the last two years, a set of analyses has focused on prevalence of foetal growth restriction and its consequences[3-6] (Text Box 2). These analyses have been published in research papers[3,5,6] and as part of a series of papers on maternal and child nutrition published in The Lancet in mid-2013[4,7-9]. Detailed methods have been published in these papers. Briefly, SGA was defined as birth weight below the tenth percentile of a reference population for a given gestational age and sex[10]. The reference used for these analyses included more than 3 million nationally representative, multi-ethnic births in the United States in 1991. Preterm birth was considered to be delivery at less than 37 weeks. Interventions that could reduce the occurrence of being SGA have been examined in systematic reviews, and the results have been published both in separate papers and in the nutrition series[7]. This paper summarizes the results of this set of analyses and discusses the implications for low- and middle-income countries, specifically for India.

Maternal undernutrition and foetal growth

From 1980 to 1990, there was a decline in the prevalence of maternal underweight (as defined by a body mass index (BMI) of <18.5 kg/m^2). This has subsequently stagnated and remains at 10% or greater in Asia and Africa[4]. Low maternal BMI, short stature, low energy intake in pregnancy and low gestational weight gain have been found to affect foetal growth adversely[1]. New analyses confirm that low maternal BMI in early pregnancy increases the risk of SGA. Maternal stunting (height <145 cm) also puts children at higher risk of both term and preterm SGA[4] (Table 1).

Small for gestational age (SGA)

In previous analyses foetal growth restriction (FGR) was defined in terms of low birth weight (<2500g) in full-term babies, because those were the data available[11]. This approach did not allow estimation of the full range of prevalence of FGR (as indicated by

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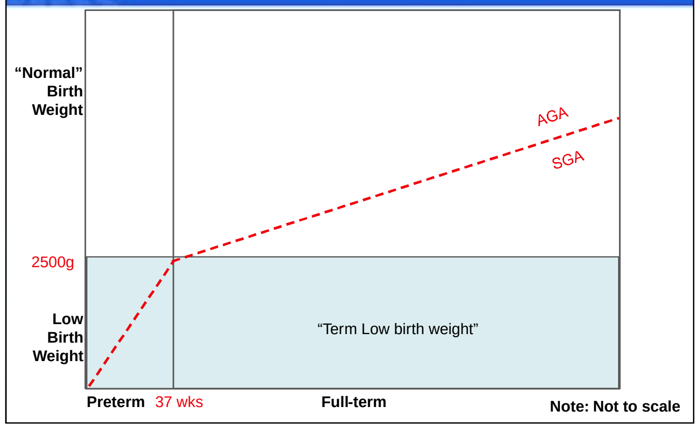
Figure 1 Number of Low Birth Wight (<2500g) Babies Born Annually in the World

Figure 2 Weight vs Gestational Age



SGA), including babies who were both preterm and SGA and those who were SGA but weighed >2500g (Figure 3, Table 3). In new analyses, it has been possible to determine estimates of SGA that overcome these limitations and provide the results for both term and preterm births[3,6](Figure 4). These estimates indicate that, in the year 2010, 32.4 million babies were born SGA, accounting for 27% of all births in low- and middle-income countries (LMIC)[6]. About 20% of the preterm births in these countries were also SGA. India has the largest number of SGA births of any country, 12.8 million (uncertainty range 11.5-14.3 million); in addition, an extremely high proportion of all births in India are SGA (46.9%)[6].

Risk of mortality in SGA

New analyses also show that SGA babies have an increased risk of death after birth as compared to appropriate for gestational age (AGA) babies[3]. In the neonatal period there is an 83% higher risk of death in the SGA group (Risk ratio [RR] 1.83; 95% Confidence Interval [CI] 1.34-2.50). In infants 1-11 months of age the risk remains elevated (RR 1.90; 95% CI 1.32-2.73). Babies who are both preterm and SGA are at highest risk (Figure 5).

The numbers of neonatal and post-neonatal deaths attributable to being SGA have been calculated from the fraction of these deaths (calculated according to the risk relationships and the prevalence of SGA) to the total number of deaths in 2011. It was estimated that, globally, 817,000 of the neonatal deaths and 418,000 of the post-neonatal deaths could have been prevented if SGA had been eliminated[3](Text Box 1,2). In calculating the total deaths attributed to nutritional conditions, only the neonatal deaths were included so as to avoid double-counting of deaths attributed to stunting and wasting after the first month of life[4]. These neonatal deaths due to SGA constitute 11.8% of all under-five deaths (Table2, Text Box 3). In India, because of the very high proportion of births that are SGA, and because more than 50% of under-five deaths occur in the neonatal period, the number of deaths attributable to SGA is very high[12]. It is estimated that 389,180 neonatal deaths and 145,884 post-neonatal infant deaths can be attributed to being born SGA[3]. This is 44.5% of the neonatal deaths in India in 2010 and 31.8% of the 1.82 million child deaths overall in that year[12].

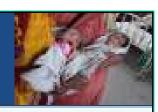
Consequences of SGA

It is known that FGR contributes to short stature in comparison to international growth standards (stunting) and this relationship has recently been quantified for three categories of births in comparison to term AGA babies (Table 3). Babies who were SGA and full-term, the largest group, had an odds ratio (OR) of 2.43 (95% CI 2.22-2.66) for stunting at 12-60 months[5]. Being SGA and preterm increased the OR to 4.51 (95% CI 3.42-5.93), higher than the odds for preterm alone 1.93 (95% CI 1.71-2.18). The estimated population attributable risk for childhood stunting in

Text Box 1 Low Birth Weight vs. Small for Gestational Age

- **Low birth weight includes babies who are born preterm or who have fetal growth restriction or both**
- **Using 2500g birth weight as threshold for LBW, babies can have fetal growth restriction without being low birth weight**
- **As indicator of fetal growth restriction we will use being small for gestational age (SGA)**
- **We consider births less than 37 weeks to be preterm**
- **Previous estimates of SGA and deaths attributed to it used "term low birth weight"**

Text Box 2 Fetal Growth Restriction



Defined by WHO Expert Committee[1] as *Small for Gestational Age*

- **<10% birth-weight for gestational age of a reference population[1]**
- **Used as a proxy for FGR**
  - **Includes pathologic growth restriction and constitutional small size**
- **Need for common reference for burden estimation**
  - **SGA Prevalence varies based on reference chosen**
  - **Over 26 Reference populations in literature (1948-2006)[2]**
- **Alexander et al[3] reference**
  - **National US births (n=3,134,879) in 1991, US Center for Health Statistics**
  - **Consensus of CHERG Expert Nutrition Panel**
  - **Most commonly used and cited**

1

Figure 3 Risk Factors for Fetal Growth Restriction and Preterm Birth

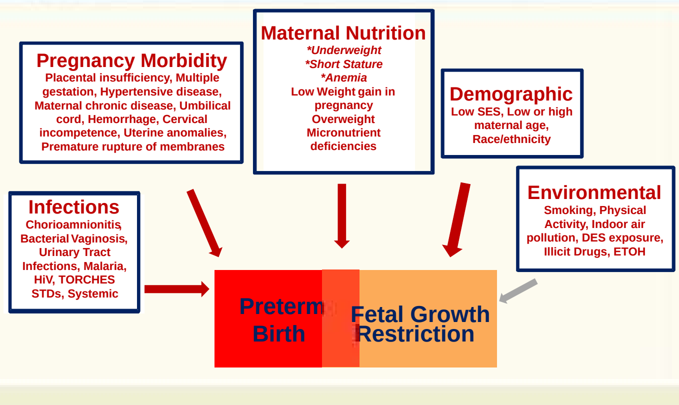
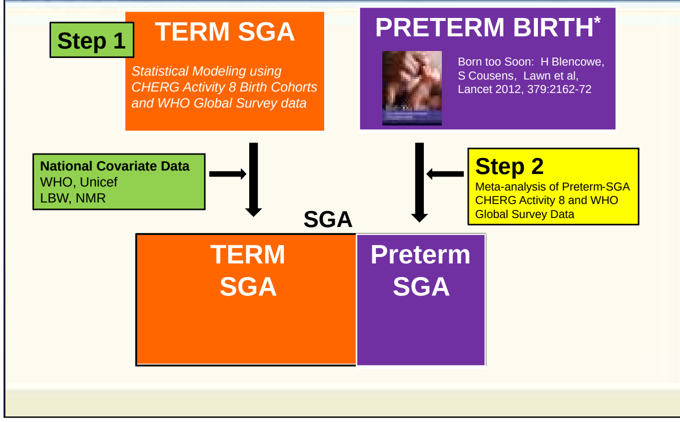


Figure 4 Overview of SGA Prevalence Estimation



LMIC is 20% for SGA and 8% for preterm birth[4,5]. In India, where the prevalence of SGA is about 45%,[5,13,14] SGA accounts for an even higher attribution of 34.6% for stunting. This means that 21.3 million children in India are stunted because of restricted foetal growth.

Undernourished and very young women are at particular risk for obstructed labor and other complications of delivery that can cause death and traumatic injury, as well as stillbirth and neonatal death[4]. Furthermore, pregnancy in adolescence can stop the growth of the mother, leading to lifetime maternal risk from short stature. In this context, interventions to raise the age of marriage and first pregnancy are especially important[7](Text Box 4). Nutrition interventions in adolescence and before conception, such as ensuring adequate folate status to prevent neural tube defects and preventing anaemia, are also important (Table 4). Additional nutrition interventions in the adolescent period may also be useful, but these require further evaluation.

Prevention of SGA

Nutritional counseling during pregnancy and balanced protein-energy supplements for women who are either undernourished or living in food-insecure households can improve the nutritional status of mothers and reduce the risk of SGA[7](Table 1). Dietary supplements to the mother that provide about 25% of energy as protein have been found to increase birth weight by 73g and reduce the incidence of SGA by 34%, with greater effects in more undernourished women.

Deficiencies of specific vitamins and minerals (micronutrients) may also contribute to FGR; the best evidence for this comes from trials of micronutrients singly or in combination during pregnancy[7]. Summarized evidence from such trials shows that both folic acid and iron supplements in pregnancy reduce the prevalence of low birth weight, presumably due to reduction of FGR . A recent systematic review of iron supplementation in pregnancy found a reduction by two-thirds in iron deficiency anemia at term, and by 19% in low birth weight[15]. Provision of multiple micronutrients during pregnancy would have even larger benefits. A meta-analysis of trials that compared multiple micronutrients to iron and folic acid supplementation found an 11% reduction in the incidence of SGA (RR 0.89; 95% CI 0.83-0.96)[16]. There are possibly benefits of providing some specific nutrients in pregnancy such as vitamin D, zinc, and omega-3 fatty acids, but these are not yet proven[7].

Food supplementation for prevention of SGA

In programmes that are intended to provide balanced protein-energy supplements in pregnancy, there are some factors to consider:

- the composition and timing in pregnancy of such

Table 1 SGA and preterm births attributable to low maternal BMI

Region	% of SGA due low BMI	%pre terms due to low BMI
Africa	5.2	3.9
Asia	7.5	5.1
Latin America	-	-

Table 2 Deaths Attributable to SGA in LMICs in 2011 (total under 5y deaths 6.9 million)

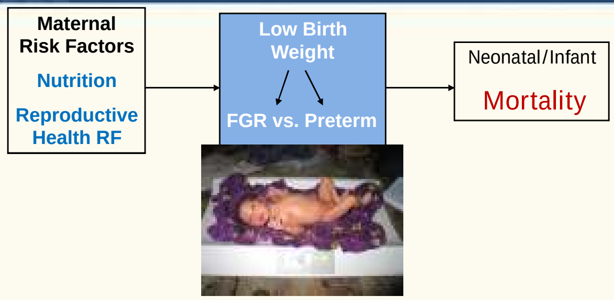
Deaths attributable to SGA in LMIC

Neonatal deaths: 817,000
Post-neonatal deaths: 418,000
Total SGA attributable deaths: 1,235,000
(17.9% of under 5 deaths attributable to SGA)

Deaths attributable to SGA in India

Neonatal deaths: 390,000
Post-neonatal deaths: 146,000
(44.5% of neonatal deaths and 31.8% of all childdeaths)

Figure 5 Estimation of mortality risk in SGA and Preterm births



Estimate neonatal and infant mortality risk associated with fetal growth restriction and preterm birth and estimate the attributable burden in low and middle income countries

Table 3 Population Attributable Risk (PAR) for Stunting Associated with SGA and Preterm

Converted OR estimates to RR using an approximation method proposed by Zhang and Yu (1998)

	SGA-Term	Preterm-AGA	SGA-Preterm
Global	0.17	0.02	0.03
South Asia	0.24	0.02	0.04
Southeast/East Asia	0.09	0.007	0.01
Africa	0.12	0.04	0.02
Latin America	0.20	0.08	0.05

Globally, 20% of stunting attributable to all SGA, and 5% to all preterm birth, although regional variation exists
In India prevalence of SGA is 45% and 35% of stunting at 2 years is attributable to SGA

supplementation should be carefully decided;

- locally available and acceptable foods should be used preferably;
- the food supplements should be targeted more towards undernourished or food-insecure women and those in vulnerable populations;
- consumption of sufficient quantities of the supplements must be assured; and
- the cost-effectiveness of alternative ways to deliver this intervention must be analysed.

In spite of the known benefits of iron and folic acid supplementation in pregnancy the use of this intervention is currently low[7]. Advancing to the use of multiple micronutrients in pregnancy instead of only iron and folic acid would provide additional benefits at a modest added cost (Table 5). Possibly the switch to a more complete set of micronutrients would increase the programme priority and widen the use of supplementation, much as the addition of zinc as part of child diarrhoea treatment has boosted both the availability and demand for the oral rehydration solution. If multiple micronutrients are to be provided, there is the need for further product development research, linked with studies of the prevalence and extent of micronutrient deficiencies in various low-income populations so as to ensure that the composition of the supplement is optimized to meet nutritional needs, reduce nutrient interactions, avoid side effects, enhance acceptability, and reduce costs. There are also specific issues concerning the combining of micronutrients and the levels of the various components needed to optimise benefit. There are also many delivery research questions regarding provision of both food and micronutrient supplements in pregnancy, including the use of service platforms. These factors include antenatal care, health days, community health workers and others, methods of creating and sustaining demand, the role of the private health sector and other sectors, and other social protection programmes.

Long-term consequences of SGA

As the evidence accumulates that poor foetal growth has both short-term consequences for survival and linear growth (i.e. stunting) and long-term adverse effects on cognitive and psychosocial development, adult stature, and risk of adult metabolic diseases,[4,17] there must be more focus on programmes and research to prevent it. However, recognizing that the prevention approaches may for some time remain only partially successful and that some of the determinants of poor foetal growth may take a generation to reduce, there is a parallel need for research on the mechanisms underlying these adverse foetal effects, how they may differ depending on the timing and type of nutritional insult during pregnancy, and how the adverse effects of SGA can be mitigated after birth.

Text box 3 SGA and Mortality

- **Prior analyses used term LBW as a proxy for IUGR**
- **Excludes a large proportion of term SGA (21% in Asia, 16% in Africa and 4% in Latin America) at increased mortality risk**
- **Prevalence of SGA is much higher than preterm, especially in South Asia**
- **Approximately 1.3 million deaths of infants could be averted by eliminating SGA births**
- **More than a half million infant deaths in India could be averted by eliminating SGA births**

Table 4 SGA Attributable to Maternal Anemia in 2010

UN regions	SGA Births 2010	Prevalence moderate-severe anemia <8g/dL	SGA births attributable to moderate-severe anemia	% SGA births attributable to moderate-severe anemia
Africa	8,494,931	3.9%	180,380	2.1%
Asia	22,460,264	2.7%	416,857	1.9%
Latin America Caribbean	1,373,974	1.4%	11,384	0.8%
Oceania**	55,324	2.8%	839	1.5%
LMIC TOTAL	32,384,492	2.9%	609,460	1.9%

LMIC – Low and middle income countries

Text box 4 Interventions to reduce SGA

- Optimizing age at first pregnancy and inter - pregnancy intervals
- Maternal Balanced Energy Protein Supplementation
- Maternal iron-folic acid/multiple micronutrient supplementation
- Maternal calcium supplementation (in at risk populations)
- Reducing maternal disease risk (malaria) ITN & IPTp
- Reducing tobacco use and exposure to household air pollution

Table 5 Maternal Supplements of Multiple Micronutrients: Selected Effects

Outcome	Old estimate	New estimate (Haider 2012)	Brand New Estimates (2013)
LBW	0.84 (0.74-0.95)	0.89 (0.83, 0.94)	0.88 (0.85-0.91)
SGA		0.87 (0.81, 0.95)	0.89 (0.83-0.96)
Preterm birth		0.99 (0.96-1.02)	0.97 (0.94-0.99)

Comparison of MMN with standard iron/folic acid use: MMN supplementation resulted in a significant 12% reduction in LBW, 11% decrease in SGA births & 3% reduction in preterm births

Conclusions

SGA is an important global problem with consequences for child survival and development, and an even more critical problem for India. Success in reducing India's neonatal and child mortality[18] may depend on addressing the problem of foetal growth restriction. Improved diets for pregnant women, as well as specific interventions such as targeted balanced protein energy supplementation and multiple micronutrient supplementation in pregnancy, which have been proven to reduce SGA, should be implemented in ways to achieve high coverage in pregnant women who can benefit. Additional nutritional interventions, e.g. in adolescence and before conception, should be evaluated and implemented if found to be effective.

The author is Professor, Institute of International Programs at Johns Hopkins, Bloomberg School of Public Health. Baltimore USA. The article is based on the Thirty Seventh Gopalan Oration delivered by Dr Black in the National Conference of Nutrition Society of India, November 21-23, 2013, held at National Institute of Nutrition, Hyderabad.

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FOUNDATION NEWS

Dr Prema Ramachandran (Director, NFI) attended the National Symposium on 'Access and Participation of Women and Girls to Nutrition & Health, Education and Training, Science and Technology" organised by Women's Studies Centre, Avinashilingam University, Coimbatore on March 13th-14th, 2014. She made a presentation on "Nutrition policies and programmes in India ".

Evolution of Mid-day Meal Programmes

Prema Ramachandran

Genesis of the programme

The Mid-day Meal scheme was first initiated in 1925-26 by the Corporation of Madras with the aim of improving school attendance. Subsequently, philanthropists and voluntary organisations joined to start free school lunch centres in villages and towns all over the state. In July 1956, the school lunch programme was launched in the government schools in Tamil Nadu as a 'People's Movement' to combat classroom hunger in school children. Encouraged by response of the people to this initiative, the Government of Tamil Nadu (erstwhile Madras) took up the school lunch programme in 1957 across all government schools in the state. By 1978, 1.86 million children in 32,000 schools were covered and this number increased to 2.03 million in 33,306 schools by 1980-81. Several states including Maharashtra, Gujarat and Andhra Pradesh also started school mid-day meal programmes in selected areas[1]. However, the populous states with high poverty, food insecurity, low school enrolment/retention and high incidence of classroom hunger were not covered under the mid-day meal programme.

School meals to improve school enrolment

A review of the primary education sector in the Eighth Five-Year plan[2] showed that the progress towards universal access to primary education was very slow in the populous states of the country. In low-income families, one of the oft-cited reasons for not sending the children to school was that the children were needed to work to earn money for the family. The Government of India took several steps to accelerate the progress towards universal primary education. These included improvements in school infrastructure and access, the employment of sufficient numbers of teachers, and the provision of free text books to the students. In addition to these efforts, the National Programme for Nutrition Support for Primary Education, (now commonly known as the Mid-day Meal Programme (MDM)) was initiated as a centrally sponsored scheme throughout the country in 1995[1] with the objectives of:

- increasing enrolment, improving school attendance and retention, inculcating good food habits in children
- promoting social integration and
- improving the nutritional status of primary school children

Initially the programme envisaged the provision of 3 kg of cereals to be distributed free of cost to children studying in classes I to IV in all Government, local body, and Government-aided primary schools who had over 80% attendance in the previous month. The Central Government provided wheat /rice to the states for the programme. Six states - Gujarat, Kerala, Orissa, Tamil Nadu, Chhattisgarh (174 tribal blocks) and Madhya Pradesh - and the Union Territory of Pondicherry, all with long track records of providing cooked mid-day meals to school children, were providing hot cooked meals under the programme. In Delhi, ready-to eat food was being distributed. All other states provided 3 kg of food grains to primary school children who had more than 80% attendance. The number of children covered under the programme increased from 33.4 million in about 3,22,000 schools in 1995-96 to 105.1 million students in 7,92,000 schools spread over 576 districts by 2000-01. There were some improvements in the rates of school enrolment and retention but there were substantial differences between states as regards both these rates[4].

School meal as legal entitlement

In 2001, the Supreme Court of India ruled that MDM is a legal entitlement for all children, and that the government should provide a hot cooked mid-day meal containing 300 kcal energy and 12 g of protein/day for 200 days in the year to all children studying in classes I to V in all government, local body, and government-aided primary schools. The Supreme Court also directed the states and Union Territories to ensure adequate community participation. The Court suggested that community-based organizations, people's representatives, non-governmental organizations and parents themselves should be involved in monitoring and supervision so that the needy children would derive optimal benefit from the programme. Over the years, the coverage under hot-cooked meals as part of the MDM has been universalized[1].

Content and quantity of food stuffs in MDM

In 2006, the Department of Primary Education constituted an Expert Committee to review the content and quantity of ingredients to be provided through the MDM. The Expert Committee recommended that the MDM programme should provide to each primary school child a hot-cooked meal containing 100 grams of cereals and 20 grams of pulses (providing 450 Kcal energy and 12 grams of protein) to address classroom hunger and energy gaps in their existing diets. Anaemia, iodine deficiency disorders and vitamin A deficiency are major public health problems in school children. In order to address these, and to inculcate the habit of eating a balanced meal, the revised MDM guidelines of 2006 included 50 g of non-tuber vegetables and recommended that the meal should contain iron- and iodine-fortified (double-fortified) salt. From the academic year 2006-07 the Central Government sanctioned additional funds to the states to cover the cost of pulses, vegetables, condiments and oil. It was envisaged that these ingredients, cooked according to region-specific recipes, could meet part of the micronutrient requirements of children[1].

MDM: bridging the energy gap

Ample data exist to show that there is a gap between the energy requirements of growing school children and their actual dietary intake; classroom hunger and undernutrition may undermine learning ability. The hot-cooked meal is meant to bridge the gap between the requirement and actual intake in home diets; MDM was expected to eliminate classroom hunger and also possibly bring about some reduction in undernutrition rates in primary school children.

The gap between actual intake and requirements are calculated from the Recommended Dietary Allowances for Indians[5] recommended by the Expert Group constituted by the Indian Council of Medical Research (ICMR). Human nutrient requirements, especially, energy requirements, have been calculated with greater precision in the last two decades, based on newer technologies which allow requirements to be computed under free living conditions over a relatively long period. Taking these into account, the FAO/WHO[6] revised the nutrient requirements in 2004. In 2010, the ICMR revised the nutrient requirements and recommended dietary allowance (RDA) values for Indians. The reference body weights for an adult man and an adult woman were computed on the basis of the averages of the 95th centile weights of the age categories 18-19, 20-24, and 25-29 years, as obtained from National Nutrition Monitoring Bureau (NNMB) and India Nutrition Profile (INP) survey data. Reference body weights for boys and girls were computed similarly from the 95th centile values of body weights of children in rural India as obtained from NNMB and INP surveys. For infants and young children, the data from WHO (2006) standards, which correspond broadly to the 95th centile of the weight of Indian rural children, were used.

Given that Indians of all age groups weigh far less than the reference population used for deriving the RDA, the ICMR expert group also computed the RDA per Kg body weight so that, requirements of energy could be computed for various age-groups on the basis of actual body weights. As can be seen from (Table), the gap between the requirement and the actual intake of primary school children is relatively low. The expert group recommendation that, 100 grams of cereals, 20 grams of pulses should be provided to each child was ample to cover the gap between energy requirement and energy intake.

As highlighted in Table, the gap between requirements and intake is highest in adolescent girls and boys. This is the period of final growth spurt, and adequate energy intake is essential for optimal growth. Experts, therefore, recommended that MDM should be extended in a phased manner to cover adolescent girls and boys. As the first step towards this goal, the Government of India extended MDM to the upper primary school children (classes 6-8). MDM in upper primary school provides 750 Kcal/meal/child. The quantum of energy currently being provided would appear to be adequate to bridge the gap between the reported energy intake and the requirements.

Feedback on adequacy of the MDM

Feedback from the states on adequacy of the MDM (as assessed by satiety reported by children) varied substantially. Some states have reported that the children are unable to eat the quantity of food provided in the MDM. There could be many reasons for this. The children might have had a good meal at home and were therefore not hungry; or, because children have likes and dislikes, they may not relish some preparations. Also, some preparations like kheer have high energy density, and so children cannot consume much of it. It is also possible that younger, smaller children do not require the amount provided in the meal, whereas older bigger children need more. Given the nature of the programme, it might be possible for age-specific norms to be indicated and followed. At the other end of the spectrum, there have been reports that the quantity of food provided was not

Table: Computed energy requirements for actual current weight in different groups

Group	Mean wt (Kg) NNMB	Req for mean wt (Calories)	Actual intake (Calories)	Gap (Calories)
Adult man	51	2346	2000	-346
Adult woman	46	1886	1738	-148
Pregnant		2236	1726	-510
lactating		2386	1878	-518
Children				
1 – 3 y	10.5	840	714	-126
4 – 6 y	14.6	1095	978	-117
7 – 9 y	19.7	1379	1230	-149
Boys				
10 - 12 y	26.6	1729	1473	-256
13 – 15 y	36.8	2208	1645	-563
16 – 17 y	45.7	2514	1913	-601
Girls				
10 – 12 y	26.7	1469	1384	-85
13 – 15 y	36.9	2030	1566	-464
16 – 17 y	42.6	2130	1630	-500

sufficient1. This might possibly be because the children skipped their morning meal and were therefore very hungry. In many areas vegetables are not part of the meal. In the past two years, there has been a steep reduction in the quantity of pulses in the meal because of the rise in the price of pulses. A meal consisting predominantly of cereals may not provide satiety from hunger.

Introduction of vegetables in MDM

In India, micronutrient deficiencies are widespread mainly because of the low dietary intake of vegetables. Earlier, the ICMR had recommended a minimum intake of 150 g of vegetables/day for this age group. According to NNMB data7, the consumption level of non-tuber vegetables was only about 100g/day. Therefore, the MDM expert group recommended that 50 g of vegetables should be provided to the children through MDM. The revised RDA (2010) recommends the consumption of 400 g of fruits/vegetables per day. If this new figure is used as the norm, at least 100 g of vegetables should be provided through MDM. Currently, most school meals do not contain vegetables. This is because the cost of vegetables is high, and the yearly increase of 7.5% in the allocations for MDM is insufficient to cover vegetable price inflation (running at 15% in 2013). Therefore, the recommendation that 100 g of vegetables should be included in the MDM, though logical, may face problems in implementation.

Improving micronutrient nutritional status of school children through MDM

Ample data exist to indicate that anaemia affects over 75% of school children in India. Anaemia is mainly due to low intake of iron and folic acid. Numerous studies have demonstrated that increasing vegetable intake and using iron-fortified iodised salt (DFS) are two sustainable and affordable methods of improving iron and folic acid intake of the population, thereby improving their haemoglobin levels. MDM guidelines envisage that vegetables will be provided as a part of the meal and that DFS will be used in the preparation of the meal, but so far these guidelines have not been operationalised[1].

Under the School Health Programme, iron and folic acid tablets are being distributed to school children. Primary school children are being given 30 mg of iron and folic acid and Upper primary school children get adult doses of iron and folic acid (composition - 100 mg iron and 50 mcg folic acid). Weekly, bi weekly and daily regimens exist but these have not been scaled up. It is imperative that the supplementation programme is operationalised throughout the country during the Twelfth Five-Year Plan[8].

Nutrition education

The MDM scheme is aimed at bridging the nutrient gap in school children, but very often the families use MDM as the substitute for home food. This would defeat the potential benefits of MDM as regards reduction in undernutrition rates. Nutrition education aimed at the children, teachers and parents should emphasize that MDM is an additional input and not a substitute for home food. School children should be taught the importance of nutrition, the need for balanced diets for their growth, and the importance of personal hygiene and timely health care. Currently, these messages are distributed in various chapters of the study material under environmental education. Devoting a separate page for each of these with appropriate and authentic messages in the text books for classes 1 to 5 will help a lot because they will be read by the teachers, parents and children. The expert group had recommended that the Department of School Education could discuss this aspect with the NCERT and other relevant agencies, and that a 'health, nutrition, and population' capsule could also be introduced in the summer training programmes for all teachers.

Physical activity

Over the years, there has been a steep reduction in physical activity levels in all segments of the population, including in children. This is one of the reasons for the emerging problem of childhood overnutrition. It is important that schools insist on adequate physical activity as part of the school day. Children, who are overweight, should be specifically encouraged to take active part in sports.

Current status of MDM

India's Mid-Day Meal is the world's largest school feeding programme reaching out to about more than 10.35 crore children (75% of the children enrolled) in 11.55 lakh schools in the country. .Currently, the Ministry of Human Resource Development is providing a cooked mid-day meal with 450 calories and 12 grams of protein to every child at primary school level and 700 calories and 20 grams of protein at upper primary school level. These energy and protein requirements for the primary school meal come from 100 gms of rice/wheat flour, 20 g pulses, 50 g vegetables, and 5 g oil, and for the upper primary meal from 150 g of rice/flour, 30 g of pulses, 75 g of vegetables, and 7.5 gms of oil. It has been reported that MDM has helped in preventing classroom hunger, promoting school enrolment, fostering social integration, and improving gender equity1.

The way forward

The country is inching towards universal primary education. MDM coverage is universal. Under the Food Security Act, MDM will receive adequate budgetary support for providing hot cooked meals to all eligible school children for the foreseeable future. Given these favourable circumstances, and provided the coordination and collaboration between the MDM programme and the school health system is improved, it would be possible to reduce undernutrition and prevent overnutrition in school children by

- undertaking height and weight measurements and computing BMI for age twice a year
- identifying undernourished children (lean children) early and initiating appropriate interventions
- getting undernourished children checked by the school health system for infections, and initiating treatment where necessary
- providing double helpings of MDM for children who are undernourished due to low food intake
- identifying over-nourished children and ensuring that they increase their physical activity levels.

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NUTRITION NEWS

The 46th Annual Conference of the Nutrition Society of India will be held at Dayanand Medical College and Hospital and Punjab Agricultural University, Ludhiana (Punjab) on 7th-8th November, 2014. The details of the same will be uploaded on the NSI website in June 2014.

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