

Malnutrition among under-five children in India and strategies for control

Swaroop Kumar Sahu,
S. Ganesh Kumar,
B. Vishnu Bhat¹,
K. C. Premarajan,
Sonali Sarkar,
Gautam Roy,
Nitin Joseph²

Departments of Preventive and Social Medicine and ¹Pediatrics, JIPMER, Puducherry, ²Department of Community Medicine, Kasturba Medical College, Manipal University, Mangalore, Karnataka, India

Address for correspondence:

Dr. Swaroop Kumar Sahu, JIPMER, Puducherry - 605 006, India. E-mail: swaroop.sahu@gmail.com

Abstract

Malnutrition among under-five children is an important concern for the health authorities in India. The aim of the present review was to assess the burden of under-nutrition and over-nutrition, its determinants and strategies required to tackle malnutrition among under-five children in India. Recent data were collected from Google search, Medline, and others. The information retrieved was reviewed and analyzed for discrepancies. Existing evidence shows that the prevalence of under-nutrition among under-five children was high and varied widely (under-weight: 39-75%, stunting: 15.4-74%, wasting: 10.6-42.3%) depending on the assessment methodology adopted. Studies on assessment of over-nutrition status among under-five children were limited. Distribution of various types of risk factors and its influence on nutrition status of children in a given set up should be analyzed for planning the control measures. Strengthening public health interventions for mild malnutrition cases and vulnerable groups, effective implementation and evaluation of the strategies at regional level, research on overweight, obesity and its etiological factors and steps for improving socioeconomic development are the prerequisites for tackling malnutrition among under-five children in India.

Key words: Malnutrition, strategies, under-five children, India

INTRODUCTION

Malnutrition among under-five children is a major public health problem in India. This is reflected by the fact that the prevalence of under-weight children in India is among the highest in the world, and is nearly double that of Sub-Saharan Africa.^[1] It is also observed that the malnutrition problem in India is a concentrated phenomenon that is, a relatively small number of states, districts, and villages account for a large share of the malnutrition burden — only 5 states and 50% of villages account for about 80% of the

malnutrition burden.^[1] Each year approximately 2.3 million deaths among 6-60 months aged children in developing countries are associated with malnutrition, which is about 41% of the total deaths in this age group.^[2] A recent study, among children aged between 3 months and 3 years of age conducted in 130 districts through Demographic and Health Surveys in 53 countries over a period from 1986 to 2006 found that — variance in mild under-weight has a larger and more robust correlation with child mortality than the variance in severe under-weight.^[3] The study concluded that the prevalence of mild under-weight deserves greater attention as a useful signal of changing public health conditions among preschool children in developing countries.^[3] Therefore, it is important for the health system to detect malnutrition at an early stage for planning and implementing timely interventions at the community level.

Millennium Development Goal 1 (Target 2) aims to halve, between 1990 and 2015, the proportion of people who

Access this article online	
Quick Response Code:	Website: www.jnsbm.org
	DOI: 10.4103/0976-9668.149072

suffer from hunger as measured by the prevalence of under-weight among under-5 years children.^[4] The burden of under-nutrition among under-five children has not changed much even though various intervention programs are in operation in India. Current changing dietary patterns are also affecting the nutrition status of under-five children resulting in increased prevalence of adult noncommunicable diseases such as obesity, diabetes, hypertension and coronary heart disease. The need of the hour is to examine the burden of under-nutrition and obesity, study its determining factors and assess the effectiveness of the various approaches to combat malnutrition among under-five children. The present review article discusses the issues and strategies for strengthening service delivery to under-five malnourished children in India.

MATERIALS AND METHODS

The information was collected from Google search engine, MedLine, and others. The keywords used for the

search included: Malnutrition, obesity, under-five children, determinants, strategies, India. The search since 1999 until date yielded 64 articles out of which 14 articles, which were not related to the topic were excluded. Twenty articles were analyzed under the section problem burden, 12 articles under determinants and remaining under the headings of introduction, recent observations, and strategies. These were reviewed and analyzed for discrepancies. The information was presented in the form of descriptions under the headings - problem burden, determinants, recent observations, strategies, and conclusion.

Problem burden

It was reported that under-weight among under-five children ranged from 39% to 75%, stunting from 15.4% to 74% and wasting from 10.6% to 42.3% in different parts of the country.^[5-24] [Table 1] On the other hand, very few studies had been conducted to assess the prevalence of overweight or obesity among under-five children.^[5-7] National Family Health Survey-3 data showed over-weight

Table 1: Studies on malnutrition among under-five children in India

Location and year published	Age group	Sample size	Prevalence %	Reference number
NFHS-2 (1998-1999)	<3 years	Multi centric study at country level	Malnutrition: 42.7 Overweight: 1.6	[5]
NFHS-3 (2005-2006)	<3 years	Multi centric study at country level	Malnutrition: 40.4 Overweight: 1.5	[6]
Karnataka (2010)	2-5 years	425	Overweight: 4.5 Obesity: 1.4	[7]
Pune (2000)	Follow-up study from infancy period to 5 years	845	Deterioration of nutritional status over time in 30-50 children	[8]
Chandigarh (2001)	0-5 years	1286	Under-weight: 51.6 (IAP criteria)	[9]
West Bengal, Kolkata (2001)	0-5 years	600	Under-weight: 46.57 (NCHS), 60.29 (IAP criteria)	[10]
Punjab at state level (2002)	0-5 years	400 households in each district	Under-weight: 50.3 Stunting: 60 Wasting: 12	[11]
Delhi (2003)	6 months-2 years	1661	Under-weight: 60.7	[12]
Delhi, urban slum (2005)	9-36 months	545	Stunting: 74 Under-weight: 75 Wasting: 19	[13]
Madhya Pradesh, Jabalpur district (2005)	0-5 years	1022 (27 tribal villages)	Stunting: 51.6 Under-weight: 61.6 Wasting: 32.9 (WHO criteria)	[14]
Bihar, Samastipur district (2005)	0-5 years	191	All children under-weight	[15]
Rajasthan, Jodhpur (2006)	0-5 years	914	Stunting: 53 Under-weight: 60 Wasting: 28 children	[16]
West Bengal, Hooghly district (2008)	0-5 years	116 males, 111 females	55.9, 51.4 and 42.3 of the girls were under-weight, stunted and wasted respectively compared to 46.6, 40.5 and 35.3 of the boys	[17]
West Bengal, Medinipur district (2008)	1-14 years	165	Stunting: 26.1 Under-weight: 33.9 Wasting: 19.4	[18]
West Bengal, Nadia district (2009)	3.0-5.9 years	2016	Stunting: 48.2 Under-weight: 48.3 Wasting: 10.6 Thinness: 49.68 and 51.57 among boys and girls, respectively	[19,20]
Andhra Pradesh (2011)	<3 years	805	Under-weight: 39 Stunting: 30 Wasting: 22	[21]
Chandigarh (2011)	0-5 years	803	Under-weight: 50.4	[22]
North Bihar (2011)	6-59 months	1405	Acute malnutrition, 15.4 (NCHS), 19.4 (2006 WHO references)	[23]
Darbhanga district				
Uttar Pradesh, Bareilly district, urban slum (2012)	0-5 years	110	Under-weight: 66.3 (IAP criteria)	[24]

NFHS: National family health survey, IAP: Indian academy of pediatrics, NCHS: National center for health statistics

prevalence as 1.6%,^[6] while another study revealed 4.5%.^[7] The relative high prevalence of overweight and obesity in some urban and high socioeconomic status groups were a matter of concern.^[25] This observed difference with respect to under-nutrition and over-nutrition in national and local studies may be due to the differences in the methodology adopted like the target group and age group chosen, operational definitions and instruments used for classification, parameters studied, sample size studied and the geographical area involved in the study.

Determinants

Under-nutrition

There are various risk factors that showed an association with under-nutrition among under-five children. West Bengal study found that significantly higher proportion of malnutrition among female children compared to the males were among the higher birth order and those belonging to families with lower per capita income.^[17] It was found that there was a significant rural-urban as well as gender difference in growth and nutritional status of Indian preschool children.^[26] Furthermore, food consumption was found to be lower among girls compared to boys.^[27] Poor feeding practices was common during infancy with 46.4% of under-six month's aged children receiving exclusive breastfeeding and 56.7% of those aged 6-9 months receiving complementary food items. The rates of exclusive breast feeding and complementary feeding were higher for mothers who had more antenatal visits and watched television.^[28] A study reported that 60% of the caregivers did not know regarding growth monitoring of child.^[29] Hence, the factors related to nutrition and growth monitoring affects the malnutrition status of children.

It is known that place of residence, household wealth, birth weight, age of child, awareness regarding diarrheal disease and acute respiratory tract infection control, maternal education, number of under 5 years children < and source of drinking water were strong predictors of child nutritional status in developing countries.^[30] In Indian preschool children, the risk of infection was more consistently associated with body mass index (BMI) for age and wasting which indicate current energy deficit as compared to weight for age and height for age.^[31] Maternal factors like age, weight and anemia also significantly affect child's nutritional status.^[30,32] In an intervention study which compared dietary intake and nutrient sources among Dalit mothers for their children aged 6-39 months living in villages based on improved access to the traditional Dalit food system noted that there were no significant difference in children's food intake between the intervention and control villages.^[33] Instead, other studies have concluded that there is a close positive link between the nutritional status of preschool children and the stages of development

of the states where they lived.^[34] Hence, the different types of risk factor distribution and its influence on malnutrition status of children in a given set up should be analyzed for planning diverse control measures in different states.

Over-nutrition

There is a paucity of data related to the prevalence and determinants of overweight and obesity among under-five children in India.^[7] The highest prevalence of overweight among preschool children was found in Eastern Europe and the Middle East, whereas the same in India and Sri Lanka was the lowest. Although the prevalence is lower in Asia than in Africa (4.9% in 2010), the number of children (18 million) affected is higher in Asia.^[35] A study conducted in Ernakulam District of Kerala, among 5-16 years of age, highlighted that childhood obesity showed an increasing trend in a short period of 2 years from 2003 to 2005.^[36] A study among 4-12 years aged children showed that the mean total calorie intake of the children was not significantly high, but the calories derived from fats was more than the desired 25%, which was especially high in the 4-7 years age group. Lack of physical activity, watching television or video for more than one 1 h daily and a positive family history of obesity contributed significantly to child obesity.^[37] It is stressed that there might be possibility of emergence of obesity during the preschool period, which should be elucidated by further studies. Furthermore, there is a need to find out the regional variation and determinants of obesity among the under-fives.

Recent observations

There is a difference between the malnutrition estimates using the recent WHO child growth standards and earlier used Indian Academy of Pediatrics (IAP) classification. The Government of India has accepted the new WHO child growth standards, based on the WHO Multicenter Growth Reference Study, which estimates severe malnutrition in children between 1 and 3 years of age to be 15.6%, much above the current estimate of 4.2%, based on the IAP classification, and 13.7% among children between 3 and 5 years of age, again way higher than the current estimate of 2.9%.^[38] There is also difference between the malnutrition estimates using the recent WHO child growth standards and the National Center for Health Statistics (NCHS) reference.^[39] Use of the new WHO standards, as compared to the earlier NCHS references, has also resulted in differences in mean Z-scores for weight-for-length and weight-for-age and changes in the prevalence of wasting, stunting and under-weight; although the direction and magnitude of difference are not consistent.^[39] Compared with the NCHS reference, the mean weight-for-length and weight-for-age Z-scores were higher, and the mean length-for-age Z-scores were similar, using the WHO standards.^[39]

It is recommended that the use of the Z-score system is important for identifying all facets of under-nutrition and incorporating Composite Index of Anthropometric Failure is important for estimating the true prevalence of under-nutrition.^[40] A recent study on assessment of nutritional status of preschool children from various states of India found that the lowest percentages of under-weight children according to the Z-score were found in the states of Goa, Kerala, and Punjab, the three most developed states in India.^[41] Along with these three states the percentages of under-weight children was also low in the North-Eastern states where women are well-educated. Thus, it was concluded that the overall development, enhancement of level of education and low gender inequality are the key factors for improvement in the health status of Indian children.^[41] However, there is a need for further interdisciplinary research to collect data from families on behavioral risk factors in order to understand why some families are more prone to having children with low weight for age Z-scores. The diversity in the significant covariates between the states showed that there was a need for Indian nutrition programs to adopt state-specific approaches to tackle malnutrition.^[42] It is concluded from another study that understanding the causal role of stunting and its prevention as well as improving birth weight are the key for improving efficacy of public health programs for preventing under-five malnutrition in India.^[43]

Strategies suggested

Short term

It is important to accurately quantify the magnitude of the problem of malnutrition among the under-five children. Weight, height and BMI for age are the anthropometric parameters commonly used for assessment of nutritional status among children. Prevalence of under-nutrition is assessed by weight for age, height for age, BMI for age, and wasting (weight for height irrespective of age) for under-five children.^[44] Of these, weight for age is the most widely used indicator for assessment of nutritional status because of ease of measurement.^[44] Children can be under-weight because they are stunted, or wasted or stunted and wasted. Under-weight cannot distinguish between current or past or past and current energy deficit. Stunting is an index of cumulative past energy deficit, but does not reflect current energy status. BMI is an index of current energy deficit because it is computed from current weight and current height of children. As low BMI is the indicator of current energy deficit, early detection of low BMI for age and expeditious correction of it is likely to be the most effective intervention for preventing stunting. Thus use of BMI for assessment of current nutritional status in Indian children is essential in all settings where length/height measurements are possible.^[44] Thus, BMI can be used for assessment of both obesity/adiposity and under-nutrition status in children.

A study by Ramachandran and Gopalan found that there was a progressive increase in under-weight and stunting rates between 3 and 23 months of age;^[44] thus, the service component should be strengthened, especially for under-two children with respect to exclusive breast feeding, supplementary feeding practices, regular growth monitoring, prevention of infections, immunization, health and nutrition education of mothers with necessary follow-up, and corrective actions. At the grass root level, planning and integration of the work of Anganwadi workers under Integrated Child Development Service (ICDS), Accredited Social Health Activists (ASHA) under National Rural Health Mission and active community participation will result in better delivery of services to target groups. Moreover, effective implementation of the services requires adequate manpower and their periodic capacity building, infrastructure development, regular supply of quality food items, and logistic support. Facility based service need to be given to children with severe acute malnutrition, those with poor appetite or acute medical complications. Promotion of low-cost sustainable solutions like optimal infant and young child feeding practices need to be facilitated for preventing the occurrence of severe acute malnutrition.^[45]

Responsive complementary feeding, whereby the mother feeds her child in response to child cues and psychomotor abilities, if low, can contribute to malnutrition. A recent study among 8-20 months old children showed that the responsive feeding intervention provided significant improvements in children's self-feeding and mother's verbal responsiveness, but not weight gain. Weight gain required more nutritional availability, especially in areas of high food insecurity.^[46] Since the variance in mild under-weight has a larger correlation with child mortality than variance in severe under-weight^[3] and the majority of under-nutrition cases belonged to mild malnutrition category, distribution of double ration even for mild malnourished children may be an important step in managing under-nutrition among children. Studies have shown that under-nutrition is more prevalence among marginalized groups such as slum dwellers, tribal population, and rural remote areas; therefore, there is a need for strengthening both coverage and quality of service delivery for these target groups following the principles of equitable distribution.

Various intervention models conducted in Bellary district in Karnataka, Tamil Nadu Integrated Nutrition Project in Tamil Nadu, Dular scheme in Bihar, Integrated Nutrition Health Project in nine states have shown varied success rates on nutritional status of children.^[47] An intervention study in Rajasthan on the impact of nutrition care centers showed a reduction in prevalence of under-nutrition from 66.7% to 59.6%.^[48] The success of programs depends on various factors including regional or state level needs,

community perceptions and behaviors, acceptability of intervention measures by households, food security issues, food beliefs or taboos, likes or dislikes, cooking and child rearing practices, quality and quantity of the food item served. In this regard, evaluation of nutritional counseling for mothers and recommending sustainable behavioral change modifications are important factors that need to be considered to reduce the burden of malnutrition.

Long-term

Factors associated with socioeconomic inequality such as poverty, illiteracy, lack of awareness regarding the quality of food items, large family and poor sanitary environment are associated with malnutrition.^[49] The malnutrition is found to be 2.7 times higher among families with lower household wealth index.^[6] Rapid population growth and political commitment have an indirect effect on malnutrition. Hence, socioeconomic development of the country with involvement of all the stakeholders concerned could result in reduction of malnutrition.

CONCLUSION

Prevalence of under-nutrition among under-five children is relatively high and varied widely depending on the assessment methodology adopted, and there are limited studies on assessment of over-nutrition. The distribution of risk factors and its influence on malnutrition among children in a given set up should be analyzed in planning diverse control measures. Strengthening public health interventions for mild malnutrition cases among the vulnerable groups with a focus on socioeconomic development and research on overweight, obesity and its etiological factors in the country are the prerequisites required to tackle malnutrition among under-five children in India.

REFERENCES

- World Bank. India, Undernourished children: A call for reform and action. Available from: <http://web.worldbank.org/WBSITE/EXTERNAL/COUNTRIES/SOUTHASIAEXT/0,contentMDK:20916955~pagePK:146736~piPK:146830~theSitePK:223547,00.html> [Last accessed on 2014 Apr 05].
- Schroeder DG, Brown KH. Nutritional status as a predictor of child survival: Summarizing the association and quantifying its global impact. *Bull World Health Organ* 1994;72:569-79.
- Bhagowalia P, Chen SE, Masters WA. Effects and determinants of mild underweight among preschool children across countries and over time. *Econ Hum Biol* 2011;9:66-77.
- Park K. Health care of the community. In: Park K, editor. *Park's Textbook of Preventive and Social Medicine*. 21st ed. Jabalpur: Bhanot Publications; 2011. p. 830-1.
- National Family Health Survey-2. Mumbai: International Institute of Population Science; 1998-99.
- National Family Health Survey-3. Mumbai: International Institute of Population Science; 2005-06.

- Kumar HN, Mohanan P, Kotian S, Sajjan BS, Kumar SG. Prevalence of overweight and obesity among preschool children in semi urban South India. *Indian Pediatr* 2008;45:497-499.
- Rao S, Joshi SB, Kelkar RS. Changes in nutritional status and morbidity over time among pre-school children from slums in Pune, India. *Indian Pediatr* 2000;37:1060-71.
- Swami HM, Thakur JS, Bhatia SP, Bhatia V. Nutritional status of pre-school children in an integrated child development service (ICDS) block of Chandigarh. *J Indian Med Assoc* 2001;99:554-6.
- Ray SK, Haldar A, Biswas B, Misra R, Kumar S. Epidemiology of undernutrition. *Indian J Pediatr* 2001;68:1025-30.
- Laxmaiah A, Rao KM, Brahmam GN, Kumar S, Ravindranath M, Kashinath K, *et al.* Diet and nutritional status of rural preschool children in Punjab. *Indian Pediatr* 2002;39:331-8.
- Khokhar A, Singh S, Talwar R, Rasania SK, Badhan SR, Mehra M. A study of malnutrition among children aged 6 months to 2 years from a resettlement colony of Delhi. *Indian J Med Sci* 2003;57:286-9.
- Kapur D, Sharma S, Agarwal KN. Dietary intake and growth pattern of children 9-36 months of age in an urban slum in Delhi. *Indian Pediatr* 2005;42:351-6.
- Rao VG, Yadav R, Dolla CK, Kumar S, Bhondeley MK, Ukey M. Undernutrition & childhood morbidities among tribal preschool children. *Indian J Med Res* 2005;122:43-7.
- Kumari S. Nutritional status of scheduled caste pre-school children. *Indian J Public Health* 2005;49:258-9.
- Singh MB, Fotedar R, Lakshminarayana J, Anand PK. Studies on the nutritional status of children aged 0-5 years in a drought-affected desert area of western Rajasthan, India. *Public Health Nutr* 2006;9:961-7.
- Dey I, Chaudhuri RN. Gender inequality in nutritional status among under five children in a village in Hooghly district, West Bengal. *Indian J Public Health* 2008;52:218-20.
- Bisai S, Bose K, Ghosh A. Nutritional status of Lodha children in a village of Paschim Medinipur district, West Bengal. *Indian J Public Health* 2008;52:203-6.
- Biswas S, Bose K, Mukhopadhyay A, Bhadra M. Prevalence of undernutrition among pre-school children of Chapra, Nadia District, West Bengal, India, measured by composite index of anthropometric failure (CIAF). *Anthropol Anz* 2009;67:269-79.
- Biswas S Jr, Bose K, Bisai S, Chakraborty R. Prevalence of Thinness among Rural Bengalee pre-school children in Chapra, Nadia District, West Bengal, India. *Malays J Nutr* 2009;15:155-64.
- Meshram II, Laxmaiah A, Gal Reddy Ch, Ravindranath M, Venkaiah K, Brahmam GN. Prevalence of under-nutrition and its correlates among under 3 year-old children in rural areas of Andhra Pradesh, India. *Ann Hum Biol* 2011;38:93-101.
- Thakur JS, Prinja S, Bhatia SS. Persisting malnutrition in Chandigarh: Decadal underweight trends and impact of ICDS program. *Indian Pediatr* 2011;48:315-8.
- Espié E, Pujol CR, Masferrer M, Saint-Sauveur JF, Urrutia PP, Grais RF. Acute malnutrition and under-5 mortality, northeastern part of India. *J Trop Pediatr* 2011;57:389-91.
- Anurag S, Kumar B, Esam MS, Ved Prakash S, Payal MS, Iram S. Nutritional status of under five children in urban slums of Bareilly. *Indian J Matern Child Health* 2012;14:1-7.
- Wang Y, Chen HJ, Shaikh S, Mathur P. Is obesity becoming a public health problem in India? Examine the shift from under-to overnutrition problems over time. *Obes Rev* 2009;10:456-74.
- Bharati P, Bharati S, Pal M, Chakraborty S, Som S, Gupta R. Growth and nutritional status of pre-school children in India: Rural-urban and gender differences. *Coll Antropol* 2009;33:7-21.
- Manu, Khetarpaul N. Gender differences in food consumption pattern and nutrient intake of Indian pre-school children (3-4 years) in Haryana State. *Nutr Health* 2006;18:141-9.
- Patel A, Badhoniya N, Khadse S, Senarath U, Agho KE, Dibley MJ. South Asia Infant Feeding Research Network. Infant and young child feeding indicators and determinants of poor feeding practices in India: Secondary data analysis of National Family Health Survey 2005-06. *Food Nutr Bull* 2010;31:314-33.

29. Ray SK. Action for tackling malnutrition: Growth monitoring or surveillance? *Indian J Public Health* 2005;49:214-7.
30. Mittal A, Singh J, Ahluwalia SK. Effect of maternal factors on nutritional status of 1-5-year old children in urban slum population. *Indian J Community Med* 2007;32:264-7.
31. Ramachandran P, Gopalan HS. Undernutrition & risk of infections in preschool children. *Indian J Med Res* 2009;130:579-83.
32. Ganesh Kumar S, Harsha Kumar HN, Jayaram S, Kotian MS. Determinants of low birth weight: A case control study in a district hospital in Karnataka. *Indian J Pediatr* 2010;77:87-9.
33. Schmid MA, Salomeyesudas B, Sathesh P, Hanley J, Kuhnlein HV. Intervention with traditional food as a major source of energy, protein, iron, vitamin C and vitamin A for rural Dalit mothers and young children in Andhra Pradesh, South India. *Asia Pac J Clin Nutr* 2007;16:84-93.
34. Som S, Pal M, Bharati P. Role of individual and household level factors on stunting: A comparative study in three Indian states. *Ann Hum Biol* 2007;34:632-46.
35. de Onis M, Blössner M, Borghi E. Global prevalence and trends of overweight and obesity among preschool children. *Am J Clin Nutr* 2010;92:1257-64.
36. Raj M, Sundaram KR, Paul M, Deepa AS, Kumar RK. Obesity in Indian children: Time trends and relationship with hypertension. *Natl Med J India* 2007;20:288-93.
37. Meenu S, Madhu S. Risk factors for obesity in children. *Indian Pediatr* 2005;42:183-8.
38. Bhasin SK. New poverty line and growth chart bring forth sharp inequalities in the Indian population. *Indian J Community Med* 2009;34:171-2.
39. Fenn B, Penny ME. Using the new World Health Organisation growth standards: Differences from 3 countries. *J Pediatr Gastroenterol Nutr* 2008;46:316-21.
40. Seetharaman N, Chacko TV, Shankar S, Mathew AC. Measuring malnutrition — The role of Z scores and the composite index of anthropometric failure (CIAF). *Indian J Community Med* 2007;32:35-9.
41. Bharati S, Pal M, Bharati P. Determinants of nutritional status of preschool children in India. *J Biosoc Sci* 2008;40:801-14.
42. Griffiths P, Matthews Z, Hinde A. Gender, family, and the nutritional status of children in three culturally contrasting states of India. *Soc Sci Med* 2002;55:775-90.
43. Mamidi RS, Shidhaye P, Radhakrishna KV, Babu JJ, Reddy PS. Pattern of growth faltering and recovery in under 5 children in India using WHO growth standards — a study on First and Third National Family Health Survey. *Indian Pediatr* 2011;48:855-60.
44. Ramachandran P, Gopalan HS. Assessment of nutritional status in Indian preschool children using WHO 2006 Growth Standards. *Indian J Med Res* 2011;134:47-53.
45. Bavdekar SB. Severe acute malnutrition: Time for urgent action. *J Postgrad Med* 2010;56:61-2.
46. About FE, Shafique S, Akhter S. A responsive feeding intervention increases children's self-feeding and maternal responsiveness but not weight gain. *J Nutr* 2009;139:1738-43.
47. National response to nutritional problems. Available from: <http://www.wcd.nic.in/research/nti1947/9.National%20response%20to%20nutrition%20problems.pdf>. [Last accessed on 2014 Apr 05].
48. Kumar S, Bhawani L. Managing child malnutrition in a drought affected district of Rajasthan — A case study. *Indian J Public Health* 2005;49:198-206.
49. Van de Poel E, Hosseinpoor AR, Speybroeck N, Van Ourti T, Vega J. Socioeconomic inequality in malnutrition in developing countries. *Bull World Health Organ* 2008;86:282-91.

How to cite this article: Sahu SK, Kumar SG, Bhat BV, Premarajan KC, Sarkar S, Roy G, *et al.* Malnutrition among under-five children in India and strategies for control. *J Nat Sc Biol Med* 2015;6:18-23.

Source of Support: Nil. **Conflict of Interest:** None declared.