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Association of Food Insecurity and Malnutrition among Young Children (6-36 Months)

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Abstract

Objective of the study was to assess the prevalence of food insecurity and malnutrition among young children (6-36 months) in urban slums of India and its consequences on the nutritional status of the children. Household-based cross-sectional study on a sample of 446 mother/child diad was conducted. Structured interview schedules were used to collect data on socio-demographic characteristics, food insecurity and household assets wealth. Height and weight were also measured. The results indicated the prevalence of child food insecurity was 38 per cent. More than 50 per cent were stunted and 36 per cent were underweight. Two-third underweight and 53 per cent stunted children were food insecure. Multivariate associations showed statistically significant inverse association of stunting and underweight with child food security status. Children from very low food secure households were 5.92 times more underweight and 4.14 times more stunted than food secure households. It was concluded that child food insecurity was associated with malnutrition. Strategies for reducing child malnutrition should focus on improving the food security.

Keywords: Food security, malnutrition, young children, urban slums.

Introduction

Child undernutrition is one of a major public health problems in developing countries including India. It is an underlying cause of death in 2.2 million children under five¹. Child malnutrition is a state of physical weakness which results from a lack of

energy and nutrients. It leads to poor cognitive, intellectual and physical development which is impossible to reverse after three years of age. It results from risk factors which are multifaceted and complex such as food insecurity, insufficient feeding practices and poor health². According to National Family Health Survey-3

(NFHS-3), 48 per cent are stunted, an indicator of chronic undernutrition³. Food security is one of the possible determinant factors of malnutrition in developing countries like India, but its role remains unclear. In case of children, especially young children in age range of 6-36 months, mothers are likely to buffer children by reducing their own intakes^{4,5}.

Food security is defined as access at all times to enough food for an active, healthy life⁶. It is an important foundation for good nutrition and health. Food security is especially important for children because the nutritional content of their diets affects not only their current health, but also their physical, mental and social development and thus their future health and well-being⁷.

Though there are reported cases of household food insecurity in India, there is paucity of research indicating food insecurity among young children and its contribution in child malnutrition remains unclear. It is also not clear whether food insecurity among children is independently associated with child malnutrition. Hence the present research assessed the prevalence of food insecurity and malnutrition among young children in India and its consequences on the nutritional status of young children (6-36 months).

Materials and Methods

Study setting

The present study was household-based and cross-sectional. It was conducted in Delhi. Delhi is divided into nine administrative districts⁸, namely: North, Central, New Delhi, North-East, South, East, North-West, West and South-West. For a representative sample selection, four out of nine districts were selected randomly. Based on the geographical spread, the 4 districts selected were South, West, East and North East. From each district, one slum was selected. For slum selection, vulnerability assessment was done for a few slums. For the assessment, a checklist was obtained and adapted from the existing reports and papers⁹. Based on the checklist, slums were characterized as less, moderate and severely vulnerable. The four slums selected were Mustafabad, Sangam Vihar, Kathputli Nagar and Kalyanpuri which were under moderate to severely vulnerable category.

Sampling procedure

The analytical cross-sectional study was conducted on a sample of 446 children in age range of 6-36 months in the year 2012. The required sample size was calculated based on the standard formula¹⁰⁻¹³. For a survey design based on a simple

random sample, the sample size required can be calculated according to the following formula:

$$n = t^2 \times p(1-p) / m^2$$

Where, **n** = required sample size

t = confidence level at 95% (standard value of 1.96)

p = estimated prevalence in the project area

m = margin of error at 5% (standard value of 0.05)

Based on the formula above, a sample size of 385 was calculated to estimate a hypothesized prevalence of food insecurity as 50 per cent with a margin error of 5 percentage points and 95 per cent confidence. Prevalence of 50 per cent was hypothesized as no previous national level data on prevalence rate of food insecurity was available and 50 per cent provides the largest sample size. Also, a study done by Agarwal *et al*¹⁴ in urban slums of Delhi identified prevalence of food insecurity as 51 per cent. Thus 50 per cent was considered apt. The design effect was assumed to be 1 as cluster sampling method was not used. The sample size was finally inflated to 445 assuming non-response rate of 5 per cent and migration rate of 10 per cent.

Sampling was done by random sampling method. All the four slums had

population of approximately 50,000. The household listing was not available for the systematic sampling method. Thus, for the ease of collecting data and maintain randomization, it was decided that two households would be picked from each lane of the slum which will meet the inclusion criteria. For picking up the two households within the lane, a lottery method was done. Chits with 1-50 numbers were kept with the researcher. Before picking any household, a chit was drawn, and that household was counted manually and was taken as the sample. This ensured equal probability of any household to get selected. In case, that household did not match the inclusion criteria, the household adjacent to it was considered and so on. Inclusion criteria of the study were

Households having at least one child in the age group of 6-36 months.

Households that extended their cooperation and support and were willing to participate in the study.

In the present sampling method, if the households without children were falling as the sample from the chit, then the household adjacent to it was included. In case adjacent household also did not have children of 6-36 months, then the next household was taken.

In the same fashion, the next household was taken by drawing out of the chit. In the selected households, all children in the age group of 6-36 months were included.

Study population

The study population comprised women within the reproductive age bracket (15 to 45 years) with children aged 6 to 36 months residing in urban slums. Mother/child pairs were chosen at the household level.

Data collection

Face-to-face interviews using structured questionnaires were used to collect data on socio-demographic characteristics, food insecurity and household assets wealth. Anthropometric measurements of height and weight were also taken. The details of interview schedule are described.

Assessment of child food security

In the present study USDA Household Food Security Scale Measure (HFSSM)¹⁵ were used to assess food security among children. Eight questions specific about food-related conditions among children were asked in *Hindi*, the local language and respondents were asked to refer to the experience of children only in the

household. The eight items included in the present study were as below:

Questions 1, 2 and 3 were coded as affirmative for the responses “often” or “sometimes,” question 7 as affirmative for responses “almost every month” or “some months but not every month,” and question 4, 5, 6 and 8 as affirmative for the response of “yes.”

As the terms “often,” “sometimes,” “almost every month,” and “some months but not every month” could be interpreted differently by different respondents; a follow-on question was added if these responses were given to questions 1, 2, 3 and 7. The follow-on question was, “How many months did that occur in the last year?” Based on the responses, the researcher categorized 10–12 months as “often” or “almost every month” and 3–9 months as “sometimes” or “some months.”

“Balanced meal” was defined as meal that contain starchy food, like rice, chapatti, potatoes, bread; a protein-rich food like pulse, meat, fish, milk, or beans; and a fruit or a vegetable. This wording was agreed by local nutritionists working in the area of public health nutrition adapted from a suggestion of Derrickson *et al*¹⁶.

No.	Items	Question/Response
1.	(I/we) relied on only a few kinds of low-cost food to feed (my/our) child/ the children) because (I was/we were) running out of money to buy food	Was that often, sometimes, or never true for you in the last 12 months?
2.	(I/We) could not feed (my/our) child/ the children) a balanced meal, because (I/we) could not afford that.	Was that often, sometimes, or never true for you in the last 12 months?
3.	(My/Our child was/The children were) not eating enough because (I/we) just could not afford enough food.	Was that often, sometimes, or never true for you in the last 12 months?
4.	In the last 12 months, since (current month) of last year, did you ever cut the size of (your child's/any of the children's) meals because there was not enough money for food?	Yes/ No
5.	In the last 12 months, (was your child/ were the children) ever hungry but you just could not afford more food?	Yes/ No
6.	In the last 12 months, did (child's name/ any of the children) ever skip meals because there was not enough money for food?	(Yes/ No
7.	[IF YES ABOVE ASK] How often did (child's name/any of the children) ever skip meals? months, never?	Was that almost every month, some months but not every month, in only 1 or 2
8.	In the last 12 months, did (your child/ any of the children) ever not eat for a whole day because there was not enough money for food?	Yes/ No

Households that reported less than two conditions among children were considered food secure⁷. Households with two, three or four conditions that indicate food insecurity among children were classified as having low food security among children. Those reporting five or more conditions are classified as having very low food security among children.

Determination of household assets wealth

A household wealth index based on household assets and household quality was used as a proxy indicator for Socio-Economic Status (SES) of the households. An absolute measure of household wealth (wealth index) used in this study was adapted from National Family Health Survey-3². It included 23 basic amenities: electricity connection; drinking water source; type of toilet facility; type of housing; cooking fuel; house ownership; number of household members per sleeping room; ownership of a bank or post-office account; and ownership of a mattress, a pressure cooker, a chair, a cot/bed, a table, an electric fan, a radio/transistor, a color television, a sewing machine, a mobile telephone, a computer, a refrigerator, a watch or clock, a bicycle and motorcycle or scooter. The Wealth Index is a composite measure of the cumulative living standard of a household. It categorized households in

five quintiles, to observe the differences between the food security and nutritional status of poor and rich populations.

Anthropometric measurements and reference values

Anthropometric measurements of children were taken and WHO AnthroPlus was used to compute nutrition indices and the results were classified according to World Health Organization 2006 cut-off points. Underweight, wasting and stunting among children were defined as Weight-for-Age z-scores (WAZ), Weight-for-Height z-scores (WHZ) and Height-for-Age z-scores (HAZ) less than 2 SD below the median according to 2006 WHO growth standards, respectively¹⁷. The children were weighed with a TANITA electronic scale sensitive to the nearest 100 g. The recumbent length of children less than two years of age (i.e., upto and including 23 months) was measured to the nearest 0.1 cm with a portable wooden infantometer. The child was placed on his/her back and the head was placed so that it is against the top end. The knees were gently pushed down by a helper. For children aged 24-35 months, stature was measured in a standing position using stadiometer sensitive to nearest 0.1 cm. The child stood without shoes on a level floor. The legs were placed

together, as also were the heels. The standard techniques were used for all measurements.

Data management and analysis

The pre-coded quantitative data was entered into Epi-Info software (version 3.4.3). Anthropometric measurements such as height, weight and age of children (6–36 months) were converted into WAZ, HAZ and WHZ z-scores using the 2006 WHO reference growth curves. Before performing the anthropometric calculations for WHZ, HAZ and WAZ, the data was cleaned and the outliers were removed. The literature recommends that the percentage of outliers should not exceed 2 per cent of the sample. The data was analyzed using Statistical Package for the Social Sciences (SPSS), version 16.

First, standard univariate descriptive statistics were calculated. Then, bivariate associations of nutritional status of children with household socio-demographic characteristics, wealth index and food insecurity (low and very low food insecurity) were examined by cross-tabulation. The statistical significance of the bivariate associations was assessed using Chi-square tests for homogeneity. Finally, the net association of nutritional status with food insecurity was examined in a multivariate logistic regression analysis.

Ethical clearance

The study protocol was presented to the Ethics Committee of the Department of Home Science, Lady Irwin College, University of Delhi, for approval. Permission for data collection was obtained from the local leaders in the respective communities and written informed consent was obtained from each respondent before interviews were conducted. The study's purpose and objectives were explained to each participant prior to interview. Study participants were free to refuse or withdraw from the study at any time.

Results and Discussion

Socio-demographic characteristics of study sample

The study comprised 446 households which had 466 children in age range of 6–36 months. The mean age of the children was 19.5 ± 8.2 months and 50.6 per cent of children were males. The other details of the sample characteristics included are given in Table I. Food insecure households had generally lower socioeconomic status as measured by household wealth index than food secure households. A greater proportion of food secure households owned homes in comparison to the food insecure households. In comparison to food secure households, households with food insecurity had lower access

TABLE I
Characteristics of Households Stratified by Household Food Insecurity

(N=446)

Household Characteristics	Number	Food Security (%)			P value
		Food Secure Households	Low Food Secure Households	Very Low Food Secure Households	
Family size					
<5	222	50.4	29.3	20.3	<0.001
≥5	224	47.3	25.9	26.8	
Ownership of household					
Owned	189	72.5	22.2	5.3	<0.001
Rented	257	31.5	31.5	37.0	
Source of portable water					
Owned	295	63.7	20.0	16.3	<0.001
Shared / Public	151	19.9	42.4	37.7	
Ration card					
Available	158	59.5	23.4	17.1	0.003
Not available	288	43.0	29.9	27.1	
Wealth index					
Poorest	90	11.1	40.0	48.9	<0.001
Poor	89	21.4	34.8	43.8	
Middle	89	58.4	21.4	20.2	
Rich	89	70.8	27.0	2.3	
Richest	89	83.2	14.6	2.3	

to their own water source. Higher food secure households had family size less than 5 in comparison to food insecure households.

Magnitude of child food insecurity and malnutrition

Table II shows the prevalence of child undernutrition and household food

insecurity. More than one-third (38%) children were food insecure. Similar results were found for underweight among children (36%) having Weight-for-Age z-scores $\leq 2SD$. Chronic malnutrition, that is, stunting was very high, with more than half children (53%) having Height-for-Age z-scores $\leq 2SD$.

TABLE II
Prevalence of Malnutrition and Household Food Insecurity

(N=466)

Indicator	Prevalence %	95% Confidence Interval (C.I)
Total food insecurity	38.1	33.6-42.8
Low	32.5	28.2-37.1
Very low	5.6	3.7-8.3
Underweight, WAZ \leq 2SD	36.1	31.7-40.6
Acute malnutrition, WHZ \leq 2SD	12.2	9.5-15.6
Chronic malnutrition, HAZ \leq 2SD	53.0	48.4-57.6

Nutritional status indices and household food insecurity

Child food security found to be related to all three nutrition indices measured in bivariate analysis. As shown in Table III, 69 per cent children in age range of 6-36 months with Weight-for-Age z-score less than 2SD were food insecure. Similarly, 53 per cent children with Height-for-Age z-score less than 2SD were food insecure in comparison to 47 per cent children who were food secure.

Multivariate regression analysis was done to identify the association. Anthropometric indicators were dependent variables and food security was the independent variable. The results were adjusted for the covariates which were wealth index quintile, gender and caste of head of the household, ownership of the house, family size, type of water facilities, type of family and availability of ration card.

Height-for-Age z-score less than 2SD as well as Weight-for-Age z-score

TABLE III
Association of Nutritional Status Indices and Child Food Insecurity

Nutrition Status Indicators	Food Secure %	Low Food Secure %	Very Low Food Secure %	p value
WAZ \leq 2SD (n=168)	31.0	58.3	10.7	<0.001
HAZ \leq 2SD (n=247)	46.6	45.3	8.1	<0.001
WHZ \leq 2SD (n=57)	47.4	47.4	5.3	0.034

less than 2SD, showed a statistically significant inverse association with child food security status, that is, the more food insecure the household, the higher the prevalence of stunted (HAZ ≤ 2 SD) and underweight (WAZ ≤ 2 SD) children. In contrast, weight-for-height z-score less than 2SD did not show a significant association with food security status.

Children from low food secure households were found to be 3.9 times more underweight (WAZ ≤ 2 SD) than food secure households and children from very low food secure households were found to be 5.92 times more underweight than food secure households (Table IV). Similarly, children from very low food secure households were 4.14 times more stunted (HAZ ≤ 2 SD) than food secure households.

The purpose of this study was to investigate the magnitude of child

food insecurity and its relationship with nutritional status of children (6-36 months) in urban slums of Delhi, India. Inadequate food security is one of the three underlying causes of malnutrition and one would therefore expect to see a link between indicators of child food insecurity and that of malnutrition.

Several important findings emerged from this study. First, a large proportion (39%) of children (6-36 months) living in urban slums was food insecure. Second, more than half (53%) young children (6-36 months) were stunted (HAZ ≤ 2 SD) and another one-third (36%) were underweight (WAZ ≤ 2 SD) for age. Lastly, child food insecurity was found to be a predictor of malnutrition.

Large proportion (39 %) of children (6-36 months) living in urban slums

TABLE IV
Multivariate Association of Nutritional Status Indices and Child Food Insecurity

Child Food Security	WAZ		HAZ		WHZ	
	Adjusted OR (95% CI)	p value	Adjusted OR (95% CI)	p value	Adjusted OR (95% CI)	p value
Food secure	Reference	-	Reference	-	Reference	-
Low food secure	3.9 (2.1-7.4)	<0.01*	3.8 (2.1-6.6)	<0.001*	1.2 (0.6-2.5)	0.576
Very low food secure	5.9 (1.7-20.9)	0.006*	4.1 (1.4-12.5)	0.01*	0.7 (0.2 - 2.7)	0.561

were food insecure. These values may be compared with food insecurity situation in Iran, a developing country where food insecurity among children was as high as 64 per cent¹⁸ and also with USA, a developed nation, where food insecurity among children was 21 per cent¹⁹. The value of 39 per cent food insecurity among urban poor children in Delhi observed in this study corroborates well with national figures of stunting (39%) among urban under-5 children².

Food insecurity among children is an indicator of the most vulnerable household. It impacts overall development of children. Inadequate food intake limits the ability of the children to learn about the world around them. Food is intimately connected to child's development and growth, which means food insecurity deserves close attention, especially at this uniquely rich developmental stage. To improve the food insecurity condition among children, mothers could be trained to prepare cheap low cost and healthy food products specific for children. They could be made aware of the importance of premix given at the anganwadi center. Mothers could be engaged in the programs which ensure that they and their children are healthy and are aware of the key nutrition issues.

More than half (53%) young children (6-36 months) were stunted ($HAZ \leq 2SD$) and another one-third (36%) were underweight ($WAZ \leq 2SD$) for age. Similar values could be observed specifically for urban poor children in Delhi with 57.7 per cent of urban poor children under 5 years of age in Delhi being stunted ($HAZ \leq 2SD$) and 46 per cent underweight ($WAZ \leq 2SD$)²⁰. The study findings imply that efforts for redressing child undernutrition issues in India should be more focussed. Malnutrition in early childhood has serious, long-term consequences because it impedes motor, sensory, cognitive, social and emotional development. Malnourished children are more likely to grow into malnourished adults, at greater risk of disease and early death.

Child food insecurity is a predictor of malnutrition among children. The results of the present study were in accordance with studies carried out in the other areas. In Bogota, Colombia, food insecure children were almost three times as likely to be underweight as food secure children, while stunting was not significantly associated with food security when controlling for covariates²¹. In Pakistan, household food insecurity was significantly associated with child stunting²². A study done among tribal children in West Bengal identified that household food

security was significantly associated with stunting, wasting and underweight children²³.

Conclusion

Findings from this study strengthen growing evidence that child

food security is a predictor of child malnutrition. The policy implication is that, strategies for improved food and nutrition security should focus on improving the household food security, together with an overall socioeconomic wellbeing of families.

REFERENCES

1. Black, R.E., Allen, L.H., Bhutta, Z.A. *et al.* Maternal and child undernutrition: global and regional exposures and health consequences. *Lancet*, 2008; **371**, 243-60.
2. Saaka, M. and Osman, S.M. Does household food insecurity affect the nutritional status of preschool children aged 6-36 months? *Int. J. Popn. Res.*, 2013.
3. International Institute for Population Sciences and Macro International. 2007. National Family Health Survey-3, 2005-06: India: Volume I. Mumbai: IIPS.
4. Graham, M.A. Food allocation in rural Peruvian households: concepts and behavior regarding children. *Social Sci. Med.*, 1997, **44**, 1697-1709.
5. Kuku, O., Gundersen, C. and Garasky, S. Differences in food insecurity between adults and children in Zimbabwe, *Fd. Pol.*, 2011, **36**, 311-317.
6. Anderson, S.A. Core indicators of nutritional state for difficult-to-sample populations. *J. Nutr.*, 1990, **120**, 1559-1600.
7. Mark, N. Food insecurity in households with children: Prevalence, severity, and household characteristics. EIB-56. U.S. Dept. of Agriculture, *Econ. Res. Serv.*, 2009.
8. Office of the Registrar General and Census Commissioner of India. Provisional Population Totals- Paper 1 of 2011, India Series-1. Office of the Registrar General and Census Commissioner. New Delhi, 2011.
9. Agarwal, S. and Taneja, S. All slums are not equal. *Ind. Pediat.*, 2005, **42**, 233-244.
10. IFAD. Calculating the sample size. Current version 1 August 2013. Available at: http://www.ifad.org/gender/tools/hfs/anthropometry/ant_3.htm (accessed on 2 September 2011).
11. FAO. Conducting small-scale nutrition surveys: A field manual, Rome, 1990.
12. UNICEF. Monitoring progress toward the goals of the World Food Summit for Children: A practical handbook for multiple indicator surveys. UNICEF. New York, 1995.
13. Magnani, R. Sampling guide. FANTA. Washington DC, 1997.
14. Agarwal, S., Sethi, V., Gupta, P., Jha, M., Agnihotri, A. and Nord, M. Experiential household food insecurity in an urban underserved slum of North India. *Fd. Security*, 2009, **1**, 239-50.

15. Hamilton, W.L., Cook, J.T., Thompson, W.W., Buron, L.F., Frongillo, E.A. Jr., Olson, C.M. and Wehler, C.A. Household food security in the United States in 1995: Summary report of the food security measurement project. United States Department of Agriculture: Washington, D.C, 1997.
16. Derrickson, J.P., Sakai, M. and Anderson, J. Interpretations of the "balanced meal" household food security indicator. *J. Nutr. Edn.*, 2001, **33**, 155-160
17. WHO, WHO Child Growth Standards: Length/Height-for-Age, Weight-for-Age, Weight-for-Length, Weight-for-Height and Body Mass Index-for-Age: Methods and Development, WHO, Geneva, Switzerland, 2006.
18. Sharafkhani, R., Dastgiri, S., Gharaaghaji, R., Ghavamzadeh, S. and Didarlo, A. The role of household structure on the prevalence of food insecurity. *Eur. J. Gen. Med.*, 2010, **7**, 385-388.
19. Coleman-Jensen, A., Nord, M., Andrews, M. and Carlson, S. Household food security in the United States, 2011. United States Department of Agriculture, Economic Research Service. Washington DC, 2012. Available at <http://www.ers.usda.gov/publications/ap/ap057/ap057.pdf> (accessed on 15 July 2013).
20. Urban Health Resource Center. Health of the Urban Poor in India. Key results from the re-analysis of NFHS-3, 2005-06 data by wealth index quartiles (Wall chart). Urban Health Resource Center. New Delhi, 2008. Available at <http://www.uhrc.in/downloads/wall-chart.pdf> (accessed August 2, 2008).
21. Isanaka, S., Mora-Plazas, M., Lopez-Arana, S., Baylin, A. and Villamor, E. Food insecurity is highly prevalent and predicts underweight but not overweight in adults and school children from Bogotá, Colombia. *J. Nutr.*, 2007, **137**, 2747-55.
22. Baig-Ansari, N., Rahbar, M.H., Bhutta, Z.A. and Badruddin, S.H. Child's gender and household food insecurity are associated with stunting among young Pakistani children residing in urban squatter settlements. *Fd. Nutr. Bull.*, 2006, **27**, 114-27.
23. Mukhopadhyay, D.K. and Biswas, A.B. Food security and anthropometric failure among tribal children in Bankura, West Bengal. *Indian Pediat.*, 2011, **48**, 311-314.