Association Between Household Food Insecurity and Nutritional Status Among Children of age <5 years: A Community-based Study in a Slum of Kolkata, Eastern India

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Abstract

Context: Household food insecurity (HFI) is considered one of the main risk factors of undernutrition. However, the evidence is not conclusive in our study settings. This study aimed to examine the association between HFI and nutritional status. **Materials and Methods:** It was a community-based cross-sectional observational study among children of age <5 years and their mothers ($n = 257$) conducted in a slum of Kolkata, West Bengal, carried out from March to May 2019. Data were analyzed using the Statistical Package for the Social Sciences software (version 16.0. Chicago, SPSS Inc.). Logistic regression analysis was performed to find out the association. **Results:** The current study found that 72.4% of participants living in food-insecure households and the proportion of underweight, wasting, and stunting among the under-five children found to be 29.9%, 17.8%, and 27.2%, respectively. Bivariate analysis showed wasting and stunting associated with HFI, whereas in multivariable regression, only stunting remained significant. **Conclusion and Implications:** Food insecurity (FI) remains a predictor of chronic undernutrition (wasting and stunting) highlighting the need for multisectoral strategies and policies to combat FI and multiple forms of malnutrition which will lay the foundation for sustainable and inclusive growth.

Keywords: Food insecurity, under-five children, undernutrition

The address of the institutions at which the work was carried out

Department of Preventive and Social Medicine, All India Institute of Hygiene and Public Health, Kolkata, West Bengal, India. It was a community-based cross-sectional observational study conducted in a slum under the service area of ward no 59

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Access this article online	
Quick Response Code:	**Website:** www.jfmpc.com
	DOI: 10.4103/jfmpc.jfmpc_635_21

Urban Primary Health Centre, Borough -7, Kolkata, West Bengal, carried out from March to May 2018.

Introduction

Food security means that "all people, at all times, have physical and economic access to sufficient, safe, and nutritious food that meets their dietary needs and food preferences for an active and healthy life."[1] Household food insecurity (HFI) has been associated with several health and nutrition outcomes, in both

How to cite this article: Burman J, Paul B, Sembiah S, Parida D, Negi R, Vantepaka S, *et al*. Association between household food insecurity and nutritional status among children of age <5 years: A community-based study in a slum of Kolkata, Eastern India. J Family Med Prim Care 2022;11:3885-90.

developed and developing countries. As the severity of HFI increases, steps taken by the household to cope with it also become more intense, starting from adjusting the food budget to adults reducing their food intake and experiencing hunger, and finally the children also experiencing reduced food intake and hunger potentially worsen nutritional status.[2] FI may also affect nutritional status through parental stress and depression which affects infant feeding.[3]

However, the relationship between HFI and the nutritional status of adults and children, particularly in developing countries, is not well established. At the household level, HFI status, socioeconomic conditions, and knowledge regarding nutritious foods are found to be the key underlying factors influencing the nutritional status of children.[4] The relative importance of each of the known risk factors of malnutrition including HFI is likely to vary between settings.[5]

HFI is one of the key determinants of chronic undernutrition in Indian children, particularly for those living in income-insecure environments.[6] Various schemes have been introduced in India such as Public distribution system, integrated child development scheme, mid-day meal program to achieve food security. Still, the country faces severe and growing FI problems because of operational inefficiencies.[7] The State of Food Insecurity in the World (2012) estimates that India is home to more than 217 million undernourished people.[8]

Children are most in danger because they are more susceptible to adverse environments and dietary changes can affect them on a large scale.[9] In underserved areas like urban slums, the situation is worse. In India, few studies were available where food security and child nutritional status have been considered. With this background, this study was undertaken to find out whether household food security can truly predict the nutritional status of children.

Materials and Methods

It was a community-based cross-sectional observational study conducted in a slum under the service area of ward no. 59; Urban Primary Health Centre, Kolkata, Eastern part of India, carried out from March to May 2019. The study population included all households with children of age 6–59 months and their mothers; simple random sampling technique was applied to recruit the study participants from the updated list of under-five children. One child was taken from each household; in a household where more than one under-five children were present, the younger child was chosen as the study participant. The proportion of stunting in under-five children in West Bengal was found to be 32.5,[10] using the formula = $z^2 Pq/d^2$ (z = standard normal deviate at 95% confidence interval [CI]; ($q = 100 - P$), with absolute precision (d) of 6% and 95% CI, the estimated minimum sample size was 234. The data were collected from the 257 mother–child pairs through face-to-face interviews with a pre-designed, pre-tested, structured schedule from mothers and anthropometric measurements of children.

Outcome variable

Nutritional status of under-five children was assessed by anthropometric measurements. Anthropometric indices were calculated using the WHO Anthro software. The Z-scores of indices, weight-for-age Z-score (WAZ), height-for-age Z-score (HAZ), and weight-for-height Z-score (WHZ) were computed and compared using the WHO Multicenter Growth Reference Standard. A child with WAZ less than −2 SD from the reference population was defined as underweight; HAZ less than −2 SD was defined as stunted, and WHZ less than −2 SD was classified as wasted; otherwise, they were considered normal.

Independent variables

1. FI was assessed using the Household Food Insecurity Access Scale which measures the insufficient quality and quantity of food, as well as anxiety over insecure access to food. It consists of nine low food status occurrence questions with responses "yes" or "no" and another set of corresponding nine questions on frequency-of-occurrence during the last 30 days of recall. Standard scoring procedure was used with the frequency scores were ranged from 0 to 3, while 0 was the score for nonoccurrence, 1 for rarely (once or twice in the past 4 weeks), 2 for sometimes (3–10 times in the past 4 weeks), and 3 for often (more than 10 times in the past month). The total score ranges from 0 to 27. The higher the score, the more the food-insecure household, and a lower score represents a more food-secure household.[11] Internal consistency was assessed by Cronbach's alpha for the Bengali version (0.87).
2. Based on UNICEF's conceptual framework for childhood undernutrition, sociodemographic factors, environmental condition, sanitation, age of the child, immunization status, availability of Integrated Child Development Services (ICDS) center, personal hygiene, and feeding practice were included as confounding variables to assess their effect on nutritional status.

Data collection technique

The face and content validity of the schedule was checked. The schedule was translated in Bengali and Hindi (local language) and back-translated into English and latter compared with the previous and corrections were made and translated into the local language. The final Bengali and Hindi questionnaire was unambiguous, simple to understand, had semantic equivalence, and conformed to the objectives of the study. A pilot study was done in a nearby slum outside the service area on 30 households who were not included in the study and the schedule was modified according to the feedback.

Data analysis

All analyses were conducted with the SPSS software version 16.0. Suitable descriptive statistics were used. Univariate and multivariable logistic regressions were used. Strength of association was assessed by odds ratio (OR) at 95% confidence interval with P value <0.05.

Ethics approval

The study protocol has been approved by an Institutional Review Board in the institution where the study was conducted. Respondents were explained about the purpose of the study and assured that all data provided would be kept confidential and anonymous and informed written consent was obtained from their parents. The study was conducted in accordance with the Declaration of Helsinki for ethical consideration.

Result

In this study, 257 children of age <5 years were included in the study. Around half of the children (43.6%) belonged to the age group of 12–24 months. Around half of them (53.6%) were boys. More than half of them were OBCs and SC/STs. Nearly, one-third of the subject's mother was educated up to primary school and three-fourth (72.4%) of them were homemakers. About half of the participants belonged to lower-middle and lower socioeconomic status according to Modified BG Prasad Scale 2018. The mean and median per capita incomes were found to be Rs. 899 and Rs. 1018.

More than one-fourth (27.6%) and 1.1% of participants rarely (once or twice) and often (more than 10 times) worried that they did not have enough food in the past 4 weeks, respectively. About 1.1% often had to eat smaller meals. About 1.5% of participants sometimes had no food of any kind to eat in their household because of lack of resources to get food. The participants reported that none of their household members go a whole day and night without eating anything because of not enough food [Table 1]. Various factors such as environmental, personal hygiene, feeding practices, availability of health services, and presence of acute illnesses related to nutritional status were described [Table 2].

The prevalence of HFI is 72.4% where 42.4% is mild, 22.6% moderate, and 7.4% of them were severe FI households,

and the proportion of underweight, wasting, and stunting among the under-five children found to be 29.9%, 17.8%, and 27.2%, respectively [Table 3]. In multivariable regression after adjusting with other variables derived from UNICEF conceptual framework, it was found that only stunting was significantly associated with HFI (Adjusted Odds Ratio = 2.4 [95% CI, 1.2–6.1]; *P* value 0.04). The final model (multivariable regression) is fit to explain the dependent variable (stunting) assured by nonsignificant Hosmer Lemeshow value [*P* value 0.253]; only 17% of stunting was predicted by the HFI after adjusting with other confounders [Naeglerke's $R^2 = 0.17$] [Table 4].

Discussion

The current study was conducted to examine the relationship between HFI and nutritional status by exploring evidence from the slum population, where more people were at risk of being malnourished. The three components of food security (availability, accessibility, and utilization/consumption) may have different conceptual constructs, risk factors, consequences, but how they interact and how their absence makes the food insecurity complex to explore.[12]

Prevalence of food security

The current study found 92.4% of under-five children to be food insecure [very low food security (27.6%), low food security (65%)], and 7.4% as food secure: [high food security], a similar study was conducted in slums of west Bengal showed similar results of very low (26.6%) and low (44.3%) food security and higher food secure proportion (29.1%) than the food security in the present study.[13] Another study done in tribal population of west Bengal showed similar very low food security (23.2%) and low food security (29.6%) and nearly half (47.2%) of them were food secure as the tribal population has better agro-ecosystem than urban slums.[14] Although a study in Karnataka found about 80.8% food insecure, of which 15.4% were severely food insecure which is less than the present study as that study was done in a

Table 1: Distribution of study participants according to their food insecurity (*n*=257)			
Questions	Rarely, *n* (%)	Sometimes, *n* (%)	Often, *n* (%)
In the past 4 weeks, did you worry that your household would not have enough food?	71 (27.6)	11 (4.3)	3 (1.1)
In the past 4 weeks, were you or any household members not able to eat the kinds of foods you/they preferred because of a lack of resources?	27 (10.5)	3 (1.1)	2 (0.7)
In the past 4 weeks, did you or any household members have to eat a limited variety of foods due to a lack of resources?	15 (5.8)	2 (0.7)	1 (0.4)
In the past 4 weeks, did you or any household members have to eat some foods that you/they really did not want to eat because of a lack of resources to obtain other types of food?	48 (18.7)	2 (0.7)	4 (1.5)
In the past 4 weeks, did you or any household members have to eat a smaller meal than you/they felt you/they needed because there was not enough food?	22 (8.5)	7 (2.7)	3 (1.1)
In the past 4 weeks, did you or any household members have to eat fewer meals in a day because there was not enough food?	12 (4.6)	5 (1.9)	2 (0.7)
In the past 4 weeks, was there ever no food of any kind to eat in your household because of lack of resources to get food?	10 (3.9)	4 (1.5)	0
In the past 4 weeks, did you or any household members go to sleep at night hungry because there was not enough food?	2 (0.7)	1 (0.4)	0
In the past 4 weeks, did you or any household members go a whole day and night without eating anything because there was not enough food?	0	0	0

Table 2: Distribution of study participants according to the various factors related to nutritional status

Environmental characteristics	No (%)
Type of house	
Semi pucca	227 (88.3)
Pucca	30 (11.7)
Sanitary latrine	
Own	66 (25.7)
Community	191 (74.3)
Place of disposal of stool of child	
Open field	22 (8.6)
Latrine	145 (56.4)
Drain	90 (35)
Source of drinking water	
Tap	228 (88.7)
Others	29 (11.3)
Fuel for kitchen	
Kerosene	107 (41.6)
Coal	22 (8.6)
LPG gas	128 (49.8)
Personal hygiene	
Hand washing with soap before having food (Yes)	103 (40.1)
Hand washing with soap after defecation (Yes)	227 (100)
Cutting nail regularly (Yes)	147 (57.2)
Feeding practices	
Prelacteal feeding (Yes)	56 (21.8)
Early initiation of breast feeding (No)	89 (34.6)
Exclusive breast feeding (No)	115 (44.7)
Health services	
Deworming (No)	114 (44.4)
Immunization status (Irregular)	56 (21.8)
H/O worm expulsion (Yes)	109 (42.4)
Illness in past 15 days (Yes)	127 (49.4)

Table 3: Distribution of study participants according to their Household food insecurity and Nutritional status (*n*=257)

	n (%)
Nutritional status	
Underweight	77 (29.9)
Wasting	46 (17.8)
Stunting	70 (27.2)
Household Food Insecurity status	
Food secure	71 (27.6)
Mild food insecure	109 (42.4)
Moderate food insecure	58 (22.6)
Severe food insecure	19 (7.4)

rural area.[15] Studies from Tamil Nadu, rural Bangladesh, Nepal, and Ghana showed 52.7%, 43%, 69%, and 54%, respectively, of households' food insecure which is less when compared with the present study.[16-19] The differences in proportion are due to the scale used and the criteria kept classifying various degrees of severity of food security. Another study in Ethiopia found a near similar prevalence of HFI (75.8%), most of the African countries suffer from severe FI because of their poor socioeconomic condition and poor agricultural resources.[9] Different parts of

the country may have varying geography, annual rainfall, and farmland size, so that they may have different amounts and types of food production consequently; they will have a different extent of FI. This implies that area-specific surveys are better to understand the real situation.[9]

Prevalence of malnutrition

In the current study, the prevalence of underweight, wasting, and stunting among children of age 6–59 months were 29.9%, 17.8%, and 27.2%, respectively, which is less than the National Family Health Survey (NFHS)-4 WB (2015–2016) data: underweight (31.6%), wasted (20.3%), and stunted (32.5%). Another study in west Bengal slums found similar results: 35.3% had a single anthropometric failure and 25.5% had multiple anthropometric failures.[13] A study in rural Bangladesh (underweight – 37.7%; wasting – 18.2%; and stunting – 36.8%), a national survey of Bangladesh (underweight – 35.7%, wasting – 16.3% and stunting – 40.2%) and Nepal (24%, 9%, and 41%) showed higher prevalence than the present study because of its poor socio-economic condition.[17,18,20] The current study findings consistent with the study done in Ghana[19] and study in Ethiopia (26.3% underweight, 14.6% wasting, and 45.6% stunting) showed higher prevalence as the latter was done in African countries where the quality of life is even poor than our underserved population of India.[9] A multi-centric survey of eight countries showed 42% (ranging from 8% to 55%) of children were stunted, and 6% (range from 0% to 17%) were wasted and stunting in India (30%) and Brazil (35%) were shifted toward the highest values which is similar with the present study as most of them were Low Middle-Income Countries.[21]

Food insecurity and malnutrition

Food insecurity (FI) leads to inadequate dietary diversity which ends up in lower nutrient intakes and could also lead to compromised immune system functions which lead to infection–malnutrition cycle.[21] A study in Kolkata stated that the HHFS was found to have a dose-response relationship with grades of anthropometric failure of under-five children.[13] The present study showed that the presence of FI is associated with stunting supported by other studies in rural Bangladesh, Ghana, and Ethiopia.[9,17,19] In a study done in Iran children living in food-insecure with severe hunger households were 10.13, 10.07, and 4.54 times as likely to be underweight, stunted, and thin, respectively.[22] After controlling for other children, maternal and household characteristics, food security is no longer statistically associated with wasting or being underweight consistent with other studies.[18,23]

In a multi-centric project done in Bangladesh, Ethiopia, and Vietnam, they find that HFI is indeed an important predictor of undernutrition in univariate logistic regression similar to the present study. However, when they control for all other explanatory variables, HFI is not statistically significant in predicting wasting. In the case of stunting and underweight,

Table 4: Relationship between household food insecurity and various factors with nutritional status (*n*=257)			
Variables	Under weight, OR (95% CI); *P*	Wasting, OR (95% CI); *P*	Stunting, OR (95% CI); *P*
Age of child (>24 m)	1.3 (0.7-2.3); 0.25	0.6 (0.3-1.2); 0.21	0.7 (0.4-1.3); 0.36
Gender (female)	1.1 (0.6-1.9); 0.6	1.7 (0.8-3.4); 0.1	0.8 (0.5-1.5); 0.67
Education of mother (upto primary)	**3 (1.9-6); 0.001**	**3.2 (1.6-6.2); 0.001**	**22 (10-40); 0.001**
Working mother	1.1 (.5-1.9); 0.82	0.4 (0.1-1); 0.06	1.1 (0.6-2.4); 0.605
Socio economic status (<median PCI)	**2.8 (1.6-4.8); 0.001**	**2.6 (1.3-5); 0.005**	**11.6 (5.6-23.7); 0.001**
Type of house (Kutcha)	**5.4 (3-9.7); 0.001**	**6.4 (3-13); 0.001**	**18 (8.9-40); 0.001**
Latrine (Community latrine)	**2.8 (1.2-4.2); 0.006**	2 (0.9-4.2); 0.06	**11.5 (4.4-29.9); 0.001**
Stool disposal (unhygenic)	**3.8 (2.2-6.7); 0.001**	**2.9 (1.5-5.6); 0.001**	**14 (7.4-29); 0.001**
Fuel used for cooking (Non LPG)	**1.9 (1.1-3.5); 0.04**	**2.7 (1.1-6.3); 0.02**	**2.8 (1.4-5.8); 0.004**
Birth weight (<2.5 kg)	**2.4 (1.4-4.6); 0.002**	**2.6 (1.3-5.1); 0.004**	**3.7 (2-6.6); 0.001**
Personal hygiene (Unsatisfactory)	**2 (1.1-3.4); 0.01**	**1.9 (1.1-3.8); 0.04**	**4.1 (2.2-7.7); 0.001**
Feeding practice (Unsatisfactory)	**3.3 (1.9-5.9); 0.001**	**2.9 (1.4-5.8); 0.002**	**15.8 (7-34.6); 0.001**
Immunization (irregular)	1.7 (0.9-3.1); 0.08	**2.2 (1.1-4.5); 0.02**	**3.7 (2-7); 0.001**
ICDS (not attending)	**3.4 (1.9-6); 0.001**	**2.7 (1.4-5.2); 0.001**	**6 (3.3-11); 0.001**
De-worming (not done)	1.1 (0.6-1.9); 0.6	1.1 (0.6-2.2); 0.6	1.2 (0.7-2.1); 0.4
Diseased within last 15 days (YES)	**2.3 (1.3-4.1); 0.002**	**2.7 (1.4-5.2); 0.001**	**4.8 (2.6-8.7); 0.001**
Food insecure household	1.4 (0.7-2.5); 0.257	**2.4 (1.2-4.6); 0.009**	**3.8 (2.1-6.9); 0.001**
		AOR: 1.7 (0.7-4.1); 0.06	**AOR: 2.4 (1.2-6.1); 0.004**

AOR=Adjusted Odds Ratio (Multivariable logistic regression); CI=Confidence Interval; OR=Odd's Ratio; Bold values indicate statistical significance. (p<0.05)

the results were mixed as HFI is not unequivocally an important predictor of either outcome.[24] Ample studies showed a positive association between FI and stunting, whereas only four studies reported a positive association between FI and child wasting, mostly in LMICs.[25,20,21,26,27]

Various studies emphasize the need for improving household socioeconomic factors and household food security status for improving dietary diversity practices and nutrition of children.[17] Initiation and expansion of new social safety net programs such as cash transfer, food transfer, and other income-generating programs can empower people and ensure household food security status which in turn will help in curbing malnutrition.[28,29]

The lack of a validated scale in our country setting makes the measurement of HFI imprecise. Although, India being a signatory to report progress on the agreed indicators of the Sustainable Development Goals (SDGs). SDG Indicator 2.1.2, that is, the prevalence of moderate or severe FI in the population, FI was not routinely included in large-scale demographic Indian surveys. The National Sample Survey Organization survey includes only one question on daily access to food, which is inadequate to capture the intensity of HFI and the NFHS measures diet diversity but not HFI experiences. Hence, Food Insecurity Experience Scale used for SDG reporting should be included in national surveys and invests in contextualizing and harmonizing the HFI scale questions and support decision making.[7]

Limitation

The cross-sectional nature of the data also limits our ability to draw any causal conclusions; so longitudinal micro-level data from large-scale surveys can help establish causal association and capture the dynamic nature of FI.

Conclusion and Implications

The prevalence of FI was found to be 72.4% and the proportion of underweight, wasting, and stunting among under-five children was found to be 29.9%, 17.8%, and 27.2%, respectively. FI remains a predictor of nutritional status (wasting and stunting) highlighting the need for multisectoral strategies and policies to combat FI and multiple forms of malnutrition.

The government of India has adopted a range of policies to strengthen food security such as the government-controlled Public Distribution System which is further backed up by the National Food Security Act (NFSA), 2013. Various schemes to enhance agricultural production and sales through the National Food Security Mission and nutritional interventions for women and children via integrated child development schemes and mid-day meal schemes play a pivotal role. Identification of bottlenecks at every level of implementation of these strategies will reduce the inequalities and lay the foundation for sustainable growth.

Declaration of patient consent

The authors certify that they have obtained all appropriate patient consent forms. In the form, the patient(s) has/have given his/her/their consent for his/her/their images and other clinical information to be reported in the journal. The patients understand that their names and initials will not be published and due efforts will be made to conceal their identity, but anonymity cannot be guaranteed.

Financial support and sponsorship

Conflicts of interest

There are no conflicts of interest.

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