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

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.” Household food insecurity (HFI) has been associated with several health and nutrition outcomes, in both

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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. FI may also affect nutritional status through parental stress and depression which affects infant feeding.

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. The relative importance of each of the known risk factors of malnutrition including HFI is likely to vary between settings.

HFI is one of the key determinants of chronic undernutrition in Indian children, particularly for those living in income-insecure environments. 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. The State of Food Insecurity in the World (2012) estimates that India is home to more than 217 million undernourished people.

Children are most in danger because they are more susceptible to adverse environments and dietary changes can affect them on a large scale. 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.

Material 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% using the formula $\frac{\frac{p}{n}}{\frac{1}{2}} - P$, where $p$ is the prevalence of stunting and $n$ is the sample size. 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. 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 questionnaires were 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 R² = 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.[13]

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.[19] 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)               | 1 (0.4)          |
| 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                |
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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)

| Nutritional status               | n (%)  |
|----------------------------------|--------|
| 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)   |

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. 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. The current study findings consistent with the study done in Ghana 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. 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.

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. 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. The present study showed that the presence of FI is associated with stunting supported by other studies in rural Bangladesh, Ghana, and Ethiopia. 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. 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.

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,
the results were mixed as HFI is not unequivocally an important predictor of either outcome.\textsuperscript{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.\textsuperscript{25,26,27}

Various studies emphasize the need for improving household socioeconomic factors and household food security status for improving dietary diversity practices and nutrition of children.\textsuperscript{17,3} 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.\textsuperscript{2,21}

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.\textsuperscript{7}

**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.

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**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.

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**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 (0.5-1.9); 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 (Kutchha)          | 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         | 2.9 (1.5-5.6); 0.001   | 14 (7-29); 0.001         |
| Stool disposal (unhygienic)      | 3.8 (2.2-6.7); 0.001         | 2.7 (1.1-6.3); 0.02    | 2.8 (1.4-5.8); 0.004     |
| Fuel used for cooking (Non LPG)  | 1.9 (1.1-3.5); 0.04          | 2.6 (1.3-5.1); 0.004   | 3.7 (2-6); 0.001         |
| Birth weight (<2.5 kg)           | 2.4 (1.4-4.6); 0.002         | 1.9 (1.1-3.8); 0.04    | 4.1 (2.2-7.7); 0.001     |
| Personal hygiene (Unsatisfactory)| 3.3 (1.9-5.9); 0.001         | 2.9 (1.4-5.8); 0.002   | 15.8 (7-34.6); 0.001     |
| Fuel used for cooking (Non LPG)  | 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       |
| Deseased 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); 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     |
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Conflicts of interest

There are no conflicts of interest.

References

1. Food and Agriculture Organization. Rome declaration on world food security, World Food Summit. Italy 13-17 November 1996. Available from: http://www.fao.org/docrep/003/w3613e/w3613e00.htm. [Last accessed on 2018 Nov 12].
2. Radimer KL, Olson CM, Campbell CC. Development of indicators to assess hunger. J Nutr 1990;120:1544-8.
3. Bronte-Tinkew J, Zaslav M, Capps R, Horowitz A, McNamara M. Food insecurity works through depression, parenting, and infant feeding to influence overweight and health in toddlers. J Nutr 2007;137:2160-5.
4. Rasheed S, Haider R, Hassan N, Pachón H, Islam S, Jalal CS, et al. Why does nutrition deteriorate rapidly among children under 2 years of age? Using qualitative methods to understand community perspectives on complementary feeding practices in Bangladesh. Food Nutr Bull 2011;32:192–200.
5. Swaminathan S, Hemalatha R, Pandey A, Kassebaum NJ, Laxmaiah A, Longvah T, et al. The burden of child and maternal malnutrition and trends in its indicators in the states of India: The Global Burden of Disease Study 1990–2017. Lancet Child Adolesc Health 2019;3:855-70.
6. Sethi V, Maitra C, Avula R, Unisa S, Bhalla S. Internal validity and reliability of experience-based household food insecurity scales in Indian settings. Agric Food Secur 2017;6:21.
7. George NA, McKay FH. The public distribution system and food security in India. Int J Environ Res Public Health 2019;16:3221.
8. Kumar R, Bagaria N, Santra S. Food security: Status and concerns of India. The International Journal of Humanities and Social Studies 2014;2:108-16.
9. Betebo B, Ejato T, Alemseged F, Massa D. Household food insecurity and its association with nutritional status of children 6-59 months of age in east Badawacho District, south Ethiopia, J Environ Public Health 2017;2017:6373595.
10. International Institute for Population Sciences. State Fact Sheet West Bengal. In: National Family Health Survey – 4 (2015-2016). Available from: http://rchips.org/NFHS/pdf/NFHS4/WB_FactSheet.pdf. [Last accessed on 2018 Jan 24].
11. Coates J, Swindale A, Bilinsky P. Household Food Insecurity Access Scale (HFIAS) for measurement of food access: Indicator guide V 3. Food and Nutrition Technical Assistance Project (FANTA). Washington, DC: FANTA; 2007.
12. Candel JJ. Food security governance: A systematic literature review. Food Secur 2014;6:585–601.
13. Mitra S, Mukhopadhyay DK, Sarkar AP, Saha I. Are household food security, nutrient adequacy, and childhood nutrition clustered together? A cross-sectional study in Bankura, West Bengal. Indian J Public Health 2019;63:203-8.
14. Mukhopadhyay DK, Mukhopadhyay S, Biswas AB. Enduring starvation in silent population: A study on prevalence and factors contributing to household food security in the tribal population in Bankura, West Bengal. Indian J Public Health 2010;54:92-7.
15. Jacob AM, Rajaram D, Manjunath B, Kunnaril R. Assessment of food insecurity and its correlates in a rural community of Karnataka: A case study. Int J Community Med Public Health 2018;5:4896-900.
16. Chaudhuri S, Mohan VR. Household food security in rural Tamil Nadu: A survey from Kaniyambadi block, Vellore district. Int J Community Med Public Health 2019;6:3928.
17. Ali NB, Tahsina T, Hoque DME, Hasan MM, Iqbal A, Huda TM, et al. Association of food security and other socio-economic factors with dietary diversity and nutritional statuses of children aged 6-59 months in rural Bangladesh. PLoS One 2019;14:e0221929. doi: 10.1371/journal.pone.0221929.
18. Osei A, Pandey P, Spiro D, Nielson J, Shrestha R, Talukder Z, et al. Household food insecurity and nutritional status of children aged 6 to 23 months in Kailali District of Nepal. Food Nutr Bull 2010;31:483-94.
19. Saaka M, Osman SM. Does household food insecurity affect the nutritional status of preschool children aged 6-36 months? International Journal of Population Research 2013;2013:12.
20. Hasan MM, Ahmed S, Chowdhury MA. Food insecurity and child undernutrition: Evidence from BDHS 2011. J Food Secur 2013;1:52-7.
21. Psaki S, Bhutta ZA, Ahmed T, Ahmed S, Bessong P, Islam M, et al. Household food access and child malnutrition: Results from the eight-country MAL-ED study. Popul Health Metr 2012;10:24.
22. Shahraki SH, Amirkhiz F, Amirkhiz B, Hamedi S. Household food insecurity is associated with nutritional status among Iranian children. Ecol Food Nutr 2016;55:473-90.
23. Chandrasekhar S, Aguayo VM, Krishna V, Nair R. Household food insecurity and children’s dietary diversity and nutrition in India. Evidence from the comprehensive nutrition survey in Maharashtra. Matern Child Nutr 2017;13(52):12447.
24. Ali D, Saha KK, Nguyen PH, Diressie MT, Ruel MT, Menon P, et al. Household food insecurity is associated with higher child undernutrition in Bangladesh, Ethiopia, and Vietnam, but the effect is not mediated by child dietary diversity. J Nutr 2013;143:2015-21.
25. Maitra C. A review of studies examining the link between food insecurity and malnutrition. Technical Paper. Food and Agriculture Organization of the United Nations; 2018. Available from: http://www.fao.org/3/CA1447EN/CA1447EN.pdf. [Last accessed on 2019 Mar 01].
26. Humphries DL, Dearden KA, Crockton BT, Fernald LC, Stein AD, Woldehanna T, et al. Cross-sectional and longitudinal associations between household food security and child anthropometry at ages 5 and 8 years in Ethiopia, India, Peru, and Vietnam. J Nutr 2015;145:1924-33.
27. Ajao KO, Ojoifeitimi EO, Adebayo AA, Fatusi AO, Afolabi OT. Influence of family size, household food security status, and child care practices on the nutritional status of under-five children in Ille-Ife, Nigeria. Afr J Reprod Health 2010;14:117-26.
28. Renzaho AMN, Chitekwe S, Chen W, Rijal S, Dhakal T, Dahal P. The synergetic effect of cash transfers for families, child sensitive social protection programs, and capacity building for effective social protection on children’s nutritional status in Nepal. Int J Environ Res Public Health 2017;14:1502.
29. Uraguchi ZB. Rural income transfer programs and rural household food security in Ethiopia. J Asian Afr Stud 2012;47:33–51.