

Household-level food insecurity and its correlates in rural Bihar: A cross-sectional study

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ABSTRACT

Introduction: Bihar has experienced high nutritional public health problem among children and women over the years. In this background, this study was planned to find the level of food insecurity and identify contributing factors in rural Bihar. **Material and Methods:** We conducted community-based cross-sectional study among 255 families residing in villages catered by RHTC, Naubatpur. A pretested semi-structured interview schedule and HFIAS were used. **Result:** A total of 27.8% of the 255 households were food insecure, of which 73.3% were severely food insecure. Kutcha houses, dispossession of agricultural land, and lower SES were found to be predictors. **Conclusion:** Around one in three families experienced food insecurity, and it was more among families residing in kutcha houses, without possession of agricultural land and belonging to lower socioeconomic status.

Keywords: Bihar, food insecurity, HFIAS, public distribution system, rural households

Introduction

Food insecurity is the inability/limited ability of a person/household to get physical and economic access to safe and healthy food. According to Food and Agriculture Association, food security is defined as “a situation when all people, at all times, have physical, social, and economic access to sufficient, safe, and nutritious food that meets their dietary needs and food preferences for an active and healthy life.”^[1]

Exponential population growth has always been the root cause of serious public health issues.^[2] Food insecurity is one among the several serious public health issues especially in sub-Saharan Africa and South Asia region. Moreover, it is more evident

in countries with high poverty, diseases, and death rates.^[3,4] Undernourishment is an indicator of hunger and food insecurity and includes underweight, stunting, and wasting.^[5] India is the second most populous country in the world with 1.35 billion people. According to NFHS-5, about 36% and 32% of under five children are stunted or underweight. India ranked 94th among 107 countries based on Global Hunger Index 2020 and placed in serious category of GHI severity scale.^[6]

Undernourished individuals face several health problems both physical and mental. Undernourishment leads to poor productivity among the adult population. It increases the risk of maternal as well as neonatal death. The underweight baby borne to an undernourished mother is prone to various infections and even death. Underweight children fall prey to several infections and their mental and social development is hampered. Undernourished children have poor intelligence and poor school performance.^[7,8] Food insecurity also affects the family as a whole. It leads to poor psychosocial development of children, disharmony among family members, and poor family

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environment for the overall health of the family members.^[9-12] Hence, it is important for primary care physicians to know about household-level food insecurity to tackle the problem of undernourishment.

The Govt. of India has initiated a variety of policies expected to have direct and indirect impacts on food insecurity, thereby improving the nutrition status. Direct interventions include: subsidized food items under the public distribution system (PDS), integrated child development services, and mid-day meals to school students, whereas the Mahatma Gandhi National Rural Employment Guarantee Act (MGNREGA) is an indirect intervention intended to alleviate food insecurity by increasing the income level of poor households. Despite these interventions, the decline rate of malnutrition is very low.^[13]

Bihar is one of the most populous states in India. The per capita developmental expenditure in Bihar is half of the National average. About 2,00,74,242 households live below the poverty line in Bihar.^[14] As per the NFHS-5 report, there is a high prevalence of stunting (44%) and underweight (42%) among under five in rural Bihar. About 27% of adult rural females are underweight. Similarly, IMR (32 SRS 2018 AND 47 NFHS-5) and MMR (149 per 1 lakh live births, SRS 2018) in Bihar are among the highest in India. This IMR (low birth weight, underweight) and MMR (anemia) are related to poor nutrition, plausibly indicating toward food insecurity.

In this background, the current study was planned to find the household level of food insecurity and identify contributing factors in rural Bihar as this type of study has not yet been done.

Materials and Methods

Study design and study setting

A community-based cross-sectional study was conducted during the months of September to November 2021 in the rural field practice area of AIIMS, Patna.

Study population

All residents permanently residing in the twelve villages were eligible to participate in the study. Adult family members who were the decision makers on rationing or cooking food in the house for more than 5 days a week and belonging to that family were included as the study participants.

Sample size and sampling method

Considering the prevalence of food insecurity as 31.7% at the household level, with a 95% confidence interval, 6% of absolute precision, and 10% of nonresponse rate, the sample size was calculated to be 255.^[12]

Villages coming within 3 kilometers of the Rural Health and Training Center (RHTC) of AIIMS Patna, Naubatpur, were considered for convenience. A total of 12 villages are there

within 3 kilometers of RHTC, Naubatpur. Since a number of families are almost equal in these villages, 21–22 families were selected randomly using systematic random sampling from each of these villages. If the respondent in the selected household was not available on the day of the visit, they were visited on the next day. In case the respondent was not available or household was locked even on the second visit or if there is a refusal for participation, the next household was selected.

Study tools and variables

A face-to-face interview was conducted using a structured semi-structured questionnaire, which had three sections. The first section comprised the sociodemographic details, including details about the agricultural land owned, if any. The Modified BG Prasad Scale 2021 was used to classify the families into five socioeconomic statuses (SES).^[15]

The second part of the questionnaire was used for assessing food insecurity. The Household Food Insecurity Access Scale (HFIAS), which is an adaptation of the approach used in estimating the prevalence of food insecurity in the United States (USA), was used in the present study.^[16] The method is based on the idea that the experience of food insecurity (access) causes predictable reactions and responses that can be captured and quantified through a survey and summarized in a scale. This tool is validated in India and has been used among the Indian population by earlier studies.^[12] The HFIAS prevalence indicator categorizes households into four levels of household food insecurity (access): food secure, mildly, moderately, and severely food insecure. Households were categorized as increasingly food insecure as these responded affirmatively to more severe conditions and/or had experienced those conditions more frequently. The questions contained in the Household Food Insecurity Access Scale (HFIAS) were asked with a recall period of four weeks (30 days). The respondent was first asked an occurrence question, i.e., whether the condition in the question happened at all in the past four weeks (with the provision of “yes” or “no” response). If the respondent answered “yes” to an occurrence question, a frequency-of-occurrence question was asked to determine whether the condition happened rarely (once or twice), sometimes (three to 10 times), or often (more than 10 times) in the past four weeks. The responses on the nine items having three important dimensions mainly anxiety and uncertainty (question 1), insufficient quality (questions 2–4), and insufficient food intake and its physical consequences (questions 5–9). The households with minimum score food access insecurity score 0 were considered most food access secure and households with a maximum score of 27 were considered most food access insecure households.

Operational definitions

- Food secure: Household encountering only worriedness, that too rarely, for not having enough food^[16]
- Mildly food insecure: Worrying sometimes or often for not having sufficient food, and/or being unable to eat favored

kinds of meals, and/or ate rarely dull monotonous categories of food (e.g., wheat porridge) or those that were disliked^[16]

- Moderately food insecure: Consumed sometimes or often dull monotonous categories of food or those that were disliked, and/or rarely or sometimes fed lesser quantity or frequency of meals^[16]
- Severely food insecure: Often fed lesser quantity or frequency of meals, and/or even once if food got exhausted or slept starving or hungry throughout the whole day and night^[16]

Details were collected regarding the benefits of the Public Distribution System (PDS) and other public food security programs (Antyodaya Anna Yojana, Annapurna Scheme, Mid-Day Meal Scheme, or Anganwadi Services). The third part contains information on anthropometric measurements (Height and weight) of family members and signs of Vit A deficiency (xerophthalmia) and iron deficiency (pallor) among children in the family. It was translated into the vernacular language (Hindi) and was cross-checked by back translating to English. It was pretested in a sample of the residents and modified.

Ethical approval

This study was approved by Institute Ethics Committee, All India Institute of Medical Sciences, Patna (AIIMS/Pat/IEC/2021/654).

Data collection

The interns posted in the Department of Community and Family Medicine during the study period were trained on the study tool and data collection process. If any house had more than one participant qualified to be a subject for the study, then one of the participants was selected using a lottery method. The data collection process was done under the supervision of senior residents of the Department of Community and Family Medicine who were also the co-investigators in the project.

Statistical analysis

The information collected was entered in MS Excel and analysis was done using SPSS version 20. The strength of the association of food insecurity with independent categorical variables was expressed using the odds ratio with a 95% confidence interval. Multiple logistic regression model was used to identify the factors associated with food insecurity. The independent variables with $P < 0.02$ were included in the model. The adjusted odds ratio with a 95% confidence interval was calculated. $P < 0.05$ was considered statistically significant.

Results

Sociodemographic profile

A total of 255 families were enrolled in the study. The median family size was 5 (Interquartile range 4–7). The median household income was Rs. 8000 (IQR 5000–16000). Male-to-female ratio in the households was 1.3:1. Among 255 families, children <13 years

comprised 56.1%, pregnant/lactating mothers comprised 6.7%, and an elderly population comprised 49.4%. Out of the total households, 79.6% possessed ration cards. Nearly 50% of the households had agricultural land ownership. In spite of such a high proportion of households having ration cards, still around 32% were not regularly availing service of the Public Food Distribution System (PDS). The main reason for this was the insufficient quantity given and poor quality of grains provided to them as ration. Only 1.2% of the households availed other food scheme benefits [Table 1]. With the median family income per month being Rs. 8000 (IQR 5000–16000), the median amount of money spent per month on health was Rs. 1000 (IQR 500–2000) and on food was Rs. 3000 (IQR 2000–6000).

Food consumption pattern

Cereals, roots and tubers, and vegetables are consumed by households every day. The median consumption of fruits, meat/poultry, eggs, and fish is less than 2 days in a week. The consumption of milk and dairy products, pulses & legumes, and fat-rich food items are highly variable [Figure 1].

Prevalence of food insecurity

Based on the responses received by the HFIAS questionnaire, the prevalence of food insecurity was found to be 27.8% (95% CI: 22.7–33.6) [Figure 2]. Out of 71 households with food insecurity, 52 (73.3%), 18 (25.3%), and 1 (1.4%) had severe, moderate, and mild food insecurity, respectively. The responses of the items of HFIAS are shown in Figure 3.

Determinants of food insecurity

In bivariate analysis, significant differences between no-mild food insecurity v/s moderate–severe food insecurity were observed by being of female gender [COR: 2.364 (1.29–4.32)], illiteracy level of the respondent [COR: 6.12 (2.66–14.07)], residing in kutchha houses [COR: 5.92 (1.5–23.41)], not possessing

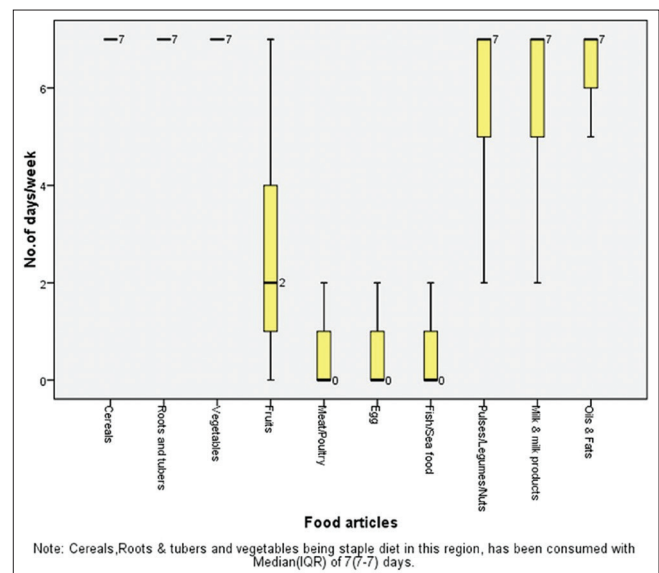


Figure 1: Box whisker plot showing types of food articles consumed in a week

Table 1: Sociodemographic details of participants (n=255)

| Sociodemographic variables | Category | n (%) |
|---|--|-------------------|
| Age (in completed years) | Mean (SD) | 48.01 (14.7) |
| Gender (respondent) | Male | 192 (75.3) |
| | Female | 63 (24.7) |
| Education | Illiterate | 73 (28.6) |
| | Up to 10 th class | 93 (36.5) |
| | 10 th class and above | 85 (34.9) |
| Occupation | Unemployed | 79 (31) |
| | Unskilled & semiskilled worker | 7 (2.7) |
| | Clerical/shop/farm, semi-professional and professional | 169 (66.3) |
| Type of family | Nuclear | 127 (49.8) |
| | Extended family | 128 (50.2) |
| House | Own | 254 (99.6) |
| | Rented | 1 (0.4) |
| Type of house | Kuccha | 13 (5.1) |
| | Pucca | 167 (65.5) |
| | Semi pucca | 75 (29.4) |
| Total no. of family members | Median (Range) | 5 (4–7) |
| Male/female ratio | 1.3:1 | |
| Presence of vulnerable population | Children <13yrs | 143 (56.1) |
| | Pregnant/lactating mothers | 17 (6.7) |
| | Elderly | 108 (42.4) |
| Own agricultural land | No | 126 (49.4) |
| | Yes | 129 (50.6) |
| Ration card | Doesn't possess | 52 (20.4) |
| | Present [#] | 203 (79.6) |
| Availing PDS services | No* | 82 (32.2) |
| | Yes | 173 (67.8) |
| Getting food grains from any other schemes | No | 252 (98.8) |
| | Yes | 3 (1.2) |
| Enrolment in Anganwadi | Children | 77 (30.2) |
| | Lactating mother | 8 (3.1) |
| | ANC Mother | 6 (2.4) |
| Total family income per month (INR) | Median (IQR) | 8000 (5000–16000) |
| Socioeconomic class (Modified BG Prasad classification) | Lower | 42 (16.5) |
| | Middle | 47 (18.4) |
| | Upper | 166 (65.1) |

*Includes households not possessing ration card. [#]includes red/blue/yellow/white ration cards issued by Govt. of Bihar¹⁹

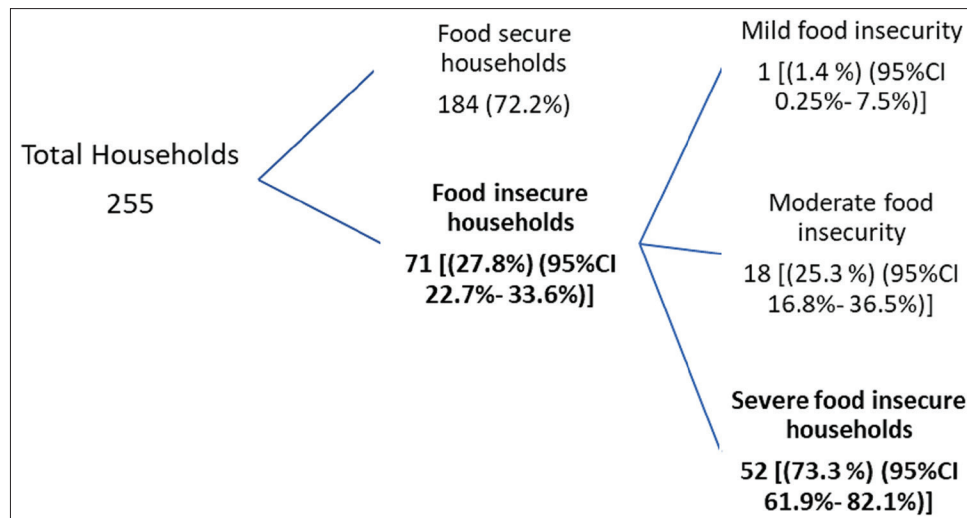


Figure 2: Prevalence of household food insecurity

agricultural land [COR: 4.78 (2.52–8.89)] and belonging to lower socioeconomic class [COR: 4.08 (1.52–10.94)]. As nourishment of the under-5 child (in terms of MAC) improves, there is a 41% reduction of the household going toward moderate–severe food insecurity [COR: 0.59 (0.36–0.96)] [Table 2].

The distribution of symptoms and signs of malnutrition of vulnerable population with respect to food insecurity is shown in Table 3.

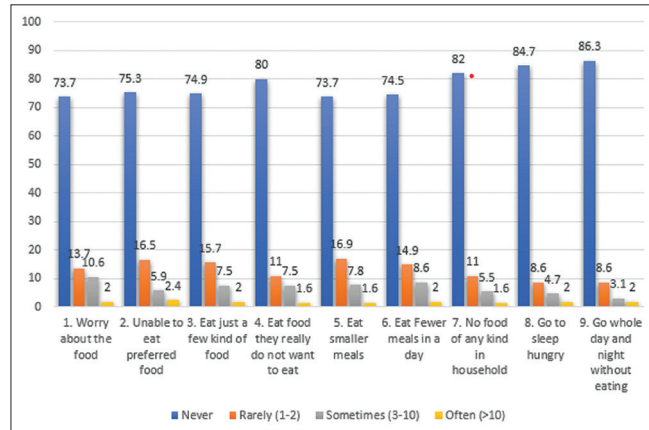


Figure 3: Clustered bar diagram showing the items of HFIAS

Discussion

The prevalence of food insecurity at the household level in a rural population of eastern India was found to be 27.8% (95%CI: 22.7–33.6). A study done by Joshi et al in India’s un-notified slums showed a higher prevalence of household food insecurity (43%).^[17] A much higher proportion of food insecurity was noticed in studies by Gopichandran V *et al.* in urban Tamil Nadu (74.6.2%) and by Jacob AM *et al.* in a rural community of Karnataka (80.8%).^[18,19] Other studies done in rural American Indian reservation also showed almost 40% of families experiencing food insecurity.^[20] However, higher levels of severe food insecurity were seen in the present study 73.3% compared to 9.2% in the urban resettlement colony of South Delhi which could be attributed to the differences in determinants of food security in urban and rural areas.^[10] Heterogeneity in food security prevalence at the regional level may partly explain the discrepancy. Intervention focusing on food insecurity needs to be region specific and tailored accordingly. Correlates of food insecurity identified in our study were consistent with existing literature—showing that being female, having less than a high school education, and having large family sizes were predictors of food insecurity.^[21,22] Around 50% of the households in our study setting owned agricultural lands and 68% availed PDS

Table 2: Correlates of household food insecurity (n=255)

| Factors | Categories (n) | No/Mild Food insecurity (185) (%) | Moderate–severe food insecurity (70) (%) | Crude odds ratio (95% CI) |
|--|--|-----------------------------------|--|---------------------------|
| Gender (respondent)* | Male (63) | 148 (77.1) | 44 (22.9) | 1 |
| | Female (192) | 37 (58.7) | 26 (41.3) | 2.364 (1.29–4.32) |
| Education* | Illiterate (73) | 43 (58.9) | 30 (41.1) | 6.124 (2.66–14.078) |
| | Up to 10th class (93) | 62 (66.7) | 31 (33.3) | 4.389 (1.94–9.89) |
| Occupation | 10th class and above (88) | 79 (89.8) | 9 (10.2) | 1 |
| | Unemployed (79) | 58 (73.4) | 21 (26.6) | 0.94 (0.5–1.71) |
| Type of family | Unskilled & semiskilled worker (7) | 5 (71.4) | 2 (28.6) | 1.038 (0.195–5.5) |
| | Clerical/shop/farm, semi-professional and professional (169) | 122 (72.2) | 47 (27.8) | 1 |
| Type of house* | Nuclear (127) | 90 (70.9) | 37 (29.1) | 1.184 (0.68–2.05) |
| | Extended family (128) | 95 (74.2) | 33 (25.8) | 1 |
| Total family members | Kutcha (13) | 3 (23.1) | 10 (76.9) | 5.926 (1.5–23.41) |
| | Pucca (167) | 134 (80.2) | 33 (19.8) | 0.438 (0.24–0.81) |
| | Semi-pucca (75) | 48 (64) | 27 (36) | 1 |
| Presence of vulnerable groups | Median (IQR) | 5 (4–7) | 5.5 (4–7) | 1.05 (0.95–1.15) |
| | No (63) | 50 (79.4) | 13 (20.6) | 1 |
| Own agricultural land* | Yes (192) | 135 (70.3) | 57 (29.7) | 1.624 (0.819–3.219) |
| | No (126) | 73 (57.9) | 53 (42.1) | 4.78 (2.52–8.89) |
| Ration card | Yes (129) | 112 (86.8) | 17 (13.2) | 1 |
| | No (52) | 39 (75) | 13 (25) | 1 |
| Availing PDS services | Yes (203) | 146 (71.9) | 57 (28.1) | 1.171 (0.58–2.35) |
| | No (82) | 55 (67.1) | 27 (32.9) | 1.484 (0.835–2.638) |
| Socioeconomic class | Yes (173) | 130 (75.1) | 43 (24.9) | 1 |
| | Lower | 108 (65.1) | 58 (34.9) | 4.08 (1.522–10.943) |
| | Middle | 40 (85.1) | 7 (14.9) | 1.29 (0.378–4.438) |
| Getting food grains from any other Govt. schemes | Upper | 37 (88.1) | 5 (11.9) | 1 |
| | No (252) | 184 (73) | 68 (27) | 1 |
| MAC (cm) of U5 Child* | Yes (3) | 1 (33.3) | 2 (66.7) | 5.412 (0.483–60.64) |
| | Median (IQR) | 14 (13–16) | 13 (12–14) | 0.594 (0.365–0.964) |

*P<0.05 is statistically significant

Table 3: Distribution of symptoms and signs of malnutrition of special groups with classification of food insecurity (n=51)

| Special group | Factors | Categories | n (51) (%) | Food secure (n=31) n (%) | Food insecure (n=20) n (%) |
|------------------|----------------------|-------------------------|--------------|--------------------------|----------------------------|
| Under 5 children | Built | Normal | 48 (94.1) | 31 (64.6) | 17 (35.4) |
| | | Short | 3 (5.9) | 0 | 3 (100) |
| | Appearance | Normal | 48 (94.1) | 31 (64.6) | 17 (35.4) |
| | | Sick | 3 (5.9) | 0 | 3 (100) |
| | Hair | Normal | 44 (86.2) | 28 (63.6) | 16 (36.4) |
| | | Lusterless | 5 (9.8) | 3 (60) | 2 (40) |
| | | Depigmented | 1 (2) | 0 | 1 (100) |
| | | Sparse | 1 (2) | 0 | 1 (100) |
| | Eyes | Normal | 27 (52.9) | 19 (70.4) | 8 (29.6) |
| | | Pallor | 24 (47.1) | 12 (50) | 12 (50) |
| | Tongue | Pale | 22 (43.1) | 14 (63.6) | 8 (36.4) |
| | | Red magenta/Normal | 29 (56.9) | 17 (58.6) | 12 (41.4) |
| | Skin# | Normal | 45 (17.6) | 30 (66.7) | 15 (33.3) |
| | | Wrinkled | 6 (2.4) | 1 (16.7) | 5 (83.3) |
| | Abdomen | Normal | 48 (94.1) | 31 (64.6) | 17 (35.4) |
| | | Distended | 3 (5.9) | 0 | 3 (100) |
| | Leg | No edema | 49 (96.1) | 30 (61.2) | 19 (38.8) |
| | | Edema of dorsum of foot | 2 (3.9) | 1 (50) | 1 (50) |
| | Alertness | Active | 49 (96.1) | 30 (61.2) | 19 (38.8) |
| | | Dull | 2 (3.9) | 1 (50) | 1 (50) |
| | MAC (cm)* | Median (IQR) | 14 (13–14.5) | 14 (13–16) | 13 (12–14) |
| Pregnant mother | Pallor status (n=7) | Absent | 5 (71.4) | 2 (40) | 3 (60) |
| | | Present | 2 (28.6) | 1 (50) | 1 (50) |
| Lactating mother | Pallor status (n=10) | Absent | 5 (50) | 3 (60) | 2 (40) |
| | | Present | 5 (50) | 0 | 5 (100) |

*Statistically significant by Mann-Whitney U test #Statistically significant by Fischer's exact test

benefits which might be the reason for the lesser prevalence of food insecurity found in the current study. They could cultivate vegetables and food grains on their agricultural lands. Many empirical studies have shown severe biases in the inter-regional distributions of the PDS supplies—states with a high incidence of poverty such as Bihar, Orissa, and Madhya Pradesh received a lower share.^[23] Other reasons of less food insecurity in the present study might be that most of them belonged to upper socioeconomic status and the average family size of 5. The present study found that low-socioeconomic status is a significant determinant of food insecurity even after adjusting for other variables in the multivariate logistic regression model which is similar to other studies.^[10,24] Hence, poverty remains the major issue that needs an immediate focus to improve the health of the Indian community.

There are a few strengths to this study. First, a validated and pretested questionnaire was used. Second, the Department of Community and Family Medicine has a strong rapport with the community where the survey was conducted. This gave us good physical access to the area to collect data, which increased the robustness of the data collected. Third, probability sampling was done, so the results can be generalized to the reference population. Fourth, data were collected through face-to-face interviews and there were no missing values among the sample. However, the study had some limitations that suggest its

findings should be interpreted cautiously. First is the ecological fallacy, a household that is food insecure does not imply that all its members are food insecure. Second is that there might be information bias because of the social desirability which was minimized by explaining clearly that the data collected were purely for research purpose. Third, the depth of poverty in the household could not be assessed which might affect the food security status.

Conclusion

Around one in three families experienced food insecurity, and it was more among families residing in kutchha houses, without possession of agricultural land, and those belonging to lower socioeconomic status. Undernourishment particularly among children must be addressed to prevent nutrition-related disorders in the community. Improvement in food consumption is a necessary but not sufficient condition for overcoming the problem of malnutrition in India. Apart from inadequate food consumption, the other important causes of malnutrition are high incidence of gastrointestinal and respiratory infections and behavioral factors such as faulty child feeding and weaning practices, all of which contribute to the low absorption of nutrients from the food consumed. Long-term interventions and multifaceted initiatives are needed to positively impact and prevent food insecurity. Awareness of low-cost nutritious food items

and appropriate cooking methods can be generated and coping strategies adopted by positive deviants during food insecure periods can be promoted. Non-government organizations, Anganwadi workers, and community welfare societies can play pertinent roles in the above-mentioned processes. Re-focusing on PDS should be a priority task. Welfare gains from food subsidy can be substantially enhanced by rationalizing the minimum support prices scheme and improving the targeting efficiency of subsidized food distribution. As dietary diversification is an important aspect of food insecurity, research in production technology of non-cereal food as well as technology access to the poor small producers should be promoted.

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Conflicts of interest

There are no conflicts of interest.

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