International Journal of Medical and Pharmaceutical Research

Online ISSN-2958-3683 | Print ISSN-2958-3675
Frequency: Bi-Monthly
Website: https://ijmpr.in/

Research Article

A Cross-sectional Study on Household Level Food Insecurity and its Determinants in a Rural Area of West Bengal

Dr. Deepumon Rajendran[1], Dr. Sanjoy Kumar Sadhukhan[2], Dr. Jayita Pal[3], Dr. Nandu Krishna[4], Dr. Mousumi Khatun[5], Athira M.P[6]

[1]Junior Resident, Department of Epidemiology, All India Institute of Hygiene and Public Health, Kolkata
[2]Professor & Head, Department of Epidemiology, All India Institute of Hygiene and Public Health, Kolkata
[3]Assistant Professor, Department of Epidemiology, All India Institute of Hygiene and Public Health, Kolkata
[4]Consultant, Department of Preventive and Social Medicine, Jipmer, Puducherry
[5]Junior Resident, Preventive and Social Medicine, All India Institute of Hygiene and Public Health, Kolkata
[6]Research scholar, Department of Economics, Government College Attingal

OPEN ACCESS

Corresponding Author:

Dr. Deepumon Rajendran
Junior Resident, Department of Epidemiology, All India Institute of Hygiene and Public Health, Kolkata.

Received: 15-02-2026
Accepted: 26-03-2026
Published: 16-04-2026

ABSTRACT

Background: Food insecurity remains a major public health challenge in low- and middle-income countries, particularly in rural populations where socioeconomic vulnerabilities and limited access to diverse foods persist. Assessing household food insecurity and dietary diversity is essential to understand its magnitude and determinants. This study aimed to estimate the prevalence of household food insecurity, assess dietary diversity, identify associated factors, and evaluate the nutritional status of family members.

Methods: A community-based cross-sectional study was conducted among 240 households in the rural field practice area of Singur, Hooghly district, West Bengal. A two-stage cluster sampling technique was used. Data were collected through face-to-face interviews using a pretested structured questionnaire. Household food insecurity was assessed using the Household Food Insecurity Access Scale (HFIAS), and dietary diversity was evaluated using the Household Dietary Diversity Score (HDDS). Anthropometric measurements were taken to assess nutritional status. Data were analyzed using appropriate statistical tests and multivariable logistic regression.

Results: The prevalence of food insecurity was 60.0%, with 37.1% mildly, 18.8% moderately, and 4.1% severely food insecure households. Inadequate dietary diversity was observed in 68.3% of households, with a mean HDDS of 6.93 ± 1.71. Diets were predominantly cereal-based, with low consumption of fruits (26%), milk (22%), and eggs (20%). Factors independently associated with food insecurity included larger family size (≥4 members) (AOR = 2.74; 95% CI: 1.01–7.41), lower socioeconomic status (classes IV–V) (AOR = 10.40; 95% CI: 4.20–25.77), BPL card possession (AOR = 2.85; 95% CI: 1.00–8.14), and livestock ownership (AOR = 8.18; 95% CI: 3.40–19.68).

Conclusion: Food insecurity is highly prevalent in the study area and is strongly associated with socioeconomic disadvantage and poor dietary diversity. Strengthening targeted food security interventions, improving access to diverse foods, and addressing underlying economic vulnerabilities are essential to improve household food security and nutritional outcomes.

Keywords*: Food insecurity; Household Food Insecurity Access Scale (HFIAS); Household Dietary Diversity Score (HDDS); Rural health; Socioeconomic determinants; Nutritional status.*

INTRODUCTION

Food security is a fundamental component of public health and human development, defined as a condition in which all individuals have physical, social, and economic access to sufficient, safe, and nutritious food that meets their dietary needs for an active and healthy life [1]. It is a multidimensional concept encompassing availability, accessibility, utilization, and stability of food systems [2]. To assess food insecurity at the household level, standardized tools such as

the Food Insecurity Experience Scale (FIES) and the Household Food Insecurity Access Scale (HFIAS) are widely used, capturing experiences related to uncertainty of food supply, inadequate quality, and insufficient quantity of food [3].

Globally, food insecurity continues to pose a major public health challenge, with an estimated 735 million people experiencing hunger in 2022, and approximately 2.4 billion people facing moderate to severe food insecurity worldwide [4,6]. The burden has been exacerbated by multiple factors including economic instability, climate change, conflicts, and disruptions due to the COVID-19 pandemic. Food insecurity has been shown to have significant health implications, with evidence suggesting a strong association with poor mental health outcomes, including depression and anxiety, as well as increased risk of chronic diseases and impaired child development [5]. The ongoing global food crisis has further intensified inequalities, disproportionately affecting vulnerable populations, particularly in low- and middle-income countries [7].

Recent global estimates indicate that the world is not on track to achieve the Sustainable Development Goal (SDG-2) of zero hunger by 2030, with projections suggesting that nearly 600 million people may remain undernourished by 2030 if current trends continue [8]. The World Food Programme reports that over 345 million people across more than 80 countries are currently facing acute food insecurity, highlighting the urgency of addressing this issue [9]. The United Nations emphasizes that eliminating hunger requires integrated multisectoral strategies addressing poverty, agricultural sustainability, and equitable food distribution systems [10]. The Global Hunger Index categorizes several countries, including India, within the "serious" category of hunger, indicating persistent challenges in achieving food security [11].

In India, food insecurity remains a significant concern, particularly in rural populations where livelihoods are often dependent on agriculture and are susceptible to seasonal variability and economic instability. Systematic reviews have reported considerable heterogeneity in food insecurity prevalence across different regions of India, with estimates ranging from 20% to over 60% in various population groups, influenced by socioeconomic and demographic factors [12]. Data from the National Family Health Survey (NFHS-5, 2019–21) indicate that 35.5% of children under five years are stunted, 19.3% are wasted, and 32.1% are underweight, reflecting underlying issues related to inadequate food access and nutritional deficiencies [13].

Despite the availability of national-level data, there is a need for localized, community-based studies to better understand the extent and determinants of food insecurity at the household level. Rural settings, in particular, may demonstrate unique patterns of food access, dietary diversity, and nutritional status influenced by socioeconomic conditions, cultural practices, and resource availability. Therefore, the present study was undertaken to assess household-level food insecurity, dietary diversity, and associated determinants in a rural area, thereby generating evidence to inform targeted interventions and policy strategies aimed at improving food and nutritional security.

The present study was undertaken in the context of persistent food insecurity in rural populations, where limited resources, socioeconomic inequalities, and dietary inadequacies contribute to poor nutritional outcomes. Although national surveys and existing studies provide valuable insights into food insecurity and nutritional indicators, there remains a significant knowledge gap in context-specific, household-level assessments that simultaneously examine food insecurity, dietary diversity, and nutritional status within the same population, particularly in rural settings of eastern India. Furthermore, limited evidence exists integrating standardized experiential measures such as the Household Food Insecurity Access Scale (HFIAS) with dietary diversity indicators like the Household Dietary Diversity Score (HDDS), along with nutritional assessment, to explore their combined relationship with socioeconomic determinants at the community level. Addressing this gap is essential for generating comprehensive and locally relevant evidence to inform targeted interventions. Therefore, the present study was undertaken with the objectives to estimate the prevalence of household food insecurity using HFIAS, to assess household dietary diversity using HDDS, to identify socio-demographic, economic, and behavioural factors associated with food insecurity, and to evaluate the nutritional status of family members using Body Mass Index (BMI).

METHODS

This community-based observational study with a cross-sectional design was conducted in the rural field practice area of the Rural Health Unit and Training Centre (RHUTC), Singur, Hooghly district, West Bengal, which is affiliated with the All-India Institute of Hygiene and Public Health, Kolkata. The study area comprises 64 villages with an estimated population of 101,180 and approximately 23,595 households. The study was carried out from January 2024 to February 2026, including phases of protocol development, ethical approval, tool pretesting, data collection, analysis, and report writing. Data collection was conducted during the period from Jan 2024 to May 2024.

The study unit was households, and the primary respondent was an adult family member, preferably a female responsible for food preparation and distribution, or alternatively the head of the household. Households where the respondent provided informed consent were included, while those unwilling to participate were excluded.

The sample size was calculated using Cochran's formula for cross-sectional studies ($N = Z^2P(1-P)/L^2$), taking prevalence (P) of household food insecurity as 36% from previous study [14], absolute error (L) as 7.5%, and Z = 1.96 at 5% significance level. After applying a design effect of 1.5 for cluster sampling [15], the final sample size was 240 households. A two-stage cluster sampling technique was employed. In the first stage, 15 villages were selected from 64

villages using probability proportional to size (PPS) sampling based on cumulative population and sampling interval. In the second stage, 16 households from each selected village were chosen by simple random sampling using a random number table. In case of non-response, the next adjacent household was included.

Data were collected through face-to-face interviews using a predesigned, pretested, structured questionnaire that was validated by experts and translated into Bengali with back-translation to ensure accuracy. The tool was pilot-tested in a similar rural area outside the study setting, and necessary modifications were made. Information on sociodemographic characteristics, household food insecurity, dietary diversity, and health indicators was collected.

Household food insecurity was assessed using the Household Food Insecurity Access Scale (HFIAS),[16]which includes nine occurrence questions with frequency-based responses (rarely, sometimes, often) over a recall period of four weeks. Scores range from 0 to 27 and households were categorized as food secure, mildly, moderately, or severely food insecure. Household Dietary Diversity Score (HDDS) [17]was used to assess dietary diversity based on a 24-hour recall of food groups consumed, categorized as adequate (≥7 food groups) or inadequate (<7 food groups).

Anthropometric measurements of all available family members were carried out using standardized procedures. Body weight was measured using a calibrated digital weighing scale, with the mother–child method used for young children. Height was measured using a non-stretchable measuring tape for standing individuals and an infantometer for children below two years. Each measurement was taken twice, and the average was recorded to minimize error. Nutritional status was assessed using Body Mass Index (BMI) as per standard WHO classification.

The primary dependent variable was household food insecurity (dichotomized as food secure and food insecure). Independent variables included sociodemographic factors (age, sex, education, occupation), household characteristics (family size, type of family), socioeconomic status (classified using Modified BG Prasad scale), possession of Below Poverty Line (BPL) card, and livestock ownership.

Operational definitions used in the study included: larger family size defined as ≥4 members; lower socioeconomic status defined as classes IV and V of Modified BG Prasad scale 2025 [18]; livestock ownership defined as possession of any domesticated animals for economic or household use; and adequate dietary diversity defined as consumption of ≥7 food groups in the previous 24 hours.

Data were entered, cleaned, and analysed using Jamovi version 2.6.44. Descriptive statistics were used to summarize the data. Association between categorical variables was assessed using Chi-square test or Fisher's exact test as appropriate. Variables with p-value <0.05 in bivariate analysis were included in multivariable logistic regression to identify independent predictors of food insecurity. Adjusted odds ratios (AOR) with 95% confidence intervals were calculated, and a p-value of <0.05 was considered statistically significant.

Efforts were made to minimize bias. Recall bias was reduced by using a short recall period (24 hours for HDDS and 4 weeks for HFIAS). Interviewer bias was minimized through training of data collectors and use of a standardized questionnaire. Measurement bias was reduced by following standard anthropometric procedures and taking duplicate measurements. Non-response bias was addressed by replacing non-responding households with adjacent households.

Ethical approval was obtained from the Institutional Ethics Committee of the All-India Institute of Hygiene and Public Health, Kolkata **IEC/2014(1)/17,** Written informed consent was obtained from all participants prior to data collection. Confidentiality and anonymity of the participants were strictly maintained throughout the study.

RESULT

The present study included 240 households from a rural area, with the majority of heads of households belonging to the middle and older age groups, and a mean age of 49.6 years. Most households were male-headed, Hindu, and belonged to lower-middle or lower socioeconomic classes. A substantial proportion of households were nuclear in structure, with large family size being common. Educational attainment was generally low to moderate, with most individuals educated up to middle or secondary level. Occupationally, the majority were engaged in semi-skilled or unskilled work. More than half of households possessed BPL cards and a large proportion were beneficiaries of the public distribution system.

Regarding economic and household characteristics, most households owned their homes and agricultural land, and a significant proportion had livestock. However, a high burden of financial strain was evident, as more than two-thirds of households reported being in debt. Around one-third of households had at least one member with morbidity, and nearly half reported addiction among family members, indicating the presence of both health and behavioural risk factors within the community.

Food insecurity was found to be a major concern, affecting majority (60%) of households. Among these, mild food insecurity was the most common, followed by moderate and severe forms. The findings indicate that while severe food deprivation was less frequent, a large proportion of households experienced compromised food access and dietary quality, reflecting a significant public health issue in the study area.

Assessment of dietary diversity revealed that the majority of households had inadequate dietary diversity, with a mean HDDS of 6.93±1.71. Dietary patterns were predominantly cereal-based, with high consumption of staples, roots, tubers,

pulses, and oils, while intake of nutrient-rich foods such as fruits, milk, eggs, and meat was comparatively low. This suggests a risk of micronutrient deficiencies and poor nutritional quality of diets.

Analysis of factors associated with food insecurity showed that joint family structure, larger family size, lower socioeconomic status, BPL card possession, livestock ownership, and household debt were significantly associated with higher levels of food insecurity in bivariate analysis. However, in multivariable logistic regression, large family size, lower socioeconomic status, BPL card possession, and livestock ownership remained independent predictors of food insecurity. Among these, socioeconomic status showed the strongest association, indicating that poverty remains the most critical determinant of household food insecurity.

After the bivariate analysis, multivariable modelling was performed to better understand the independent predictors of household food insecurity. A stepwise modelling approach was adopted to assess the incremental contribution of different groups of variables.

In **Model 1**, which included only sociodemographic variables, the overall model was statistically significant ($\chi^2 = 93.0$, df = 4, $p < 0.001$), indicating that these factors collectively contributed to the prediction of household food insecurity. The model demonstrated moderate explanatory power, as reflected by McFadden pseudo-R^2 of 0.288. Within this model, **lower socio-economic status and larger family size emerged as important predictors**, while family type showed a relatively weaker independent association.

With the inclusion of economic and asset-related variables in **Model 2**, such as household debt and livestock ownership, the overall model fit improved further ($\chi^2 = 122$, df = 6, $p < 0.001$). This improvement was accompanied by an increase in explanatory power (McFadden $R^2 = 0.379$), suggesting that **economic and livelihood-related factors added substantial predictive value beyond basic sociodemographic characteristics**. In this model, **lower socio-economic status and livestock ownership remained significantly associated with food insecurity**, whereas the effect of household debt was attenuated after adjustment, indicating possible confounding effects.

A further, though modest, improvement in model performance was observed in the final **Model 3**, which incorporated all selected variables including household addiction status. The final model remained highly significant ($\chi^2 = 124$, df = 7, $p < 0.001$), with a slight increase in explanatory power (McFadden $R^2 = 0.385$). In this fully adjusted model, **lower socio-economic status and larger family size continued to demonstrate strong independent associations with food insecurity**, reaffirming their central role. **Livestock ownership also remained a significant predictor**, while family type, household debt, and addiction status did not retain statistical significance, suggesting that their effects were largely mediated or confounded by underlying socio-economic and household structural factors.

These findings indicate that while multiple factors contribute to food insecurity at the univariate level, **poverty and household size remain the most robust and consistent determinants**, even after comprehensive adjustment.

Table 1: Socio-demographic characteristics of households (N = 240)

Variable	Category	No. (%)	Descriptive Statistics
Age of Head of Household (years)	<30	23 (9.6)	Mean (SD): 49.6 (11.9) Median (IQR): 50 (41–60) Range: 30–69
	31–45	82 (34.2)	
	46–60	85 (35.4)	
	≥60	50 (20.8)	
Sex	Male	185(77.1)	-
	Female	55 (22.9)	
Religion	Hindu	220(91.7)	-
	Muslim	20 (8.3)	
Caste	General	104(43.3)	-
	Other Backward Classes	58 (24.2)	
	Scheduled Caste	72 (30.0)	
	Scheduled tribe	6 (2.5)	
Highest level of education	Illiterate	24 (10.0)	-
	Primary	37 (15.4)	
	Middle	72 (30.0)	
	Secondary	61 (25.4)	
	Higher Secondary	28 (11.7)	
	Graduate+	18 (7.5)	
Occupation	Skilled	29 (12.0)	-
	Semi-skilled	77 (33.0)	
	Unskilled	53 (22.0)	
	Homemaker	29 (12.0)	
	Unemployed	11 (4.0)	
	Retired	41 (17.0)	

Family Type	Nuclear	167(69.6)	-
	Joint	73 (30.4)	
Family Size	<4	53 (22.1)	Median: 4 (IQR 4–5)
	≥4	187(77.9)	
Socioeconomic Class*	Class I	7 (2.9)	Mean PCI: ₹3113 (SD 2033) Median: ₹2667
	Class II	9 (3.8)	
	Class III	69 (28.7)	
	Class IV	137(57.1)	
	Class V	18 (7.5)	
BPL Card	Yes	141(58.7)	-
	No	99 (41.3)	
PDS Utilization	Yes	193(80.4)	-
	No	47 (19.6)	

*Assessed by Modified BG Prasad Scale 2025 [18]

Table 2: Household economic, health, and behavioralcharacteristics (N = 240)

Variable	Category	No. (%)
House ownership	Own	209 (87.1)
	Rented	31 (12.9)
Agricultural land	Yes	159 (75.0)
	No	81 (25.0)
Livestock	Yes	159 (66.3)
	No	81 (33.7)
Debt	Yes	173 (72.1)
	No	67 (27.9)
Morbidity in family	Yes	85 (35.4)
	No	155 (64.6)
Current Addiction in family(Alcohol, Tobacco)	Yes	117 (48.8)
	No	123 (51.2)

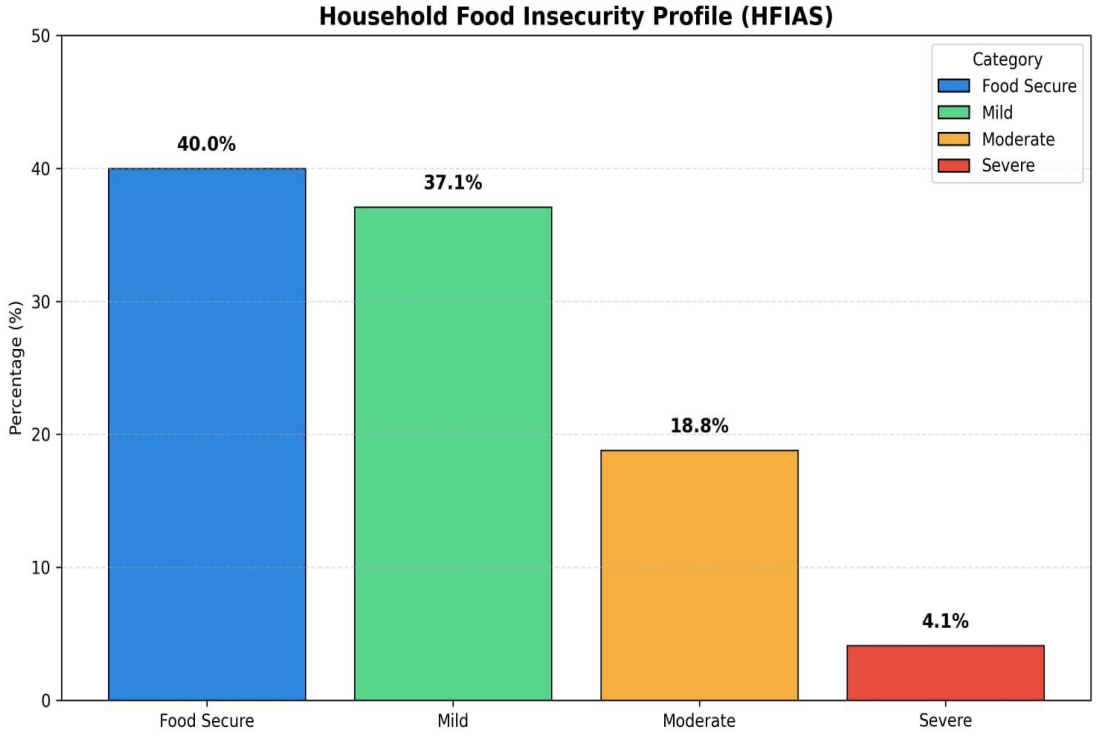

Figure 1: Distribution of households by food insecurity (HFIAS) (N = 240)

Table 3: Distribution of households according to Household dietary diversity assessed by Household Dietary Diversity Scoreand food consumption (N = 240)

Category	No. (%)	Descriptive Statistics
Inadequate (<7)	164 (68.3)	Mean (SD): 6.93 (1.71)
Adequate (≥7)	76 (31.7)	Median (IQR): 6 (6–8)
Total	240 (100)	Range: 5–12

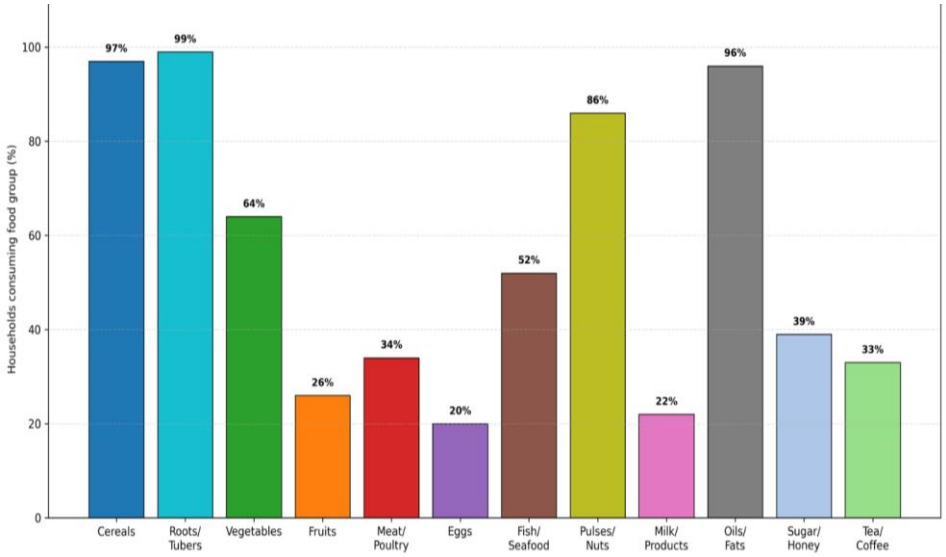

Figure 2: Food Group wise Household Dietary Diversity Pattern

Table 4: Factors Associated with Household Food Insecurity (Bivariate andMultivariable Analysis) (N = 240)

Variable	Category(n)	Food Insecure n(%)	χ^2	p-value	Adjusted Odds Ratio (95% CI)
Family type	Joint(73)	56(76.7)	12.2	<0.001*	1.85 (0.83–4.13)
	Nuclear(167)	88(52.7)			Reference
Family size	≥4(187)	130(69.5)	32.0	<0.001*	2.74 (1.01–7.41)
	<4(53)	14(26.4)			Reference
Socioeconomic status (SES)	IV–V(155)	125(80.6)	77.7	<0.001*	10.40(4.20–25.77)
	I–III(85)	19(22.4)			Reference
BPL card	Yes(141)	103(73.0)	24.3	<0.001*	2.85 (1.00–8.14)
	No(99)	41(41.4)			Reference
Livestock ownership	Yes(159)	110(69.2)	16.6	<0.001*	8.18(3.40–19.68)
	No(81)	34(42.0)			Reference
Debt	Yes(173)	117(67.6)	15.0	<0.001*	1.74 (0.59–5.09)
	No(67)	27(40.3)			Reference
Addiction	Yes(117)	62(53.0)	4.67	0.031*	—
	No(123)	82(66.7)			Reference

DISCUSSION

The present study assessed the prevalence and determinants of household food insecurity in a rural area and found that 60% of households were food insecure, with the majority experiencing mild to moderate levels. These findings are consistent with national-level observations reported in NFHS-5, which highlights a substantial burden of undernutrition

and food-related deprivation across Indian households [19]. Similar patterns have been observed in other developing settings where food insecurity remains a persistent issue due to socioeconomic disparities and limited access to resources.

In the present study, 68.3% of households had inadequate dietary diversity, with a mean HDDS of 6.93, indicating suboptimal dietary intake. Comparable findings were reported by Mekuria et al., where 64.1% of households had low dietary diversity in Ethiopia, highlighting similar dietary patterns in resource-limited settings [20]. The predominance of cereal-based diets and limited consumption of fruits, milk, and animal-source foods observed in this study aligns with global evidence suggesting that poor dietary diversity is strongly linked to food insecurity and micronutrient deficiencies [21].

Further, this study demonstrated that only 31.7% of households had adequate dietary diversity, which is comparable to findings from studies using HDDS guidelines, where higher dietary diversity is associated with improved household food access and nutritional outcomes [22]. In contrast, a study conducted in Pakistan by Hashmi et al. reported relatively better dietary diversity levels, with a higher proportion of households consuming diverse food groups; however, they still found a significant association between low dietary diversity and food insecurity [23]. This difference may be attributed to variations in socioeconomic conditions, urban-rural differences, and access to markets.

The association between dietary diversity and food insecurity observed in the present study is further supported by similar findings from Hashmi et al., who reported that households with lower dietary diversity scores had significantly higher odds of being food insecure [24]. This indicates that dietary diversity can serve as an important proxy indicator for assessing household food access and nutritional adequacy.

With regard to determinants, this study identified lower socioeconomic status (AOR = 10.40), larger family size (AOR = 2.74), BPL card possession (AOR = 2.85), and livestock ownership (AOR = 8.18) as significant predictors of food insecurity. These findings are in agreement with the study by Kundu et al., which reported that household income, family size, and economic vulnerability were major determinants of food insecurity, with economically disadvantaged households having significantly higher odds of experiencing food insecurity during the COVID-19 pandemic [25]. The strong association with socioeconomic status in the present study underscores the critical role of poverty in determining food access.

Interestingly, livestock ownership was found to be positively associated with food insecurity in this study, which may reflect that households owning livestock are still economically vulnerable and rely on livestock as a coping mechanism rather than a sign of prosperity. Similar observations have been reported in developing country settings where asset ownership does not always translate into improved food security due to limited productivity or market access [25].

Additionally, although factors such as household debt and family type were significant in bivariate analysis, they did not retain significance in multivariable analysis, suggesting the presence of confounding and interaction effects between socioeconomic variables. This highlights the multifactorial nature of food insecurity, where multiple interrelated determinants influence household food access.

Overall, the findings of the present study are consistent with existing literature, demonstrating that food insecurity is closely linked to socioeconomic disadvantage, inadequate dietary diversity, and household-level vulnerabilities. The study reinforces the need for integrated interventions focusing on poverty alleviation, improved food access, and promotion of dietary diversity to address food insecurity in rural populations.

LIMITATIONS OF THE STUDY

The present study has certain limitations that should be considered while interpreting the findings. Being a cross-sectional study, causal relationships between food insecurity and its associated factors cannot be established. The assessment of household food insecurity and dietary diversity relied on self-reported data using recall-based tools (HFIAS with a 4-week recall period and HDDS with a 24-hour recall), which may be subject to recall bias and reporting inaccuracies. Although efforts were made to minimize bias through standardized data collection procedures, the possibility of interviewer bias cannot be entirely excluded. Additionally, the study was conducted in a specific rural field practice area of West Bengal, which may limit the generalizability of the findings to other regions with different socioeconomic and cultural contexts. Seasonal variations in food availability were not specifically accounted for, which could influence dietary diversity and food security status. Despite these limitations, the study provides valuable community-level insights into the magnitude and determinants of household food insecurity.

CONCLUSION

The present study demonstrates that household food insecurity is highly prevalent in the rural study area, affecting a substantial proportion of households, predominantly at mild to moderate levels, indicating compromised food access and dietary quality. A significant proportion of households exhibited inadequate dietary diversity, with diets largely cereal-based and deficient in nutrient-rich foods, reflecting poor nutritional adequacy. Food insecurity was found to be strongly associated with lower socioeconomic status, larger family size, BPL card possession, and livestock ownership, highlighting the critical role of economic vulnerability and household characteristics. Overall, the findings underscore that food insecurity is a multifactorial issue driven by socioeconomic constraints and suboptimal dietary practices, warranting targeted, context-specific public health interventions to improve food access and nutritional outcomes.

Acknowledgment: Nil
Conflict of interest: Nil

REFERENCES

1. Food and Agriculture Organization of the United Nations. Hunger [Internet]. Rome: FAO; [cited 2024 Jan 25]. Available from: http://www.fao.org/hunger/en/
2. Food and Agriculture Organization of the United Nations. An introduction to the basic concepts of food security [Internet]. [cited 2026 Jan 27]. Available from: https://www.fao.org/agrifood-economics/publications/detail/en/c/122386/
3. Food and Agriculture Organization of the United Nations. About the Food Insecurity Experience Scale (FIES) [Internet]. [cited 2026 Jan 27]. Available from: https://www.fao.org/measuring-hunger/access-to-food/about-the-food-insecurity-experience-scale-(fies)/en/
4. Food and Agriculture Organization of the United Nations. An introduction to the basic concepts of food security [Internet]. 2008 [cited 2024 Jan 17]. Available from: https://www.fao.org/3/i0430e/i0430e.pdf
5. Pourmotabbed A, Moradi S, Babaei A, Ghavami A, Mohammadi H, Jalili C, et al. Food insecurity and mental health: a systematic review and meta-analysis. Public Health Nutr. 2020;23(10):1778–90. Available from: https://www.cambridge.org/core/journals/public-health-nutrition/article/food-insecurity-and-mental-health-a-systematic-review-and-meta-analysis/CB76D90D879907A6050DCAE2AD4F07EE
6. Food and Agriculture Organization, IFAD, UNICEF, WFP, WHO. The State of Food Security and Nutrition in the World 2023 [Internet]. [cited 2026 Jan 27]. Available from: https://www.who.int/publications/m/item/the-state-of-food-security-and-nutrition-in-the-world-2023
7. World Food Programme. Global hunger crisis [Internet]. [cited 2024 Jan 18]. Available from: https://www.wfp.org/global-hunger-crisis
8. Food and Agriculture Organization. The State of Food Security and Nutrition in the World 2025 [Internet]. [cited 2026 Jan 27]. Available from: https://openknowledge.fao.org/items/ea9cebff-306c-49b7-8865-2aef3bfd25e2
9. World Food Programme. Ending hunger [Internet]. [cited 2024 Mar 3]. Available from: https://www.wfp.org/ending-hunger
10. United Nations. Goal 2: Zero Hunger [Internet]. [cited 2024 Jan 11]. Available from: https://www.un.org/sustainabledevelopment/hunger/
11. Concern Worldwide. Global Hunger Index 2025 [Internet]. [cited 2026 Jan 27]. Available from: https://www.concern.net/knowledge-hub/2025-global-hunger-index
12. McKay FH, Sims A, van der Pligt P. Measuring food insecurity in India: a systematic review of the current evidence. Curr Nutr Rep. 2023;12(2):358–67. Available from: https://www.ncbi.nlm.nih.gov/pmc/articles/PMC10264273/
13. International Institute for Population Sciences (IIPS) and ICF. National Family Health Survey (NFHS-5), 2019–21: India [Internet]. [cited 2026 Jan 27]. Available from: https://ruralindiaonline.org/en/library/resource/national-family-health-survey-nfhs-5-2019-21-india/
14. 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(3):203–8.
15. Bennett S, Woods T, Liyanage WM, Smith DL. *A simplified general method for cluster-sample surveys of health in developing countries*. World Health Statistics Quarterly. 1991;44(3):98–106.
16. Coates J, Swindale A, Bilinsky P. *Household Food Insecurity Access Scale (HFIAS) for measurement of food access: Indicator guide (Version 3)*. Washington, DC: Food and Nutrition Technical Assistance Project (FANTA), Academy for Educational Development; 2007.
17. Swindale A, Bilinsky P. *Household Dietary Diversity Score (HDDS) for measurement of household food access: Indicator guide (Version 2)*. Washington, DC: Food and Nutrition Technical Assistance Project (FANTA), Academy for Educational Development; 2006.
18. Pandey VK, Aggarwal P, Kakkar R. *Modified BG Prasad socioeconomic classification, update – 2025*. Indian Journal of Community Health. 2025;37(1):1–4.
19. International Institute for Population Sciences (IIPS) and ICF. National Family Health Survey (NFHS-5), 2019–21: India [Internet]. [cited 2026 Jan 27].
20. Mekuria G, Wubneh Y, Tewabe T. Household dietary diversity and associated factors among residents of Finote Selam town, Northwest Ethiopia: a cross-sectional study. BMC Nutr. 2017;3:28. Available from: https://doi.org/10.1186/s40795-017-0148-0
21. Food and Agriculture Organization. Guidelines for measuring household and individual dietary diversity [Internet]. Rome: FAO; [cited 2024].
22. Food and Nutrition Technical Assistance (FANTA). Household Dietary Diversity Score (HDDS) Indicator Guide [Internet]. [cited 2024 Feb 5]. Available from: https://www.fantaproject.org/monitoring-and-evaluation/household-dietary-diversity-score
23. Hashmi S, Safdar NF, Zaheer S, Shafique K. Association between dietary diversity and food insecurity in urban households: a cross-sectional study. Risk Manag Healthc Policy. 2021;14:3025–35.

24. Hashmi S, Safdar NF, Zaheer S, Shafique K. Association between dietary diversity and food insecurity in urban households. Risk Manag Healthc Policy [Internet]. 2021;14:3025–35. Available from: https://www.dovepress.com/association-between-dietary-diversity-and-food-insecurity-in-urban-households-peer-reviewed-fulltext-article-RMHP
25. Kundu S, Banna MHA, Sayeed A, Sultana MS, Brazendale K, Harris J, et al. Determinants of household food security and dietary diversity during the COVID-19 pandemic in Bangladesh. Public Health Nutr. 2021;24(5):1079–87. Available from: https://www.cambridge.org/core/journals/public-health-nutrition/article/determinants-of-household-food-security-and-dietary-diversity-during-the-covid19-pandemic-in-bangladesh.