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Factors Affecting Household Food Security in Bundelkhand Region of India

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ABSTRACT

This study assessed the food security status of the households and examined factors influencing food security within the surveyed households. A total of 240 samples were gathered from Lalitpur and Jhansi districts in the Bundelkhand region using a multistage random sampling technique during the period of August to September 2022. The Indicator approach and Binary Logistic Regression methods were used to analyze the data. The results show households belonging to the Jhansi district had a substantially higher level of food security in comparison to the Lalitpur district. The findings show that Socioeconomic and demographic characteristics of surveyed households have a significant role in determining the level of food security. Hence, the development of an appropriate policy to protect households from the adverse effects of natural disaster like drought and health- hazards like COVID-19 are suggested.

INTRODUCTION

Food insecurity is a pervasive global issue, with a particular pronounced present in emerging nations like India. Despite the country's ability to generate excess food, a significant portion of its population, arounds one-third, experiences severe poverty. Further, a substantial proportion of children, approximately one-half, suffer from various forms of malnutrition (Kannan et al., 2000). India has a significant increase in food grain production, with a fourfold jump from 50 million tonnes in 1950 to 219.3 million tonnes in 2007–2008 (Kumar, 2010). This growth occurred despite a threefold rise in population from 33 million to more than 100 million. Moreover, the issue of food security is a highly contested and debated topic among scholars working on development issues, and for policymakers to come out from hunger, malnutrition, poverty and unemployment. According to Sharma & Sharma (2008) & Jatav (2022), a household is considered to be food secure when it possesses the physical, economic, and social access to the necessary amount of food items including food grains, fruits, vegetable, meat, eggs and other nutritional product in terms of quantity, quality, and safety. Additionally, Mishra et al., (2008) state that food security is achieved when the available food is culturally acceptable and when there is no significant risk of losing access to such food.

The determination of food security is contingent upon several criteria, which are included within the framework of four fundamental pillars i.e., food availability, food accessibility, food stability, and food utilization. The concept of food availability encompasses the domestic production of food grains within a given region. On the other hand, food accessibility pertains to the reliability of food availability, either through importing from surplus regions or by maintaining a reserve stock at the micro level, particularly during periods of man-made or natural disasters. It is important to note that food stability ensures that households consistently have access to an adequate food supply. Additionally, food utilization refers to the extent to which individuals or households are able to obtain sufficient energy and nutrition from their food consumption (Jatav et al., 2021a; Jatav, 2022). In totality, food security is a complex concept that encompasses several dimensions and is influenced by diverse factors, including social, economic, and demographic. Hence, the evaluation of

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household's food security has significant importance for the formulation of food policy in the most backward region of India namely Bundelkhand region.

Various indicators of food security have been created and are commonly employed to assess its status. However, there is considerable ambiguity regarding the specific dimensions (availability, access, utilization, or stability), levels (ranging from global to individual), or components (quantity, quality, safety, cultural acceptability, and preferences) of food security that these indicators are intended to capture. The aims of this study is to provide clarification on indicators for the dimensions of food security at the household level, as well as to identify the drivers of food security in the Bundelkhand region using an indicator approach and the Binary Logistic Regression Analysis methods.

METHODOLOGY

The study was undertaken in the Bundelkhand region of Uttar Pradesh (UP) in India. Two districts of Bundelkhand region namely Lalitpur and Jhansi were selected due to the preponderance of drought in the region. Using multistage random sampling technique, a total 240 samples were collected from four villages. The Larauni and Madpura villages were selected from Mauranipur & Moth Development Blocks of Jhansi district, while Badanpur and Manikpur villages were randomly selected from the Talbehat & Mehroni Development Blocks of Lalitpur district to elicit households-level information on the determinants of food security.

To analyse data, an indicator approach was used to assess food security status of surveyed villages in the Bundelkhand region (Jatav, 2021; Chetri et al., 2023). As the study used differential data; hence, it is prerequisite to standardize the data before calculating the agricultural sustainability index (Mishra et al., 2023). To standardize indicators into a common range (0, 1) based on their functional link with food security, this study utilized the min-max approach (Iyengar and Sudarshan, 1982). Equations 1 and 2 were adopted for larger-better-type and smaller-worse-type indicators, respectively.

$$Z_{ij} = \frac{X_{ij} - Min(X_{ij})}{Max(X_{ij}) - Min(X_{ij})} \quad \ldots (1)$$

$$Z_{ij} = \frac{Max(X_{ij}) - X_{ij}}{Max(X_{ij}) - Min(X_{ij})} \quad \ldots (2)$$

i = 1,2,….I and j = 1, 2, ….

Where, Z_{ij} is the standardize value of ith indicator in jth household, X_{ij} is actual value of ith indicator in jth household; $max(X_{ij})$ and $min(X_{ij})$ are the maximum and minimum values of ith indicator in the jth household, respectively.

Finally, the food security index was first calculated for household, and then village level. An average of four component i.e., food availability, food accessibility, food stability and food utilization using equation 3 was taken to calculate food security index.

$$P_j = \frac{\sum_{i=1}^{I} Z_{ij} * W_i}{\sum_{i=1}^{I} w_i} \quad \ldots (3)$$

Moreover, the Binary Logistic Regression (BLR) model was adopted for identifying the key influencing determinants of food security in the surveyed households (Singh, 2020a; Jatav et al., 2021a; Jatav & Singh, 2023). The logistic distribution function for the decision on food security measures can be specified as:

$$Logit\ (P) = \log\left(\frac{P}{1-P}\right) \quad \ldots (4)$$

Let $P_i = P_r\left(\frac{Y=1}{x=x_i}\right)$, then model can be written as ... (5)

$$P_r\left(y - \frac{1}{x_i}\right) - \frac{exp^{x'b}}{1 + e^{x'b}}; = log\left(\frac{P}{1-P}\right) = Logit(P_i) - \beta_0 + \beta_i \ldots (6)$$

Where; P_i is a probability of household's food security status (we have used index value), X_i's are independent variables, β_o is the intercept and β_i is the regression coefficient of food security.

RESULTS AND DISCUSSION

Food Accessibility Index (FASI)

Table 1 shows the food accessibility index together with its corresponding indicators. The calculated food accessibility index reveals that households belonging to the Manikpur village of Lalitpur district exhibit comparatively lower access to resources for obtaining food, whilst households belonging to the Larauni village of Jhansi district have significantly higher level of food accessibility in comparison to the other surveyed villages. The findings from the cross-indicator analysis indicate that the highest access to local markets, access to daily needs goods, access to all seasonal roads, and access to midday meals were the main contributing factors for higher food accessibility in Larauni village compared with Manikpur village. The data reveals that about 62 per cent of households in Larauni village has the access to the local market, while only 41 per cent of households in Manikpur village have access to the local market. More than 72 per cent of households in Larauni village have access to necessary goods for daily consumption expenditure, while only 55 per cent of households in Manikpur village have access. Further, about 85 per cent of households in Larauni village have access to all seasonal roads, while only 58 per cent of households have access. Likewise, about 82 per cent of children get a midday meal in Larauni village, while only 78 per cent of children get a midday meal in Manikpur village.

Food Availability Index (FAI)

Table 1 shows a comprehensive overview of the village-wise food availability index. The findings indicate that households in Larauni village exhibit comparatively higher levels of food accessibility (i.e., a 0.603 index score) compared with households in Manikpur village (i.e., a 0.500 index score). The cross-indicator analysis reveals that relatively higher perceived farm productivity loss, consumption of supplement and low-cost food for children, food skips due to non-availability of food, and hunger but not eating food due to non-availability of food were the main influencing factors for lower food availability for households in Manikpur village compared with Larauni village.

Food Stability Index (FSBI)

According to the data shown in Table 1, it can be seen that households in Larauni village (i.e., 0.513 index score) exhibit a

Table 1. Index values of various sub-components for food security of surveyed villages

Indicators	Larauni	Madpura	Badanpur	Manikpur
Food Accessibility Index (FASI)				
Access of local market	0.620	0.550	0.480	0.410
Access of necessary goods in local market	0.720	0.680	0.650	0.550
Access of all seasonal roads	0.850	0.820	0.650	0.580
Price of food increases day-by-day	0.900	0.950	0.890	0.820
Wages are relatively less to food inflation	0.950	0.920	0.820	0.630
Access of Ration Card	0.910	0.925	0.930	0.920
Ration under PMGKY	0.950	0.935	0.940	0.953
Access of mid-day meal	0.820	0.853	0.860	0.790
Food accessibility index	0.840	0.829	0.778	0.707
Food Availability Index (FAI)				
Fertile agricultural land	0.250	0.400	0.370	0.462
Perceived that farm productivity declined	0.920	0.740	0.820	0.750
Supplement and low cost food to children	0.620	0.550	0.590	0.500
Adults skipped food due to non-availability food	0.490	0.320	0.450	0.290
Children skipped food due to non-availability food	0.590	0.480	0.550	0.450
Were you ever hungry, but didn't eat	0.750	0.520	0.650	0.550
Food availability index	0.603	0.502	0.572	0.500
Food Stability Index (FSBI)				
Increase use of chemical fertilizer	0.850	0.750	0.690	0.650
Diversification of cropping pattern	0.210	0.195	0.165	0.150
Irregularities in rainfall	0.950	0.920	0.890	0.750
Electricity connection	0.535	0.250	0.275	0.550
Awareness of food prices in local market	0.605	0.580	0.550	0.480
Awareness of minimum support price	0.450	0.410	0.380	0.330
Storage capacity for farm produce	0.225	0.200	0.195	0.145
Food stability index	0.513	0.444	0.417	0.402
Food Utilization Index (FUI)				
Aware of balance diet	0.450	0.390	0.370	0.350
Households afford balance food	0.290	0.250	0.210	0.190
Taking meat and eggs for balance diet	0.260	0.255	0.210	0.150
Weight loss due to not eating enough food	0.850	0.760	0.710	0.690
Cut the size of children's meal	0.880	0.810	0.790	0.720
Consultation with government officials on nutrition status	0.260	0.200	0.180	0.150
Attained nutrition diet programme	0.180	0.150	0.120	0.090
Food utilization index	0.453	0.402	0.370	0.334

Source: Field Survey Data (2022)

substantially higher level of food stability, as indicated by their index score. In contrast, households in Manikpur village demonstrate a comparatively lower level of food stability, with an index score of 0.402. The findings of the cross-indicator analysis indicate that several factors significantly influenced the level of food stability in Larauni village in comparison to Manikpur village. These factors include a higher availability of fertile land, the higher utilization of chemical fertilizer in agriculture, higher crop diversification rate, higher awareness of food prices in the local market, higher access to the minimum support price, and higher storage capacity in Larauni village compared with Manikpur village. In statistics term, about 28 per cent of households reported that they have fertile land suitable for wheat production with assured irrigation facilities, while households in Manikpur village have only 15.8 per cent fertile land. Further, about 85 per cent of households in Larauni village have used chemical fertilizer to increase farm productivity, while the corresponding figure for the households in Manikpur village was only 65 per cent. Furthermore, about 21 per cent of households in Larauni village have diversified their cropping pattern in favour of low water intensive crops, while only 15 per cent of households in Manikpur village have diversified. Likewise, about 60 per cent of households in Larauni village were aware of food prices in the local market, while only 48 per cent of households in Manikpur village were aware of it. Nearly half of the households in Larauni village were aware of the minimum support price, while only 33 per cent of households in Manikpur village were aware of the minimum support price. Lastly, about 22.5 per cent of households in Larauni village have storage capacity to store farm produce, which results in higher farm returns, while only 15.5 per cent of households in Manikpur village have storage capacity. In totality, households in Larauni village have a more stable food system, while households in Manikpur village have a relatively less stable food system.

Food Utilization Index (FUI)

Table 1 shows the food utilization index pertaining to the households that were surveyed in different villages of Bundelkhand region. The food utilization indices, as determined by calculations, indicate that households in Larauni village exhibited a higher propensity to use their food resources in order to ensure food security, in comparison to households in Manikpur village. The findings of the cross-indicator analysis indicate that households in Larauni village exhibited higher awareness of importance of a balance diet, specifically in terms of incorporating meat and eggs to meet their nutritional needs. Additionally, these households were more likely to engage in consultation with government officials regarding balanced diets and actively participate in nutrition diet programs. These factors collectively contributed a higher level of food utilization in households belonging to the Larauni village, as compared to those in the Manikpur village. The study findings revealed that around 45 per cent of households in Larauni village were aware of a balanced diet, while only 35 per cent of households in Manikpur village were aware of it. Further, about 29 per cent of households were in a position to afford balanced food in Larauni village, while only 19 per cent of households in Manikpur village were in this position. Furthermore, about 26 per cent of households in Larauni village have consulted with nutrition experts on a balanced diet, while only 15 per cent of households in Manikpur village have consulted. Likewise, about 18 per cent of households in Larauni village have attended the nutrition diet program, while only 9 per cent of households in Manikpur village have attended.

Food Security Index (FSI)

Table 2 depicts the village-wise food security status of the surveyed village. The findings indicate that households in Larauni village of Jhansi district exhibited a higher level of food security, while households in Manikpur village of Lalitpur district had a comparatively lower level of food security. The cross-component analysis reveals that households in the Larauni village experience higher food security due to higher levels of food accessibility, availability, stability, and utilization. Conversely, households in Larauni village face lower food security as a result of lower levels of food accessibility, availability, stability, and utilization.

Table 2. Village wise food security index

Components	Larauni	Madpura	Badanpur	Manikpur
Food accessibility index	0.840	0.829	0.778	0.707
Food accessibility index	0.603	0.502	0.572	0.500
Food stability index	0.513	0.444	0.417	0.402
Food utilization index	0.453	0.402	0.370	0.334
Food security index	0.602	0.544	0.534	0.486

Source: Field Survey Data (2022)

Factors affecting household's food security

Table 3 depicts factors affecting household's food security in the surveyed village. This study assumes that households have food security index score above from 0.500 was food secure, and households have food security index score below 0.500 was food insecure. The food security status was modelled as a binary variable where 1 = food secure (index value >0.500), and 0 = food insecure (index value <0.500). The overall predictive power of the model was high indicating that independent variables had significant impact in explaining the food security status of surveyed households. The Chi-square (95.21, $p<0.005$). The results show that all the variables are positively associated with the food security status except household size. The age of individuals has a significant role in influencing the state of food security within households (Abdullah et al., 2019). The findings indicate a positive and statistically significant correlation between age and food security. The calculated odds ratio indicates that households with

Table 3. Factors affecting household's food security status

Independent Variables	Coefficient	Odds Ratio	P-value
Age (Age of head in number of years)	0.873	2.41	0.001*
Gender (Male =1; otherwise = 0)	0.214	2.37	0.008*
Education (Literate = 1; otherwise = 0	0.095	1.15	0.005*
Household size (Number of households members)	-0.482	1.74	0.001*
Remittances (household receive remittances = 1; otherwise = 0)	0.866	4.21	0.000*
Employment (Head of Household is employed = 1; otherwise = 0)	0.192	3.15	0.003*
Livestock ownership (HHs own livestock = 1; otherwise = 0)	0.088	2.45	0.004*
Credit (HHs has access to institutional credit = 1; otherwise = 0)	0.817	1.15	0.009*
Market access (HHS has access to local market =1; otherwise =0)	0.659	1.93	0.001*
Food aid (HHs receive food aid = 1; otherwise 0)	0.832	2.29	0.005*
Drought (HHs perceived drought is responsible for crop loss =1; otherwise = 0)	0.067	3.45	0.010*
Constant	-0.087	0.91	0.000*
LR Chi^2		29.54	
Prob> Chi^2		0.0056	
Pseudo R^2		0.9521	
Log Likelihood		-88.842	
No. observation		240	

Source: Estimated from field survey data, 2022.

Note: *, **, and *** indicate 1, 5, 10% level of significance respectively.

elder members were more likely to be food secure compared to households with younger members. Also, education is a crucial factor that significantly influences the level of food security. It gives them knowledge and awareness and increases the chances of obtaining job (Rejula et al., 2017; Jatav, 2020). The findings indicate that there is 2.37 times higher probability that a household is food secure, if he/she literate than that of illiterate household. Remittances had always been remained one of the important source of income and external finances for many poor people across the developing countries (Jatav & Sanatan, 2022; Jatav & Kalu, 2023). Majority of the people (at least one member from each family) are outside of the home and doing jobs in different cities of India including Delhi and Mumbai. Every year they send a lot of money to home. The household were asked whether they receive remittance or not? The effect of remittances was found significant. Households receiving remittances were found relatively more food secure while those do not receive remittances were lacking food security. Further, if head of households employed and getting regular income were found food secure than that of others. Likewise, household owned livestock was found food secure compared with household have not owned any livestock. For instance, the calculated odds ratio show that there is a 2.45 times higher probability of food security than that of household does not owned any livestock. Credit, market access and food aid were also found positively related with food security status of surveyed households. Higher credit from institutional sources ensures regular supply of resources to meet food requirement. Likewise, access of market along with awareness of food price help to a household to get food at a reasonable rate and government schemes are adding to the food security (Vijayan et al., 2023). The Central Government started an ambitious scheme called *Pradhan Mantri Garib Kalyan Yojna* on March 2020. Under this scheme, free ration was started to provide eligible households. It played vital role in household's food security during COVID-19. The BLR results show that a household has received food aid is more likely food secure compared with household who donesn't received food aid. Lastly, perception on drought also helps to store food items to deal with natural disasters like drought as it is frequent in Bundelkhand region. The calculated odds ratio shows that there is a 3.45 times higher probability a household food secure vis-à-vis.

CONCLUSION

The findings indicate that households in Jhansi district has a substantially higher level of food security in comparison to those belonging to the Lalitpur district. Several factors influencing food security demonstrate a positive and statistically significant correction between socioeconomic and demographic characteristics and food security of surveyed households. Hence, the present study suggests that the formulation of an appropriate strategy to protect household from adverse impacts of natural disasters like drought as it frequent in Bundelkhand region, and health-hazard like COVID-19.

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