Determinants of Food Insecurity in Rural India: An Exploration using the Food Insecurity Experience Scale

Vaishali Bansal[1]

Food and Agriculture Organization of the United Nations, New Delhi, India
<vaishalibansal02@gmail.com>

Abstract

Food insecurity remains a persistent challenge in rural India, shaped by interactions between agricultural production, livelihoods, caste, gender, and access to public distribution systems. This paper examines its determinants using the Food Insecurity Experience Scale (FIES) developed by FAO. The analysis draws on primary surveys conducted in purposively selected villages across six Indian states between 2015 and 2023. These surveys captured household socio-economic conditions, focusing on agriculture, land, food consumption, common property resources, and social protection. Household questionnaires collected data on demographics, education, occupation, land and cropping, food consumption, indebtedness, housing, sanitation, and welfare access. The FIES module, translated into local languages, was administered to one randomly selected adult per household.

An ordered logit regression model identified determinants of food insecurity using FIES-based probability scores. The dependent variable comprised nine ordered categories of severity. Independent variables included per capita cereal production, occupation, social group (with emphasis on Scheduled Tribes and Scheduled Castes), gender of respondent, and access to the Public Distribution System (PDS).

Results show that higher per capita cereal production significantly reduces the probability of moderate and severe food insecurity, underscoring the importance of land and agriculture. Stable, assured incomes play a protective role. Households dependent on casual manual labor, pensions, or remittances were most vulnerable, while those with land, businesses, or private salaried jobs did not differ significantly from government employees.

Caste disparities persist: Scheduled Tribe households were significantly more food insecure than non-SC/ST households, even after controlling for occupation and land, pointing to structural disadvantage. Gender differences were not statistically significant, though patterns are suggestive. In poorer occupational groups, men appeared more food insecure, possibly due to migration for precarious informal work. In wealthier or salaried households, women appeared more vulnerable, potentially reflecting intra-household inequalities in food allocation and reporting.

Access to subsidized food through the PDS showed a positive association with food insecurity, reflecting its targeted design, with ration cards concentrated among vulnerable households. Two caveats apply: many food-insecure households still lack ration cards, and subsidized grain is often insufficient to ensure food security. This highlights structural limitations in current PDS design and coverage.

Overall, food insecurity in rural India is shaped by agricultural access, occupation, and social identity, with land and secure incomes central. Scheduled Tribe households and those reliant on manual labor or remittances remain especially vulnerable. While the PDS reaches many insecure households, it is insufficient to eliminate food insecurity, indicating the need for broader entitlements. This study contributes rare primary evidence across diverse agro-ecological and social contexts and links household data with

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internationally comparable measures, reinforcing the importance of agriculture, regular employment, and addressing structural inequalities across caste and occupation.

Keywords: Food insecurity; FIES; India; agriculture; livelihood.

1 Introduction

Food insecurity refers to the condition of being at the risk of not having access to adequate and nutritious food. While hunger (or, undernourishment) is the state when a person consumes, on a regular basis, inadequate dietary energy, food insecurity is a much broader concept. A person can be in a state of food insecurity because of unavailability of food, or also because of various socio-economic barriers such as low purchasing power, social discrimination or irregular jobs, that may make food inaccessible. The severity of food insecurity can also vary across individuals depending upon the constraints they face in accessing adequate and nutritious food. Over the last few decades, experience-based measures of food insecurity have attempted to capture the degree of constraint in accessing food faced by people. Of the various measures, the Food Insecurity Experience Scale (FIES), developed by FAO over the last decade, is a relatively new measure of food insecurity that provides a framework for globally comparable estimation of prevalence of food insecurity based on data on experiences of food insecurity faced by people.

FIES is an experience-based measure that uses information on experiences of food insecurity faced by an individual or a household to make probabilistic estimates of the severity of food insecurity a person suffers from. Usually, two levels of severity -- moderate and severe -- are used for estimating prevalence of food insecurity. Accordingly, prevalence is estimated for severely food insecure population, and moderately or severely (henceforth, moderate+) food insecure population. These are estimated using responses to a set of FIES questions that are posed to a sample of individuals (Box 1).

Each question is designed to ask the respondent whether, over the reference period, they have experienced a particular situation -- for example, having had to skip a meal or having had to consume inadequate quantity of food because of lack of money or other resources. These situations are expected to be associated with different degrees of severity of food insecurity. It is important to point out that, although questions about these situations are answered in Yes or No, and not on a quantitative scale, each question is factual and related to a specific kind of experience. While it is the case that, like with any other factual question, inter-personal differences in interpretation, perceptions and behaviours may influence how people respond to these questions, the questions are not designed to seek perceptions of people about either their own or social conditions. Based on the differences in severity of each of these events experienced by people, the FIES model derives a population-specific scale of severity of food insecurity.

Assuming that usually a person facing a high degree of food insecurity would answer questions regarding moderate degrees of food insecurity also in the affirmative, probability of a person answering a question in the affirmative depends on the distance between the position of the question (determined by item severity) and the position of the person (person severity) on the severity scale. After obtaining the item severity and person severity, various statistical checks are applied to validate the derived scale of severity of food security. Once the scale is validated, proportions of different levels of severity of food insecurity are estimated depending upon the thresholds marked on the scale of severity of food insecurity (Ballard, Kepple, and Cafiero, 2013; Cafiero et al., 2016; Cafiero, Viviani, and Nord, 2018).

Box 1: FIES Standard Individual-level Survey Module

The standard FIES survey module comprises the following questions (items):
During the last 12 months, was there a time when, because of lack or money or other resources: 1. you were worried that you would not have enough food to eat? 2. you were unable to eat healthy and nutritious food? 3. you ate only a few kinds of foods? 4. you had to skip a meal? 5. you ate less than you thought you should? 6. your household ran out of food? 7. you were hungry but did not eat? 8. you went without eating for a whole day?

This paper examines the prevalence and determinants of food insecurity in rural India using the Food Insecurity Experience Scale (FIES), based on primary surveys conducted in selected villages across six states—Jharkhand, Madhya Pradesh, Andhra Pradesh, Haryana, Manipur and Rajasthan. Section 2 describes the survey locations, data collection, and sampling strategy. Section 3 presents estimates of the prevalence and severity of food insecurity across the study villages. Section 4 analyses the key determinants of food insecurity, including access to land, occupation and economic status, common property resources, access to the Public Distribution System, and gender disparities, along with results from a multivariate regression model. Section 5 concludes the paper.

2 Survey Locations and Methodology

The analysis in this paper uses data from primary surveys conducted in purposively selected rural locations in six States of India -- Jharkhand, Madhya Pradesh, Andhra Pradesh, Haryana, Manipur and Rajasthan. The primary objective of these surveys was to study the overall socio-economic conditions of the people in the survey areas, with a primary focus on agriculture, land, livelihoods, food consumption and access to public protection programmes. Each village was selected after a preliminary assessment to ensure that the selected village was broadly representative for the region in terms of the character of agriculture (in particular, cropping pattern and irrigation), sources of livelihoods, social composition and access to common property resources. In most villages, a village questionnaire was used to make a preliminary assessment of caste structure, pattern of landholdings, sources of livelihoods, and access to public schemes. These questionnaires were filled on the basis of group discussions with key informants in the village including village-level elected representatives and officials.

The method of sampling households varied across villages. A census of all households was done in four villages in Jharkhand and all the four villages of Andhra Pradesh. Voters' lists were used as the sampling frame in one village in Jharkhand and in three villages in Madhya Pradesh and Manipur. In these villages, a simple random sample of voters was selected, and households of the sampled voters were surveyed. In all 4 villages of Haryana and one village in Madhya Pradesh. household lists maintained by the village-health workers -- the Accredited Social Health Activists (ASHA) – were used as the sampling frame.

Additional information on caste of households was added to these lists in consultation with the ASHA workers. A stratified random sample -- with caste as the stratifying variable -- was used for surveys in these multi-caste villages. In villages where a sample survey was conducted, appropriate sample weights were used in the estimations.

In each survey household, a detailed household-level questionnaire was canvassed. This questionnaire had questions on basic demography of the household, educational status of members, their occupations, land ownership, cropping pattern, food consumption, access to common property resources, asset holdings, indebtedness, housing and sanitation, and access to social welfare schemes. Information on dietary patterns of households was collected in some villages. The survey was based on an interview with household members. Usually, it was ensured that the most informed member of the household -- the one who was primarily responsible for economic decisions in the household -- participated in the survey. Other members of the household were also invited to join in the interviews and provide information.

The standard Food Insecurity Experience Scale (FIES) individual-level survey module was canvassed with a single, randomly-selected, adult member of each household. This member was selected on the spot using a Kish grid, which is a matrix of random numbers which is used to randomly select a member from the household as a respondent in the survey. The selected member was taken aside for asking these questions separately. Each survey team had at least one woman investigator. If the person selected on the basis of the Kish grid happened to be a woman, she was asked these questions by one of the woman investigators. Given that there are subtle differences between different FIES questions, to ensure that respondents understand the FIES questions well, these were carefully translated in each local language spoken by the respondents in all the survey locations. In all, FIES data were collected from a total of 1456 respondents (Table 1). Out of these, FIES data were incomplete for 35 respondents; these cases were dropped from the analysis.

Table 1: Number of observations (set of 8 FIES questions), by survey states, India.

State of Selected Villages	Sample
Jharkhand (5 villages)	613
Madhya Pradesh (6 villages)	205
Andhra Pradesh (4 villages)	122
Haryana (5 villages)	358
Manipur (2 villages)	96
Rajasthan (1 villages)	62
Total	1456

3 Prevalence of Food Insecurity in Study Villages

In this analysis, FIES data collected in all the villages were pooled in order to construct a robust FIES severity scale. Once the scale was established, prevalence rates for moderately+ and severely food insecure persons were estimated separately for all survey locations. The survey results indicate substantial variation in the prevalence of food insecurity across states.

Table 2 provides estimates of prevalence of moderate+ and severe food insecurity for each survey village. Of all the villages covered in this study, prevalence of food insecurity was found to be highest in the survey villages of Madhya Pradesh, Jharkhand and Andhra Pradesh (Araku Valley).

Over 70 per cent of the population in Ambajora (73.5 per cent), Jolo Champa (77.9 per cent) and Khartanga (69.7 per cent) in Jharkhand, and Raikhora (73.1 per cent) and Karbalkhora (76.8 per cent) in Ratlam district of Madhya Pradesh was moderately+ food insecure. The level of severe food insecurity was also very high in these villages. Jolo Champa in Jharkhand, a village situated on a hill, deep in the forest, shows

up as the most food insecure village with about half of the population (47.9 per cent) in the village being severely food insecure. Severe food insecurity was also very high in Karbalkhora in Madhya Pradesh. About 45.8 per cent population in the village had suffered experiences of going hungry whole day. Although Hehal, Belgaria Village and Belgaria Colony in Jharkhand were relatively better off compared to other villages in Jharkhand, about half of the population even in these multi-caste villages was moderately+ food insecure. Prevalence of moderate+ food insecurity in the surveyed villages of Anuppur district in Madhya Pradesh -- Padripani (62.4 per cent), Sarai (66.2 per cent), Gadhidadar (56.9 per cent) and Rahu ka gaon (55 per cent) -- was also quite high. Most of these villages were inhabited by Scheduled Tribes (ST) who were primarily dependent on own-crop production, collection of food items from common property resources and ration received from PDS for their daily consumption of food.

It is noteworthy that, while the moderate+ food insecurity was about 38 per cent in survey villages in Manipur, only about 8 per cent of people were severely food insecure.

Despite being in an agriculturally-advanced state, prevalence of food insecurity was found to be quite high even in the four survey villages of Haryana – Birdhana (28.8 per cent), Cheher Kalan (22.9 per cent), Khandrai (27.2 per cent) and Jamalpur Shekhan (36.1 per cent). Cheher Kalan village in Haryana was surveyed twice, in 2018 and 2023. Over this period, the prevalence of moderate+ food insecurity remained unchanged at about 23 per cent, while the prevalence of severe food insecurity rose from 6.5 per cent in 2018 to 8.1 per cent in 2023.

Of all the survey villages, prevalence of moderate+ food insecurity was lowest in Rewasi in Rajasthan (14.8 per cent).

Table 2: Prevalence of different severity of food insecurity, by survey villages in different states of India.

State	Village	Moderate+ food insecurity	Severe food insecurity
Jharkhand	Ambajora	73.5	38.1
Jharkhand	Belgaria Colony	56.2	25.5
Jharkhand	Belgaria Village	45.8	19.2
Jharkhand	Hehal	51.7	22.0
Jharkhand	Jolo Champa	77.9	47.9
Jharkhand	Khartanga	69.7	34.0
Madhya Pradesh	Gadhidadar	56.9	17.3
Madhya Pradesh	Karbalkhora	76.8	45.8
Madhya Pradesh	Padripani	62.4	18.8
Madhya Pradesh	Rahu ka gaon	55.0	31.3
Madhya Pradesh	Raikhora	73.1	33.8
Madhya Pradesh	Sarai	66.2	27.6
Andhra Pradesh	Araku Valley	57.5	26.0
Haryana	Birdhana	28.8	7.2
Haryana	Cheher Kalan	22.9	6.5
Haryana	Cheher Kalan (revisit)	23.0	8.1
Haryana	Jamalpur Shekhan	36.1	12.6
Haryana	Khandrai	27.2	9.2
Manipur	Irengband	37.4	7.4
Manipur	Tentha	39.3	8.7
Rajasthan	Rewasi	14.8	4.4

The wide variation in the prevalence of food insecurity across the surveyed villages points to substantial differences in underlying socio-economic conditions, including access to land, nature of livelihoods, and

effectiveness of public provisioning systems. These inter-regional contrasts reflect deeper structural inequalities that shape households' ability to access adequate and nutritious food. However, descriptive patterns of prevalence alone are insufficient to explain the observed disparities. A more detailed examination of the underlying determinants is required to understand why certain households and regions are more vulnerable than others. Accordingly, the following section shifts from descriptive analysis to an exploration of key household-level determinants of food insecurity, including access to agricultural land, occupation and economic status, dependence on common property resources, access to the Public Distribution System, gender disparities, and evidence from a multivariate regression analysis.

4 Determinants of Food Insecurity

4.1 Access to Agricultural Land and Food Insecurity

Access to land and own crop production are important factors in ensuring the food security of people in rural areas. As per the latest available NSSO Consumption survey data, about 26 per cent of the total calories consumed by rural population comes own-produced food. Various scholars have argued that redistribution of land is an important policy option in addressing food security of rural households in poor and developing countries (Alemmeta, Agidew, and Singh, 2018; Lipton and Saghai, 2016). Holden and Ghebru (2016) argued that land redistribution and provision of secure tenurial rights are associated with improved food security status of rural households. With better and secured access to land, households are able to produce food for their subsistence, are more resilient in dealing with economic shocks, have an incentive to invest in land, and have better access to credit. A study of about 1000 households in Salem district of Tamil Nadu found that prevalence of food insecurity was lower among households with formal land titles against those with informal access to land (Dagdeviren, Elangovan, and Parimalavelli, 2023). Studies in other countries have also found evidence of relationship between own farm production and food security. For example, in a study of rural households in Lebanon, Ghattas et al. (2013) found that household food security was significantly negatively related with own-farm crop production of the households. Rammohan and Pritchard (2014) showed that landholdings of households are an important determinant of food and nutrition security of households in rural Myanmar.

Survey data from the study villages show considerable variation in land distribution, with widespread small holdings and significant landlessness in several regions. In many villages in Jharkhand, Madhya Pradesh and Andhra Pradesh, the majority of households cultivate less than 2 acres of land, often under rain-fed and low-productivity conditions. In contrast, villages in Haryana exhibit high land inequality, with a large proportion of landless households alongside a small group of large landholders. In some cases, land acquisition for mining and environmental shocks have further reduced access to cultivable land, increasing dependence on markets for food.

Table 3 presents the relationship between size of operational holdings and food insecurity. The results indicate a clear association between land access and food security, but with important nuances. Households cultivating less than 2 acres exhibit the highest levels of food insecurity, with 48.4 per cent moderately or severely food insecure and 23.1 per cent severely food insecure. Landless households also face high levels of food insecurity (40.2 per cent moderately+), though slightly lower than marginal farmers. In contrast, households with larger holdings -- particularly those operating more than 8 acres -- have the lowest prevalence of food insecurity (26.2 per cent moderately+ and 6.3 per cent severe). These results should be interpreted with caution, as the observed relationship may reflect other underlying factors. For instance, landless households may include those with more stable non-farm or migrant incomes, making them less food insecure than marginal farmers.

The findings suggest that very small and unviable landholdings do not provide sufficient protection against food insecurity. While access to land matters, the scale and productivity of land are equally important. The relatively better outcomes among some landless households also indicate the role of non-agricultural

income sources. Overall, improving food security requires not only expanding access to land but also enhancing its productivity and supporting diversified livelihoods.

Table 3: Proportion of food insecure households, by size-classes of operational holding, pooled survey data, India.

Operational holding category	Moderate+ food insecurity	Severe food insecurity
Landless	40.2	14.7
0 to 2 acres	48.4	23.1
2 to 5 acres	30.1	11.6
5 to 8 acres	43.2	7.0
More than 8 acres	26.2	6.3

4.2 Occupations and Economic Status

Occupational structure is a key determinant of food security in rural areas, reflecting differences in income stability, asset ownership, and vulnerability to shocks. Households in the study villages were classified into eight occupational categories based on their primary source of income, broadly corresponding to economic classes ranging from large peasants and salaried employees to manual workers and households dependent on remittances or pensions.

Table 4 presents the relationship between occupational categories and food insecurity. The results show a clear gradient across economic classes. Households with relatively secure and higher incomes such as large peasants, those engaged in large businesses, and government salaried employees have the lowest prevalence of food insecurity. For instance, only about 26.6 per cent of large peasants and 20 per cent of households with large businesses are moderately or severely food insecure, with very low levels of severe food insecurity.

In contrast, the most vulnerable groups are those dependent on precarious or low-paying sources of income. Households reliant on pensions and remittances exhibit the highest levels of food insecurity (60.2 per cent moderately+ and 23.7 per cent severe), followed closely by hired manual labourers (58.3 per cent moderately+ and 30.4 per cent severe). These households typically lack both productive assets and stable employment, making them highly susceptible to food insecurity.

Notably, even households with private salaried employment show high levels of food insecurity (54 per cent moderately+), reflecting low wages and job insecurity in informal labour markets. Poor and middle peasants fall in the intermediate range (around 40 per cent moderately+), indicating that small-scale cultivation alone does not ensure food security. Households engaged in small businesses (Own Account Enterprises) also face considerable food insecurity (34 per cent moderately+ and 11 per cent severe), reflecting low and unstable incomes among self-employed workers such as street vendors, gig workers, and basket weavers.

Overall, the results highlight that income stability and quality of employment, rather than employment per se, are critical in determining food security outcomes.

Table 4: Proportion of food insecure households, by economic classes, pooled survey data, India.

Occupation	Moderate+ food insecurity	Severe food insecurity
Large peasant	26.6	6.5
Poor and middle peasant	40.5	15.4
Hired manual labour	58.3	30.4
Self-employed (Own Account Enterprise)	34.1	11.2
Self-employed (Large)	20.0	5.5

Salaried employee (Private)	54.0	15.3
Salaried employee (Government)	27.8	7.2
Remittances/Pensions	60.2	23.7

4.3 Food Collection through Common Property Resources

Access to Common Property Resources (CPR) such as forests is important for the food security and livelihood of households in forest-fringe villages (FAO, 2013). In India, such villages are predominantly inhabited by Scheduled Tribes (ST). Scheduled Tribe households living in such forest-fringe villages are engaged in collection of food and other commodities from forests for their food and incomes. However, the steady depletion of forest resources, administrative and legal barriers, growing urbanisation, expansion of mining activities and increasing privatisation have resulted in a fall in their access to forests (Jodha, 1986, 1989, 1990; Menon and Vadivelu, 2006; Narain and Vij, 2016). Collections from forests and other common property resources, such as wild fruits, nuts, roots, fungi, herbs and animal protein, complement the food and nutrition needs of households in areas near forests (Bharucha and Pretty, 2010; Karki et al., 2018; Mitra, 2020; Rawal, Bansal, and Thokchom, 2019; Vira, Wildburger, and Mansourian, 2015). Sunderland et al. (2013) point out that forests contribute to food security of households by way of direct contribution to food, through income generation and through provision of ecosystem services.

Survey data show that collection from common property resources (CPRs), especially forests, is widespread in forest-fringe villages in Jharkhand, Madhya Pradesh and Andhra Pradesh. A large proportion of households reported collecting food from forests -- about 79 per cent in Padripani, 76 per cent in Jolo Champa, 75 per cent in Sarai and 61 per cent in Araku Valley. These include fruits, mushrooms, leaves, seeds, and forest produce such as mahua flowers, tendu leaves, and honey, often supplemented by small-scale income from sale of these items.

Survey results show that proportion of households that were heavily dependent on collection of food from forests also faced high proportion of moderately+ food insecurity. For instance, in Sarai, about 89 per cent of moderately or severely food insecure households and 83 per cent of severely food insecure households relied on forest collection, while in Jolo Champa and Karbalkhora, over 70 per cent of severely food insecure households depended on CPRs. The fact that such households remain food insecure despite collection of food from forests shows that, as a result of depletion of forests and restricted access to forest resources, availability of food from forests is meagre and irregular. As a result, while food from forests is important for food insecure households in forest-fringe villages, it is not enough to mitigate food insecurity.

4.4 Access to Public Distribution Scheme

Various scholars have noted the crucial role public distribution system (PDS) in India plays in addressing food insecurity of people (Dreze and Khera, 2013, 2015; Mooij, 1998; Swaminathan, 2000). Under the National Food Security Act, all households identified as ‘Priority Households (PH)’ are entitled to receive 5 kilograms of food grains per person per month at subsidised prices through ration shops. Households covered under Antyodaya Anna Yojana (AAY), which was originally designed for the poorest of poor but whose coverage has been steadily reduced after enactment of the NFSA, are entitled to 35 kilograms of food grains per household per month.

The information collected from survey villages brings out several important gaps in both coverage and delivery in the public distribution system in the survey locations.

Across the survey locations, access to ration cards varies considerably. In some villages, particularly in Jharkhand, more than half of households did not possess ration cards, while in parts of Madhya Pradesh coverage was much higher, reaching around 90-95 per cent, though gaps remained in certain locations where nearly one-third of households were excluded. Even among those with access, procurement of

subsidised grain was often unreliable: about 68 per cent of households in Jharkhand, nearly 50 per cent in Madhya Pradesh, and over 90 per cent in Manipur reported receiving less grain than their entitlement, with some households receiving none at all.

Despite these gaps, a majority of food insecure households are covered under the PDS -- about 81 per cent of moderately or severely food insecure households and 84 per cent of severely food insecure households possess ration cards. However, a significant minority remains excluded, with around 19 per cent of moderately food insecure and 16 per cent of severely food insecure households lacking access. These findings suggest that while the PDS reaches a large share of vulnerable households, exclusion errors and delivery failures limit its effectiveness. Access alone is insufficient to ensure food security, highlighting the need for improved coverage, reliable provisioning, and stronger implementation.

4.5 Gender Disparities in Prevalence of Food Insecurity in the Study Villages

Survey data reveal that gender disparities in food insecurity are more complex and context-specific than commonly assumed. While global evidence typically shows higher food insecurity among women, the results from the study villages present a mixed pattern.

Across most villages, severe food insecurity is generally higher among women. For example, in Karbalkhora, 55.7 per cent of women were severely food insecure compared to 35.3 per cent of men, and in Sarai, the gap was even larger (63.1 per cent for women versus 17.5 per cent for men). Similarly, in Padripani, severe food insecurity affected 23.1 per cent of women compared to 14.2 per cent of men.

However, patterns for moderate or severe food insecurity (moderate+) are less consistent. In several villages, men exhibit higher levels of moderate+ food insecurity. For instance, in Jolo Champa, 90.3 per cent of men were moderately+ food insecure compared to 69.6 per cent of women, and in Raikhora, the corresponding figures were 98.0 per cent for men and 66.7 per cent for women. Similar trends are observed in Khartanga and Araku Valley.

Further analysis by occupation reinforces these patterns. Among more precarious livelihood groups, men face higher food insecurity; for example, in private salaried employment, 73.0 per cent of men were moderately+ food insecure compared to 39.7 per cent of women, and severe food insecurity was also higher among men (22.4 per cent versus 10.0 per cent). Among households dependent on remittances and pensions, the gap is even wider, with 95.0 per cent of men moderately+ food insecure compared to 60.0 per cent of women, and severe food insecurity at 58.9 per cent versus 23.5 per cent. In contrast, among relatively better-off groups such as large peasants, women exhibit higher food insecurity, with 33.2 per cent moderately+ food insecure compared to 22.1 per cent of men, and 9.5 per cent severely food insecure compared to 4.5 per cent of men.

Overall, the findings indicate that gender disparities in food insecurity are shaped by economic roles and livelihood structures, rather than gender alone.

4.6 A Regression Analysis of Socio-economic Determinants of Food Insecurity

To investigate the socio-economic determinants of food insecurity in the study villages, a multi-variate logistic regression model is estimated using the Food Insecurity Experience Scale. The model, estimated using pooled survey data collected from six states, namely Jharkhand, Madhya Pradesh, Andhra Pradesh, Haryana, Manipur and Rajasthan, attempts to examine the relationship of probability of being food insecure with access to food production from own farm, occupation class of the household, social group, gender, and access to public distribution system. It is noteworthy that the food security status of a household may be determined by many other factors including levels of incomes, access to markets, disruption of food

supply due to disasters and catastrophes, and seasonal variations in access to food. These are not controlled for because of lack of comparable data from all the surveys.

4.6.1 Model Specification

The regression model used in the analysis is outlined in equation (1).

$$\text{Prob(FI)} = f(P, O, R, S, G * O) \quad (1)$$

where f is a ordered-logistic function, and the independent variables are as follows:

Dependent Variable: Prob(FI)

Model 1: Probability of being moderately+ food insecure

Model 2: Probability of being severely food insecure.

Independent Variables in both the models:

P: Per capita cereal production from household operational holding.

O: Primary occupation category of the household indicating the economic class of the household with;

- Salaried government employee households as the base category.
- Salaried employee (Private): 1 if the household was primarily dependent on private salaried employment, 0 otherwise.
- Self-employed (Large) : 1 if the household has a substantial business enterprises such as brick kilns, petrol pumps, commission agents and big traders, 0 otherwise.
- Self-employed (Own-account enterprises): 1 if the primary occupation of the household is a small own-account enterprise (OAE) with no hired workers, 0 otherwise.
- Large peasant: 1 the household is primarily engaged in cultivation and has more than 10 acres of land, 0 otherwise.
- Poor and middle peasant: 1 if the household is primarily engaged in cultivation and has operational holding of less than 10 acres, 0 otherwise.
- Hired manual labour: 1 if the household is primarily dependent on income from hired manual labour, 0 otherwise.
- Remittances and Pensions: 1 if the household is solely dependent on remittances and pensions, 0 otherwise.

R: Per capita foodgrain received from PDS ration shop

S: Social group dummies

- Scheduled Caste (SC): 1 if the household belonged to a Scheduled Caste, 0 otherwise.
- Scheduled Tribe (ST): 1 if the household belonged to a Scheduled Tribe, 0 otherwise

Gender: 1 if food insecurity data are for a woman, 0 otherwise.

The questions on food security were asked to a randomly selected adult member of each household and referred to food insecurity faced by that person (and not the household as a whole). Gender of the respondent is also included in the regression as an explanatory variable. However, since the relationship of gender with food security was complex, and varied across different economic classes, interaction dummies are used to examine the relationship between gender and food insecurity for different occupation classes.

- Woman from salaried employee (government) household: 1 if food security data are for a woman from a salaried employee (government) household, 0 otherwise.
- Woman from salaried employee (private) household: 1 if food security data are for a woman from a salaried employee (private) household, 0 otherwise.
- Woman from a self-employed (large) household : 1 if food security data are for a woman from a self-employed (Large) household, 0 otherwise.
- Woman from a self-employed (OAE) household: 1 if food security data are for a woman from a self-employed (OAE) household, 0 otherwise.
- Woman from a large peasant household: 1 if food security data are for a woman from a large peasant household, 0 otherwise.
- Poor and middle peasant: 1 if food security data are for a woman from a poor or middle peasant household, 0 otherwise.
- Hired manual labour: 1 if food security data are for a woman from a hired manual labour household, 0 otherwise.
- Remittances and pensions: 1 if food security data are for a woman from a household dependent on remittances and pensions, 0 otherwise.

An ordered Logit model is used for estimation. This is because the dependent variable takes only nine specific values of probability which are ordinal. It may be noted that the probability of being food insecure (dependent variable) is associated with a raw score, and therefore each observation has one of the nine different values of probability.

4.6.2 *Results*

Table 5 summarises the regression results from models estimated using the two dependent variables.

For both the models, probability of having more than the specified severity of food insecurity is negatively and significantly related to per capita cereal production of a household. In other words, greater availability of cereals from household operational holding reduces the probability of a person facing moderate+ food insecurity. It may be noted here that the extent of operational holding of the household was strongly correlated with per capita cereal production, and was therefore not used as an independent variable.

Association between occupation class of the household and food insecurity was determined by keeping the households belonging to government salaried employment class as the base category. The results show that persons belonging to all the occupational categories other than government salaried employees had higher probability of being food insecure. Households engaged in hired manual labour and households solely dependent on pensions and remittances were the most food insecure. These results were true for both the models and were strongly significant at 1 per cent.

It is clear that regular, assured and high salaries of government employees resulted in members of such households having relatively low probability of facing food insecurity. Persons belonging to large peasant households, households with large business enterprises and households with private salaried incomes did

not have a significantly higher probability of facing moderate+ or severe levels of food insecurity than the government salaried employees. In contrast, persons belonging to hired manual labour households, poor and middle peasant households, and households dependent on pensions and remittances had a higher probability of being severely food insecure than persons belonging to households with government salaried jobs. The regression results also show that persons belonging to Scheduled Tribes were significantly more food insecure than non-SC/ST households. The coefficients for Scheduled Caste individuals were not significant in either model. This is perhaps because the disparities between Scheduled Caste and non-SC/ST households were captured in other control variables because of occupational disparities and disparities in access to land between Scheduled Caste and non-SC/ST households.

Table 5: Regression of probability of being food insecure with per capita cereal production, primary occupation of the household, and per capita subsidised ration received from PDS, pooled survey data, India.

	Dependent variable: Probability of			
	Moderate+ Food Security (1)		**Severe Food Security (2)**	
Variable	Coefficient	p-value	Coefficient	p-value
Per capita cereal production (kg)	-0.098***	(0.000)	-0.089***	(0.000)
Self-employed (Large)	0.668*	(0.065)	0.658*	(0.067)
Large peasant	0.885**	(0.021)	0.819**	(0.032)
Self-employed (OAE)	1.11***	(0.000)	1.046***	(0.000)
Salaried employee (Private)	0.899*	(0.075)	0.917*	(0.071)
Poor and middle peasant	1.425***	(0.000)	1.416***	(0.000)
Hired manual labour	1.835***	(0.000)	1.827***	(0.000)
Remittances and Pensions	2.489***	(0.006)	3.695***	(0.003)
Per capita PDS ration received	0.014	(0.215)	0.02*	(0.08)
Scheduled Castes (SC)	0.174	(0.226)	0.2	(0.166)
Scheduled Tribes (ST)	0.706***	(0.000)	0.703***	(0.000)
Female: Salaried employee (Govt)	0.347	(0.282)	0.339	(0.293)
Female: Self-employed (Large)	0.382	(0.349)	0.432	(0.29)
Female: Large peasant	0.691	(0.111)	0.702	(0.102)
Female: Self-employed (OAE)	0.09	(0.692)	0.135	(0.548)
Female: Salaried employee (Private)	0.224	(0.672)	0.141	(0.79)
Female: Poor and middle peasant	-0.173	(0.292)	-0.15	(0.363)
Female: Hired manual labour	-0.019	(0.921)	-0.044	(0.813)
Female: Remittances and Pensions	-1.117	(0.253)	-2.036	(0.119)
Intercepts				
0–0.046	-0.17	(0.466)	-0.132	(0.572)
0.046–0.136	0.483**	(0.039)	0.52**	(0.026)
0.136–0.357	0.963***	(0.000)	1***	(0.000)
0.357–0.657	1.326***	(0.000)	1.363***	(0.000)
0.657–0.874	1.769***	(0.000)	1.806***	(0.000)
0.874–0.965	2.145***	(0.000)	2.183***	(0.000)
0.965–0.987	2.72***	(0.000)	2.759***	(0.000)
0.987–0.989	3.767***	(0.000)	3.528***	(0.000)
Residual Deviance:	5835.044		5837.473	
AIC:	5889.044		5891.473	

Note: * p<0.1; ** p<0.05; *** p<0.01.

Gender disparities in prevalence of food insecurity are not found to be statistically significant. This may be because, even though the questions were asked about their individual experiences of food insecurity, respondents do not always differentiate between their personal experiences and the experiences of the households as a whole. It may also be that there is a cultural gender bias in reporting of food insecurity experiences. These two factors can result in understating of gender differences in food insecurity experiences because of these coefficients may turn out to be statistically insignificant. While the results are not statistically significant, the signs of the coefficient are noteworthy. In case of hired manual workers, poor and middle peasants, and households dependent on remittances, the coefficients are negative, suggesting that men may have higher probability of facing moderate+ or severe food insecurity than women among such households. This is likely because men from such households are more likely to migrate for casual employment in the informal sector, and living precariously during such periods are exposed to high levels of food insecurity. In contrast, in large peasant households, households with own businesses, and households dependent on government salaried jobs, the coefficient is positive, suggesting the possibility of higher probability of women facing food insecurity than men in such households. The association between per capita PDS ration received and probability of being food insecure comes to be positive in both the models but significant only in model 2. This positive relationship between the two could be explained by the fact that the coverage of public distribution system in India is not universal. It is supposed to be targeted to people who are poor and food insecure, and therefore higher probability of being food insure is associated with persons belonging to households with ration cards. The targeting is stronger for belonging suffering from severe food insecurity. In the context of this relationship between access to subsidised ration and food insecurity, two caveats must be noted. First, as shown in Section 6.8, a significant proportion of food insecure households did not have access to ration cards. Secondly, given the limitations of the targeted public distribution system, it is clear that having a ration card and access to subsidised foodgrain through it was not sufficient to ensure that the households became food secure.

5 Conclusion

This paper examines the prevalence and determinants of food insecurity in rural India using the Food Insecurity Experience Scale (FIES), an experience-based measure that captures constraints in access to food through people's lived experiences. Using primary survey data from villages across six states—Jharkhand, Andhra Pradesh, Haryana, Madhya Pradesh, Manipur and Rajasthan—the study provides detailed insights into both the extent and underlying drivers of food insecurity across diverse socio-economic and agro-ecological contexts.

The results show that food insecurity remains widespread in the surveyed regions, with particularly high prevalence in Scheduled Tribe-dominated villages in Jharkhand, Andhra Pradesh and Madhya Pradesh. These regions are characterised by small and fragmented landholdings, low agricultural productivity, and limited access to irrigation and markets. Even in relatively better-off regions such as Haryana, a significant proportion of households face moderate or severe food insecurity, reflecting deep inequalities in land distribution and the persistence of precarious, informal employment.

The analysis of determinants highlights the central importance of access to productive assets and stable livelihoods. Households that are landless or cultivate only very small plots are among the most food insecure, underscoring the limited viability of marginal landholdings in ensuring subsistence. At the same time, the findings reveal that land ownership alone is not sufficient; the scale, quality, and productivity of land are equally critical. Households dependent on casual manual labour, low-paying private salaried work, or remittances exhibit the highest levels of food insecurity, reflecting the vulnerability associated with irregular and insecure income sources.

The study also shows that while collection from common property resources is widespread in forest-fringe villages, it does not significantly mitigate food insecurity. Forest-based livelihoods provide important

supplementary food and income, but their seasonal and uncertain nature, combined with declining access to resources, limits their effectiveness as a reliable safety net. Similarly, although the Public Distribution System reaches a large proportion of vulnerable households, exclusion errors and inadequate provisioning reduce its capacity to ensure food security. A notable share of food insecure households remain outside its coverage, and many beneficiaries receive less than their entitled quantities.

Gender disparities in food insecurity are found to be complex and context-dependent. While severe food insecurity is often higher among women, patterns vary across regions and occupational groups. In poorer households, men may face higher food insecurity due to migration and precarious working conditions, whereas in relatively better-off households, women may experience greater vulnerability, possibly reflecting intra-household inequalities in access to food and resources.

Overall, the findings suggest that food insecurity in rural India is shaped by the interaction of land access, livelihood structure, and social inequalities. Addressing food insecurity therefore requires a multi-dimensional approach that goes beyond expanding food transfers. Policies must focus on improving access to productive assets, enhancing agricultural productivity, strengthening rural employment opportunities, and ensuring more effective and inclusive delivery of social protection programmes.

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Declaration of generative AI and AI-assisted technologies in the manuscript preparation process

During the preparation of this work the author(s) used ChatGPT (OpenAI) in order to assist with language refinement, sentence restructuring, and improving overall coherence of the manuscript. After using this tool, the author(s) carefully reviewed and edited the content as needed and take full responsibility for the content of the published article.