Food Insecurity Among Community-Dwelling Older Adults in India: Exploring Residence Status and Regional Variability Using the LASI Survey 2017-19

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Abstract

Background and objectives: Food insecurity remains a significant public health concern in India, especially among older adults. In India, the complexity of addressing food insecurity is compounded by regional variations and a significant population of older adults living in rural areas. Therefore, targeted interventions are needed to address social inequality and its association with food insecurity affecting the ageing population, especially in under-resourced regions. This study aims to contribute towards achieving the Sustainable Development Goals by examining the rural-urban and regional variability in food insecurity among community-dwelling older adults in India.

Methods: The data for the present study was taken from Wave 1 of the Longitudinal Ageing Study in India (LASI), 2017-19. LASI utilized internationally comparable research designs, instruments, and scientific procedures to produce reliable and credible statistics for policymakers and long-term scientific studies. The present study incorporates individuals aged 60 years and more and includes 14696 women and 13707 men to map the prevalence of food insecurity. Food insecurity was assessed using four dichotomous questions, which included skipping meals, reducing meal size, going without food for a day, and weight loss due to lack of food. A "yes" response to any of these questions indicated food insecurity. Overall, food insecurity was defined as 1–4 positive responses to four items. The place of residence was categorized as rural and urban, and the geographical region was coded as North, Central, East, Northeast, West and South. Binary logistic regression was performed to confirm the findings.

Results: The study found that food insecurity was prevalent among older adults, with an overall prevalence of 8.8% (95% CI 8.4-9.1). The prevalence was significantly higher in rural areas, with 77.3% (95% CI 75.6-79.0) compared to 22.7% (95% CI 21.0-24.4) in urban areas. Food insecurity also varied significantly across different geographic regions, with the central region having a prevalence of 22.3% (95% CI 20.7-24.0) and the northeast region having a prevalence of 9.2% (95% CI 8.1-10.5). After adjusting for sociodemographic and health factors, it was found that older adults living in rural areas had 1.34 times higher odds of being food insecure than those living in urban areas (95% CI: 1.21-1.50, p<0.001). Additionally, older adults in the central region had higher odds of food insecurity with an adjusted odds ratio (AOR) of 1.71 (CI: 1.47-1.99, p<0.001), and those in the eastern region had an AOR of 1.59 (CI: 1.37-1.84, p<0.001) compared to those in the northern region.

Conclusions: The findings of the study indicate that it is important for policymakers and healthcare providers to prioritize the needs of older adults in under-resourced regions and to develop tailored interventions to address the specific social inequalities faced by this vulnerable population.

Introduction

Food insecurity is a multidimensional phenomenon defined as "a situation that exists when all people, at all times, have physical, social and economic access to sufficient, safe and nutritious food that meets their dietary needs and food preferences for an active and healthy life" [1]. Deprivation due to food insecurity and hunger is not only undesirable but can also contribute to poor dimensions of health and well-being [2]. The relationship between social inequalities and food insecurity has been extensively studied by researchers in developed countries [3-5]. However, food insecurity and hunger are complex and multifaceted in India [6,7]. Despite the country's significant economic progress over the last few decades, India continues to grapple with high levels of hunger and malnutrition [8-10]. In the most recent Global Hunger Index (2023), India ranks 107th out of the 121 studied countries, which shows that the country is at the end of the 'serious' category [11]. This is a major challenge to reach the zero hunger (Sustainable Development Goal 2) goal by 2030.

India, with a population of over 1.4 billion people, exhibits a remarkable degree of diversity, encompassing a wide range of cultural, social, and economic differences [12]. The immense range of diversity in India poses unique challenges in tackling the problem of food insecurity [13]. These variations significantly influence the availability, accessibility, and affordability of food, especially for vulnerable populations such as older adults [14]. Moreover, the concentration of older adults in rural areas (71.0%) further complicates the issue, as rural communities often face additional barriers to accessing adequate nutrition due to limited infrastructure and resources [15,16]. Exploring the rural-urban disparities in food insecurity among community-dwelling older adults in India can provide crucial insights for policy and intervention strategies. Furthermore, regional variability also plays a significant role in understanding food insecurity among older adults [17]. The country is geographically diverse, encompassing different climatic zones, agricultural practices, and cultural traditions across its states and regions. These regional variations influence the availability and accessibility of food resources and, consequently, the prevalence of food insecurity among older adults [7,18]. The impact of food insecurity on older adults is of significant concern, as it has broader implications for their health and well-being compared to the general population.

Older adults experience physiological changes, chronic health conditions, and limited mobility, making them more susceptible to the adverse effects of food insecurity [19,20]. The older adult population in India is expected to witness a rapid increase in the coming years. By 2050, it is projected to reach around 319 million, constituting around 20% of the total population [21]. To achieve Sustainable Development Goal 3, and promote well-being for all ages, understanding food insecurity nuances across geographical regions and rural-urban areas in India is crucial. By identifying and analyzing these disparities, targeted interventions can be designed to address the unique challenges faced by older adults in under-resourced regions. In light of these considerations, this study aims to investigate the rural-urban and regional variability in food insecurity among community-dwelling older adults in India. The findings from this research can inform evidence-based policies and programs that prioritize social equality and ensure that ageing populations in all regions have access to nutritious and sufficient food. Ultimately, this research contributes to the broader goal of ensuring food security and well-being among older adults in India.

Material and methods

Study sample: The data used in this study was obtained from the Longitudinal Ageing Study in India (LASI) Wave 1 2017-19. The LASI survey aimed to enhance the understanding of health issues among older adults in India and the processes associated with population ageing. To ensure the reliability and acceptability of the statistics, LASI employed internationally comparable research designs, instruments, and state-of-the-art scientific methodologies. The LASI Wave 1 collected comprehensive information on various aspects, including demographic characteristics, household economic status, health and biomarkers, health insurance and healthcare utilization, family and social networks, social security schemes, work and employment, retirement and pension, life satisfaction and expectations, including food insecurity. The study encompassed a sample size of 73,396 respondents, comprising 42,261 women and 31,135 men aged 45 years and above representing all states and union territories in India. LASI targeted community-dwelling Indian residents from both rural and urban areas, forming a diverse and representative cohort for longitudinal analysis. More detailed information about weights and survey design is available at https://www.iipsindia.ac.in/lasi. The present study only incorporates individuals aged 60 years and older and includes 14,696 women and 13,707 men to meet the specific objectives of the research.

Assessment of food insecurity: Food insecurity was measured by the four questions, as follows: (a) In the last twelve months, did you ever reduce the size of your meals or skip meals because there was not enough food in your household? (b) In the last twelve months, were you hungry but didn't eat because there was not enough food in your household? (c) In the past twelve months, did you ever not eat for a whole day because there was not enough food in your household? (d) Do you think that you have lost weight in the last twelve months because there was not enough food in your household? The study considered respondents who reported "yes" to at least one of these questions to be 'food insecure' [22]. Cronbach's α of 0.81 was obtained for the food insecurity scale in the present study.

Geographical region and residence: The study employed a methodology that took into account the classification of residence as rural or urban and the division of Indian states into distinct geographical regions. The geographical regions were categorized as follows:

- North: This region included Jammu and Kashmir, Himachal Pradesh, Punjab, Chandigarh, Uttarakhand, Haryana, Delhi, and Rajasthan.
- Central: The central region comprised Uttar Pradesh, Chhattisgarh, and Madhya Pradesh.
- East: West Bengal, Jharkhand, Odisha, and Bihar constituted the eastern region.
- Northeast: The northeastern region consisted of Sikkim, Arunachal Pradesh, Nagaland, Manipur, Mizoram, Tripura, and Assam.
- West: This region encompassed Goa, Gujarat, Daman and Diu, Maharashtra, Dadra and Nagar Haveli.
- South: The southern region included Andhra Pradesh, Karnataka, Lakshadweep, Kerala, Tamil Nadu, Puducherry, Andaman and Nicobar Islands, and Telangana.

Covariates: The factors associated with food insecurity in the study population were carefully examined. These factors included age, gender (male and female), educational attainment (less than primary education and primary education completed), current

employment status (currently working and retired/not working), economic status (poorer, poor, middle, rich, richer), experiences of everyday discrimination (yes or no), presence of depressive symptoms (yes or no), limitations in activities of daily living (ADL) (yes or no), limitations in instrumental activities of daily living (IADL) (yes or no), and indicators of malnutrition (body mass index, BMI). ADL and IADL are categorized as 'yes' if they faced limitations in performing one or more aspects and 'no' if the respondent did not face any limitations. Economic status was assessed through Monthly Per Capita Expenditure (MPCE), where MPCE denotes total monthly household consumption expenditure divided by household size. Includes households' per capita spending on food and non-food items, including health, education, utilities, etc. In the present study, MPCE's poorest or poor were coded as low economic status, middle as middle economic status, and richest or richer as high economic status.

Institutional Review Board Statement: The present study was exempted from any ethical consideration as the LASI Wave 1 survey already received ethical clearance from the Ethical Review Board of the Indian Council of Medical Research (ICMR) before the survey.

Informed Consent Statement: The study used a data set available online in the public domain; hence, there was no need to seek ethical consent to publish this study.

Statistical Analysis: Descriptive statistics were conducted to analyze the data in the study and to assess any variations in the distribution of food insecurity across the different variables, a chi-square test and t-test were utilized. Furthermore, multiple binary logistic regression models were employed to examine the association between food insecurity and regional variation as well as residence variation. These models were adjusted for variables that showed significance in the bivariate models. The data were analyzed using IBM Statistical Package for Social Sciences (IBM SPSS), version 25.0.

Results

Sample characteristics: Table 1 presents the characteristics of the sample of older adults (aged 60 years and above) categorized by their food insecurity status in India. Out of the total 28,403 older adults included in the study, the overall prevalence of food insecurity was 8.8% (n=2,489). Notably, food insecurity was significantly higher in rural areas, accounting for 77.3% (n=1,925) of the cases, compared to 22.7% (n=564) in urban areas. There were also significant variations in food insecurity across different geographic regions. The eastern region had the highest prevalence at 24.7% (n=615), while the northeast region had a prevalence of 9.2% (n=230). Additionally, the study found that women (n=1,353, 54.4%), individuals with less than primary education (n=1,974, 79.3%), and those with a poorer economic status (n=695, 27.9%) were more food insecure. Further details are depicted in Table 1.

Table 1. Characteristics of older adults (aged 60 years and above) categorized by the food insecurity status in India during the year 2017-19

| | Total N=28403 | Food Insecurity status | | Test-value | p-value |
		Secure n=25914, 91.2%	Insecure n=2489, 8.8%		
Age, mean (SD)	68.6±7.2	68.6±7.3	68.7±7.3	t=-0.05	0.960
Gender, %					
Male	13707 (48.3)	12571 (48.5)	1136 (45.6)	χ^2=7.5	0.006
Female	14696 (51.7)	13343 (51.5)	1353 (54.4)		
Residence, %					
Rural	18976 (66.8)	17051 (65.8)	1925 (77.3)	χ^2=136.4	<0.001
Urban	9427 (33.2)	8863 (34.2)	564 (22.7)		
Geographical region, %					
North	5226 (18.4)	4901 (18.9)	325 (13.1)	χ^2=321.6	<0.001
Central	3796 (13.4)	3240 (12.5)	556 (22.3)		
East	5254 (18.5)	4640 (17.9)	614 (24.7)		
Northeast	3706 (13.0)	3476 (13.4)	230 (9.2)		
West	3730 (13.1)	3475 (13.4)	255 (10.2)		
South	6691 (23.6)	6182 (23.9)	509 (20.4)		
Educational status, %					
<Primary Education	18726 (65.9)	16752 (64.6)	1974 (79.3)	χ^2=217.4	<0.001
≥Primary Education	9677 (34.1)	9162 (35.4)	515 (20.7)		
Present working status, %					
Working	8579 (30.2)	7739 (29.9)	840 (33.7)	χ^2=16.3	<0.001
Retired/not working	19824 (69.8)	18175 (70.1)	1649 (66.3)		
Economic status, %					
Poorer	5803 (20.4)	5108 (19.7)	695 (27.9)	χ^2=134.9	<0.001
Poor	5870 (20.7)	5308 (20.5)	562 (22.6)		
Middle	5837 (20.6)	5350 (20.6)	487 (19.6)		
Richer	5599 (19.7)	5189 (20.0)	410 (16.5)		
Richest	5294 (18.6)	4959 (19.1)	335 (13.5)		
Everyday discrimination, %					
Yes	4532 (16.0)	3659 (14.1)	873 (35.1)	χ^2=743.6	<0.001
No	23871 (84.0)	22255 (85.9)	1616 (64.9)		
Depressive symptoms, %					
Yes	7745 (27.3)	6526 (25.2)	1219 (49.0)	χ^2=648.2	<0.001
No	20658 (72.7)	19833 (74.8)	1270 (51.0)		
ADL, %					
Yes	5553 (19.6)	4805 (18.5)	748 (30.1)	χ^2=191.3	<0.001
No	22850 (80.4)	21109 (81.5)	1741 (69.9)		
IADL, %					
Yes	12159 (42.8)	10775 (41.6)	1384 (55.6)	χ^2=182.4	<0.001
No	16244 (57.2)	15139 (58.4)	1105 (44.4)		
BMI, mean (SD)	22.1±4.7	22.3±4.7	20.9±4.4	t=14.3	<0.001

Table 2. Association of food insecurity with the residence status of Indian older adults (aged 60 years and above), 2017-19

	Model I			Model II			Model III		
	OR	95% CI	p-value	AOR	95% CI	p-value	AOR	95% CI	p-value
Residence									
Rural	1.8	1.6-2.0	<0.001	1.5	1.4-1.7	<0.001	1.3	1.2-1.5	<0.001
Urban		Reference			Reference			Reference	
Gender									
Male					Reference			Reference	
Female				1.0	0.9-1.1	0.954	1.0	0.9-1.1	0.737
Education									
<Primary				1.7	1.6-1.9	<0.001	1.4	1.3-1.6	<0.001
≥Primary					Reference			Reference	
Present work status									
Yes					Reference			Reference	
No				0.90	0.82-0.98	0.020	0.78	0.71-0.86	<0.001
Economic status									
Poorer				1.78	1.55-2.04	<0.001	1.6	1.4-1.9	<0.001
Poor				1.42	1.23-1.64	<0.001	1.4	1.2-1.6	<0.001
Middle				1.25	1.08-1.44	0.003	1.2	1.1-1.4	0.009
Richer				1.11	0.95-1.29	0.180	1.1	0.9-1.3	0.212
Richest					Reference			Reference	
Everyday discrimination									
Yes							2.5	2.3-2.8	<0.01
No								Reference	
Depression									
Yes							2.2	2.0-2.4	<0.001
No								Reference	
ADL									
Yes							1.5	1.3-1.7	<0.001
No								Reference	
IADL									
Yes							1.2	1.0-1.3	<0.001
No								Reference	
BMI							0.96	0.95-0.97	<0.001

Note: Mode I, unadjusted; Mode II, adjusted for gender, education, present work status and economic status. Model III is fully adjusted. OR: odds ratio, CI: Confidence Interval

Association of food insecurity with residence status: Table 2 presents the findings on the relationship between food insecurity and residence status among older Indian adults. The unadjusted model (Model I) showed that rural older adults had significantly higher odds of food insecurity compared to those in urban areas (OR= 1.8, 95% CI= 1.6-2.0, p<0.001). After adjusting for sociodemographic factors (Model II), the association remained significant, with rural older adults having 1.5 times higher odds of food insecurity (AOR= 1.5, 95% CI= 1.4-1.7, p< 0.001) compared to urban older adults. Even after further controlling for additional factors such as everyday discrimination, depression, ADL, IADL, and BMI (Model III), the association between residence status and food insecurity persisted, with rural older adults having 1.3 times higher odds of food insecurity (AOR= 1.3, 95% CI= 1.2-1.5, p< 0.001) compared to urban older adults.

Table 3. Association of food insecurity with the geographical region of Indian older adults (aged 60 years and above), 2017-19

	Model I			Model II			Model III		
	OR	95% CI	p-value	AOR	95% CI	p-value	AOR	95% CI	p-value
Region									
North		Reference			Reference			Reference	
Central	2.3	2.0-2.6	<0.001	2.1	1.8-2.4	<0.001	1.7	1.5-2.0	<0.001
East	1.8	1.6-2.1	<0.001	1.7	1.4-1.9	<0.001	1.6	1.4-1.8	<0.001
Northeast	0.9	0.8-1.1	0.402	0.9	0.7-1.1	0.149	1.0	0.9-1.2	0.726
West	1.1	0.9-1.3	0.330	1.1	0.9-1.3	0.333	1.1	0.9-1.3	0.552
South	1.3	1.1-1.5	<0.001	1.3	1.1-1.5	0.001	1.1	1.0-1.3	0.202
Residence									
Rural				1.4	1.3-1.6	<0.001	1.3	1.1-1.4	<0.001
Urban					Reference			Reference	
Gender									
Male					Reference			Reference	
Female				1.0	0.9-1.1	0.734	1.0	0.9-1.1	0.698
Education									
<Primary				1.8	1.6-1.9	<0.001	1.5	1.4-1.7	<0.001
≥Primary					Reference			Reference	
Present work status									
Yes					Reference			Reference	
No				0.90	0.82-0.99	0.025	0.77	0.70-0.85	<0.001
Economic status									
Poorer				1.5	1.3-1.7	<0.001	1.5	1.3-1.7	<0.001
Poor				1.3	1.1-1.5	0.001	1.3	1.1-1.5	0.005
Middle				1.2	1.0-1.3	0.047	1.2	0.9-1.3	0.054
Richer				1.1	0.9-1.2	0.388	1.1	0.9-1.2	0.361
Richest					Reference			Reference	
Everyday discrimination									
Yes							2.5	2.3-2.7	<0.001
No								Reference	
Depression									
Yes							2.2	2.0-2.3	<0.001
No								Reference	
ADL									
Yes							1.5	1.3-1.6	<0.001
No								Reference	
IADL									
Yes							1.2	1.1-1.4	<0.001
No								Reference	
BMI							0.97	0.96-0.98	<0.001

Note: Mode II, adjusted for sex, education, present work status and economic status. Model III is fully adjusted. OR: odds ratio, CI: Confidence Interval

Association of food insecurity with the geographical region: Table 3 presents the association between food insecurity and geographical region among older Indian adults. In the unadjusted model (Model-I), the Central (OR= 2.3, 95% CI= 2.0-2.6, p< 0.001), East (OR= 1.8, 95% CI= 1.6-2.1, p< 0.001) and South (OR= 1.3, 95% CI= 1.1-1.5, p< 0.001) regions showed significantly higher odds of food insecurity compared to the North

region. After adjusting for sociodemographic factors (Model II), the associations remained significant, with the Central (AOR= 2.1, 95% CI= 1.8-2.4, p< 0.001), East (AOR= 1.7, 95% CI= 1.4-1.9, p< 0.001) and South (OR= 1.3, 95% CI= 1.1-1.5, p< 0.001) region having higher odds of food insecurity compared to the North region. However, the Northeast and West regions did not show significant associations with food insecurity. In the fully adjusted model (Model III), controlling for additional factors, the associations between the Central (AOR= 1.7, 95% CI= 1.5-2.0, p< 0.001) and East (AOR= 1.6, 95% CI= 1.4-1.8, p< 0.001) regions with food insecurity remained significant. Additionally, rural residence (AOR= 1.3, 95% CI= 1.1-14, p< 0.001) was also significantly associated with higher odds of food insecurity.

Discussion

The results of the present study reveal important insights into the rural-urban and regional disparities in food insecurity among community-dwelling older adults in India. The overall prevalence of food insecurity in this study was found to be 8.8%, which is lower than the prevalence of 18.5% reported in a study by Smith and colleagues (2023) using data from the World Health Organization's Study on Global AGEing and Adult Health (SAGE) collected between 2007 and 2010 [23]. Nevertheless, it is crucial to acknowledge that the study conducted by Smith and colleagues (2023) focused on individuals aged 50 years and above and utilized older data compared to the present study. Despite these differences, both the study suggests food insecurity is a persistent issue of inadequate access to nutritious food in this vulnerable population. Consequently, it underscores the need to prioritize and target efforts to address food insecurity across various regions and settings in the country.

In terms of the rural-urban divide, the current study revealed a notable discrepancy in the prevalence of food insecurity between rural areas (77.3%) and urban areas (22.7%), highlighting the increased susceptibility of older adults living in rural regions. One of the notable strengths of this study is its comprehensive control of sociodemographic factors, physical and psychosocial health, and lifestyle factors, which enhances the robustness of the relationship between rural residence and a higher likelihood of experiencing food insecurity. These results align with previous research that has consistently shown limited access to food stores and a lack of healthy food choices among the older population in rural areas [24-26]. The study by McKay and colleagues (2023) further supports the need for focused research on food insecurity in rural areas, considering that more than 70% of India's population resides in these regions [7]. The present study fills an important gap in the existing literature by providing valuable insights into the impact of residence status on food insecurity among older adults in India.

The study also investigated regional disparities in food insecurity among older adults and found significant associations between certain regions (Central and East) and higher odds of food insecurity, even after accounting for various factors. Notably, previous studies have also highlighted the presence of food insecurity in these regions, emphasizing the need for targeted interventions [27-32]. These studies have reported alarming levels of food insecurity and poverty in states like Madhya Pradesh, Jharkhand, Odisha, and Bihar, which require focused efforts to improve the economic status and alleviate food insecurity. The particularity of the current study lies in its exclusive emphasis on the older adult population, thereby addressing a research gap that exists in the current body of literature. The findings underscore the necessity for state-level policy-

making in a heterogeneous country like India, where a one-size-fits-all approach may not effectively address the needs of vulnerable groups, especially older adults. Targeted policies and interventions tailored to specific regions and populations are crucial for effectively tackling food insecurity among older adults in India.

This study possesses several strengths. It is a novel investigation conducted on a large-scale national dataset encompassing community-dwelling aged populations. To the best of the author's knowledge, this study stands as the first of its kind to examine the burden of food insecurity and its association with geographic region as well as residence status. The study aligns with the 2030 Sustainable Development Goals and seeks to address a gap in the existing literature by offering estimates of the present prevalence of food insecurity and identifying social inequalities associated with it among the old age population. However, it is important to note that this study is cross-sectional in nature, which limits its ability to establish causal relationships. Another limitation of this study is the use of self-reported measures of food insecurity, which may introduce response bias and subjective interpretation of the participants. To overcome potential bias in self-reported measures of food insecurity, future studies could consider utilizing objective measures such as household food expenditure or nutritional biomarkers to provide a more accurate assessment of food insecurity.

Conclusion:
The present study provides important insights into the rural-urban and regional disparities in food insecurity among older adults in India. The study's strengths lie in its use of a large-scale national dataset and its focus on older adults, filling a gap in the existing literature. In order to achieve the 2030 Sustainable Development Goals, it is crucial to address food insecurity among older adults in India. The study highlights the need for targeted efforts and state-level policy-making to address this issue. By understanding the underlying factors contributing to food insecurity and implementing targeted interventions, policymakers can work towards ensuring that older adults have access to sufficient and nutritious food, ultimately improving their overall well-being and quality of life.

Data sharing statement: The detailed methodology with complete survey design and data collection information is available at https://www.iipsindia.ac.in/lasi.

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