Multi-Dimensional Evaluation of Food Security Among Rural Women Agricultural Workers in Puducherry

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Abstract

Purpose : Multidimensional research on food security was vital in an era marked by changing dietary requirements, expanding populations, and shifting climate patterns. This study evaluated food security from multiple angles for rural women who work as agricultural laborers in Puducherry.

Methodology : A mixed-method approach was employed, and data were collected from a random sample of 5,044 female agricultural workers across all 98 rural revenue villages in the union territory of Puducherry. Through a combination of data analysis, the research also studied the percentage of respondents who were most insecure, insecure, secure, and most secure through simple statistical methods and the relationship between food security status and other parameters such as type of ration card, daily wages, days of employment and income per month.

Findings : The study revealed that 0.5% to 7.0%, 7.1% to 27.3%, 8.9% to 26.0%, and 57.9% to 69.7% of the respondents were the most insecure, insecure, secure, and secure groups, respectively. The study also revealed that most individuals in all categories hold the below-poverty line (BPL) card. The most insecure category had a higher percentage of respondents earning lower wages (<₹150) and employed for fewer days (<15). In contrast, those in the most secure category had a more significant proportion of individuals earning higher wages (>₹300) and employed for more days (>25). A substantial proportion had an income in the range of ₹3,000–₹10,000.

Implications : The results underscore the reliance on external sources for food, sacrifices made for children, and the importance of socioeconomic factors. The findings offered insights for targeted interventions and policy improvements to address food security challenges effectively.

Originality : This micro-level study offered a granular perspective, delving into the specific dynamics that shape food security at local levels – within communities, households, and individuals.

Keywords : **food security, rural women, agricultural workers, availability, accessibility, utilization, stability, sustainability, affordability, safety, nutritional quality, governance, policy**

JEL Classification Codes : J16, J21, J24, J31, J43

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A fundamental component of human well-being is food security. Multi-faceted research on food security is essential in a world where changing dietary needs, fluctuating climatic patterns, and an expanding population are all major issues. While global and national analyses provide invaluable insights, it is at

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the micro level that the true intricacies of the issue are revealed. Micro-level studies offer a granular perspective, delving into the specific dynamics that shape food security at local levels – within communities, households, and individuals. The demand for such micro-level studies is driven by the urgency to create targeted strategies to uplift the most vulnerable and build resilient food systems for a sustainable future. The present study attempts to analyze various dimensions of food security, understand the food security status at the national and regional level, and uses the bottom-up approach to uncover hidden vulnerabilities, tailor interventions to precise contexts, and amplify the effectiveness of policy and action.

Definition and Dimensions of Food Security

Food security is a fundamental human right closely linked to the Right to Food, recognized under Article 21 of the Constitution of India. The World Food Summit of 1996 defines food security as the condition achieved "when all people, at all times, have physical and economic access to sufficient, safe, and nutritious food that meets their dietary needs and food preferences for an active and healthy life" (FAO, 1996). Multidimensional research on food security is vital in a world where expanding populations, changing climatic patterns, and changing dietary needs are all faced.

Food produced locally and imported from other areas are both considered available, guaranteeing an adequate supply of food to suit the populace's demands. Accessibility includes socio-cultural, physical, and financial access, guaranteeing that food is available to all societal groups and acceptable in their respective cultures. Utilization focuses on the individual's ability to consume adequate quantities of food of the required quality, enabling them to lead healthy lives and realize their full potential. It considers food's nutritional value, ensures a range of nutrient-dense foods are accessible, and supplies essential vitamins, minerals, and other nutrients needed for normal growth and development.

Stability addresses the capacity of nations, communities, households, and individuals to withstand shocks to the food chain system, be they natural disasters or man-made crises. It involves maintaining food security in climate-related events, economic downturns, or conflicts. Sustainability encompasses ecological factors, such as biodiversity and climate change, as well as socio-cultural and economic aspects. It emphasizes the long-term perspective and considers the implications of present actions on the food security of future generations.

Affordability ensures that individuals have the financial means to access food without facing financial hardships and safety, which addresses the need for food to be free from contamination and harmful substances, safeguarding consumer health. Furthermore, food sovereignty emphasizes the rights of individuals and communities to determine their own food and agricultural systems, ensuring local control and decision-making power over production, distribution, and consumption. Effective governance and policy frameworks are vital in achieving food security and establishing supportive policies, regulations, and institutions that facilitate equitable access to food and sustainable agricultural practices.

The relationship between space and time influences the dimensions of food security. Availability and accessibility operate at global, national, local, and household levels, ensuring adequate food is produced and imported to meet the population's needs. Utilization focuses on the individual level, addressing the quality and quantity of food required for a healthy life. Together, these dimensions represent the spatial aspect of food security. In addition to space, time plays a crucial role in food security. The stability dimension addresses the short-term time dimension, considering the ability of nations, communities, households, and individuals to withstand shocks to the food chain system, whether caused by natural disasters or man-made crises. It involves the resilience and adaptive capacity to maintain food security during challenging times. Sustainability introduces the long-term time dimension to food security. It considers ecological factors such as biodiversity, climate change, and socio-cultural and economic factors. Sustainable food security ensures that present actions do not compromise the ability of future generations to meet their food needs.

The stability and sustainability dimensions, which function over varying timescales, impact the availability and accessibility of space dimensions. While sustainability is a long-term time dimension that prioritizes ecological factors, stability is a short-term time dimension including socio-cultural elements. Addressing all these dimensions and the relationship between space and time is crucial for achieving complete food security. It requires integrated approaches that consider the global, national, local, household, and individual levels and account for both present needs and future generations.

Status of Food Security

Food security in India is still a complicated issue and a major source of concern. India, one of the most populated nations on earth, has the difficult responsibility of making sure that its people always have access to enough food that is safe and nourishing.

Various global indicators and assessments provide insights into the country's food security situation. One such indicator is the Global Food Security Index (GFSI), which assesses the food security performance of countries worldwide. According to the GFSI, India has improved in recent years but still ranks below the global average, highlighting the need for further efforts to enhance food security. According to the United Nations Food and Agriculture Organization (FAO), despite food production and availability progress, a significant portion of the Indian population continues to face challenges in accessing nutritious food. According to FAO estimates, a significant portion of India's population suffers from chronic hunger and malnutrition, underscoring the necessity of focused initiatives to address these problems successfully.

Agricultural production plays a crucial role in India's food security landscape. The country has a diverse agricultural production basket, including rice, wheat, pulses, fruits, and vegetables. Rice and wheat, in particular, are staple food crops and form a significant part of the Indian diet. The quantity of agricultural production in terms of crop yield and livestock is essential for ensuring food availability and accessibility. However, fluctuating weather patterns, water scarcity, and limited access to modern farming techniques can impact agricultural production and food security.

In recent years, India has made strides in increasing agricultural production and enhancing self-sufficiency. The Green Revolution, initiated in the 1960s, boosted crop yields and transformed India into a food-surplus nation. The government has also implemented various schemes and programs to support farmers, improve irrigation facilities, promote sustainable farming practices, and enhance agricultural productivity. These efforts have contributed to increased food production, but further advancements are necessary to meet the growing demands of a burgeoning population and ensure long-term food security.

India's high poverty rate is one of the main obstacles to food security. The poverty line continues to be reached by a sizable section of the populace, especially in rural areas. A sufficient and well-balanced diet can be difficult for those whose purchasing power is restricted by poverty. Consequently, many people and families struggle to achieve their dietary requirements.

Malnutrition is another critical aspect of the food security situation in India. While the country has made progress in reducing undernutrition, the prevalence of malnutrition, particularly among children, remains alarmingly high. India continues to face challenges related to stunting, wasting, and micronutrient deficiencies, which can have long-term consequences on individuals' physical and cognitive development.

The state of food security in India is made worse by the unequal distribution of resources and restricted access to food. Unequal access to nutrient-dense food is a result of differences in socioeconomic class and income, especially for disadvantaged and marginalized communities. Limited access to markets, lack of infrastructure, and inadequate storage facilities further impede the efficient distribution of food across the country.

Climate change, environmental concerns, and agricultural methods affect India's food security. Smallholder farmers, who employ a large percentage of the agricultural workers, frequently struggle with issues including

unpredictability in weather patterns, poor irrigation facilities, and restricted access to loans. Climate change-related events like droughts and floods can lead to crop failures and jeopardize food production.

The Indian government has implemented various initiatives and programs to address these challenges and improve food security. The National Food Security Act, enacted in 2013, aims to provide subsidized food grains to eligible households, ensuring a certain level of food access. Additionally, schemes like the Integrated Child Development Services (ICDS) and the Mid-day Meal Scheme focus on addressing malnutrition among children.

Despite these efforts, India still has a long way to go in achieving comprehensive food security. It requires a multi-faceted approach encompassing increased agricultural productivity and targeted interventions to reduce poverty, improve access to nutritious food, and enhance resilience to climate change. Strengthening social safety nets, investing in agricultural research and development, promoting sustainable farming practices, and enhancing rural infrastructure are among the strategies that can enhance food security in the country.

Puducherry, formerly known as Pondicherry, is a union territory in southern India. It comprises four enclaves of former French India, namely Pondicherry, Karaikal, Yanam, and Mahe, encompassing 490 square kilometers (49,000 hectares). The geographical setting of Puducherry is characterized by its surrounding states: the Puducherry and Karaikal regions are bordered by Tamil Nadu in the Cauvery Delta region, Kerala surrounds the Mahe region, and Andhra Pradesh surrounds the Yanam region.

Within Puducherry's union territory, land usage distribution highlights important agricultural statistics. The net area sowed accounts for approximately 31.46% (15,307 hectares) of the total area, while the total cropped area encompasses 54.91% (26,716 hectares) of the territory. Notably, 23.45% (11,409 hectares) of the area is used for multiple cropping, indicating land utilization for more than one crop during a single agricultural season. Regarding irrigation, the net irrigated area covers approximately 28.60% (13,918 hectares) of the region, while the gross irrigated area represents 46.43% (22,589 hectares) of the total area.

During the agricultural year 2019–2020, significant food production was observed within the union territory of Puducherry. Table 1 presents the specifics of the food production and offers insightful information about crop varieties, productivity, and total food availability. These figures overview Puducherry's agricultural environment and serve as a starting point for evaluating the area's food security.

Table 1 lists the food produced locally in Puducherry union territory in 2019–2020. The extra food needed is brought into the Puducherry Union Territory from nearby states like Tamilnadu, Kerala, and Andhra Pradesh, where agriculture is one of the main industries.

Table 1. ***Food Production in the UT of Puducherry During 2019–2020***

S. No	Item	Quantity Per Year
1	Food grains	64.156 Tonnes
2	Rice	63.343 Tonnes
3	Sugarcane	187.720 Tonnes
4	Milk	49.500 Metric Tonnes
5	Egg	113.78 Lakhs
6	Meat (Livestock)	7247.35 Metric Tonnes
7	Meat (poultry)	7388.04 Metric Tonnes
8	Marine Fish	37481.43 Metric Tonnes
9	Inland Fish	6025.66 Metric Tonnes

Source : Directorate of Economics & Statistics (2020). *Puducherry at a Glance-2020*. Government of Puducherry.

Literature Review

The literature review on food security in India provides valuable insights into various dimensions of the topic, encompassing studies conducted by multiple researchers. The selected works shed light on key aspects such as the impact of climate change, policy interventions, agricultural practices, gender dynamics, socio-economic determinants, migration, urban food systems, technological innovation, land degradation, agricultural diversification, and food waste. Collectively, these studies contribute to the overall understanding of the complexities surrounding food security in India and offer valuable perspectives on addressing the challenges at hand.

Rani and Reddy (2023) explored the impact of climate change on food security, emphasizing the need for climate-resilient agricultural practices, risk management strategies, and disaster preparedness to mitigate the adverse impacts on food production and access. Lencucha et al. (2020) examined the role of agricultural policies in enhancing food production. They found that input support, output support, and technical support impacted production, income, and other outcomes.

Singhal and Gupta (2020) analyzed the role of institutional credit, the area cultivated, and the use of fertilizers in increasing agricultural production. Giribabu (2021) studied the impact of the National Rural Livelihood Mission in three districts of Nagaland and highlighted its contribution to socioeconomic improvement. De Souza and Pai (2012) highlighted that microfinance facilitates rural women's socio-economic empowerment, thereby increasing consumption. Sonam et al. (2019) studied the SHG-bank linkage model of microfinance using Poisson regression and its contribution to socioeconomic empowerment. Narayanan (2021) emphasized the importance of bringing additional food sources into the mainstream and specifically acknowledged the contribution of free collection to increasing dietary adequacy and quality.

Gangadhara Rao (2014) estimated the transformation in rural labor in terms of its composition and wages and suggested that farming should be mechanized to nullify the negative wage impact on the cost of cultivation. Wolde (2021) highlighted the importance of creating regional or international integration, enabling countries to exchange, share and adopt technologies that ultimately increase production and strengthen technology adoption and extension services, access and provision of input and output markets, rural infrastructural development, credit access, and development of irrigation canals.

Singh and Mahajan (2017) compared the cost and profitability of conventional and organic wheat cultivation. They suggested that instead of switching from conventional to organic techniques, conventional techniques need to be blended with organic techniques by incorporating organic techniques for national food and nutritional security.

Sahu (2019) explored the food security status of the Bhuiya community in the Palamu district of Jharkhand and revealed that food security among the households is seasonal and cyclic, and food distribution priority is children rather than men and then women. Roy (2017) explored the determinants of hunger through multivariate logistic regression analysis and showed that hunger is negatively and significantly influenced by per-capita food grain production and is positively and significantly affected by poverty, price level, and economic growth.

These studies highlighted the need for adaptive strategies, policy coherence, improved governance, gender-sensitive approaches, targeted interventions, and sustainable practices to address food security challenges. In pursuing comprehensive and successful food security measures, the researchers' insights highlight the significance of considering agricultural practices, policy frameworks, nutritional aspects, migration, urbanization, technological innovation, land management, agricultural diversification, and food waste.

The literature review provides a current level of knowledge about food security in India through a detailed analysis and synthesis of the research findings from various studies. It acts as a basis for additional study, directing the investigation of viable remedies and policy suggestions to improve food security, lessen vulnerabilities, and guarantee fair access to wholesome, sustainable, and safe food for all demographic groups.

Objectives

The objectives of the present study are summarized as follows:

- To provide insights into the overall food security.
- To assess the degree of food security among rural women employed in agriculture in Puducherry's UT.
- Based on their degrees of food security, these rural women agricultural workers should be divided into the most insecure, insecure, secure, and secure groups.
- To investigate the relationship between food security and variables including ration card type, daily earnings, number of workdays, and monthly income.
- To determine possible policy ramifications and suggestions for enhancing rural women agricultural workers' food security.

Methodology

There are 129 revenue villages spread throughout Puducherry's union territory, divided into various regions. The Mahe and Yanam regions are categorized as urban, whereas urban and rural areas characterize the Karaikal and Puducherry regions. As per the 2011 Census, Puducherry's population is 12,47,953, with women accounting for 6,35,442 individuals. The Department of Economics and Statistics, Government of Puducherry, estimated that there were 50,607 rural women engaged in agricultural labor in 2019.

For this study, a total of 5,044 female agricultural workers were randomly selected from 98 revenue villages in the rural areas of the Pondicherry and Karaikal regions. The survey was conducted from 2022 to 2023. The evaluation of levels of food security was done by asking the respondents the following seven specific questions:

(1) How many times in the past three months did your household have no food because of a lack of resources?

(2) How often has your household relied on wild or locally available foods and meats in the past three months?

(3) How many times in the past three months did your household borrow food?

(4) How often have your relatives and friends given you food in the past three months?

(5) How many times have you borrowed food on credit from a shop in the past three months?

(6) In the last three months, how often did adult members cut back on their food intake to ensure the kids had enough to eat?

(7) How many times have you sent your children to live with relatives in the past three months due to a lack of food?

The respondents are provided with four response options for each question:

- Frequently (3–7 days/week)
- Sometimes (1–2 days/week)
- Once in a while (2–3 days/month)
- Never

These response options are designed to correspond to varying levels of food security: *Most insecure, insecure, secure, and most secure*. For each question, the respondents are categorized into one of these four groups based on their responses, and the percentages of respondents in each group were computed. The total percentages for the four food security categories are determined using the combined answers to all seven questions.

The Likert Scaling Method was also employed to group the respondents into four categories (most insecure, insecure, secure, and most secure) based on their overall food security status. The percentages of respondents in each category are calculated, and the least common and highest common percentages for each category are determined.

During the survey, data on various factors and parameters are collected, including the type of ration card, daily wage, days of employment, and family income. The correlation between these factors and food security is analyzed to establish their relationship.

This methodology provided a comprehensive framework for evaluating food security levels and understanding its associated factors. The information gathered and examined this way improved our comprehension of food security in the chosen Puducherry regions. They made it possible to pinpoint the main variables affecting food security.

Analysis and Results

The questionnaire-based replies from the respondents are tallied, compiled, and examined, as explained below:

Table 2 shows the frequency distribution among different categories with the number of respondents who have no food due to lack of resources and their percentage. There are 5,044 respondents; 239 of them do not have food very frequently (3–7 days/week), 964 do not have it occasionally (1–2 days/week), 848 do not have it occasionally (2–4 days/month), and 2,993 never have any issues getting food because of a lack of resources. Due to a lack of resources, 4.7%, 19.2%, 16.8%, and 59.3% of rural agricultural women workers in the UT of Pondicherry, respectively, are the most insecure, insecure, secure, and most secure.

Table 3 displays the frequency distribution across the various categories and the percentage and number of

Table 2. ***Frequency Distribution of Respondents Having no Food to Eat Because of Lack of Resources***

Q1. How often in the past three months has your household had no food because of a lack of resources?	Category	Number of Respondents	Percentage
(A) Frequently (3–7 days/week)	Most Insecure	239	4.70
(B) Sometimes (1–2 days/week)	Insecure	964	19.20
(C) Once in a while (2–3 days a month)	Secure	848	16.80
(D) Never	Most Secure	2,993	59.30
Total		5,044	100.00

Table 3. ***Frequency Distribution of Respondents Relying on Wild/Nearby Fields for Food***

Q2. How often has your household relied on wild or locally available foods and meats in the past three months?	Category	Number of Respondents	Percentage
(A) Frequently (3–7 days/week)	Most Insecure	187	3.7
(B) Sometimes (1–2 days/week)	Insecure	1,375	27.3
(C) Once in a while (2–3 days a month)	Secure	450	8.9
(D) Never	Most Secure	3,032	60.1
Total		5,044	100.00

Table 4. ***Frequency Distribution of Respondents Borrowing Food***

Q3. How many times in the past three months did your household borrow food?	Category	Number of Respondents	Percentage
(A) Frequently (3–7 days/week)	Most Insecure	153	3.0
(B) Sometimes (1–2 days/week)	Insecure	777	15.4
(C) Once in a while (2–3 days a month)	Secure	999	19.8
(D) Never	Most secure	3,115	61.8
Total		5,044	100.0

Table 5. ***Frequency Distribution of the Number of Times Relatives and Friends Give Food***

Q4. How often have your relatives and friends given you food in the past three months?	Category	Number of Respondents	Percentage
(A) Frequently (3–7 days/week)	Most Insecure	132	2.6
(B) Sometimes (1–2 days/week)	Insecure	672	13.3
(C) Once in a while (2–3 days a month)	Secure	993	19.7
(D) Never	Most Secure	3,247	64.4
Total		5,044	100

respondents who relied on the field for food. Among the 5,044 responders, 187, 1,375, 450, and 3,032, in that order, rely on nearby fields or forests for food frequently (3–5 days per week, sometimes 1–2 days per week), infrequently (2–4 days per month), and never. Accordingly, Table 3 shows that, concerning this factor, 3.7%, 27.3%, 8.9%, and 60.1% of rural agricultural women workers in the UT of Puducherry are the most insecure, secure and most secure, respectively.

Table 4 shows the frequency distribution among different categories with the number of respondents who borrowed food and their percentage. Of 5,004 respondents, 153, 7,77,999, and 3,115 respondents borrowed food frequently (3–7 days/week). Occasionally (1–2 days per week), infrequently (2–3 days per month), and never in the previous three months. Accordingly, depending on this factor, 3.0%, 15.4%, 19.8%, and 61.8% of Puducherry's rural agricultural women workers are the most insecure, secure, and most secure.

Table 5 shows the frequency distribution among different categories with the number of respondents for whom relatives and friends gave food and their percentage. Out of 5,044 respondents, 132, 672, 993, and 3,247 respondents depended on their friends and relatives frequently (3–7 days/week), sometimes (1–2 days/week), once in a while (2–3 days a month) and never in the past three months for food, respectively. Therefore, based on this aspect, 2.6%, 13.3%, 19.7%, and 64.4% of rural agricultural women workers in Puducherry are most insecure, insecure, secure, and most secure, respectively.

Table 6 shows the frequency distribution among different categories with the number of respondents who borrowed food on credit from a shop and their percentage. Out of 5,044 respondents, 351, 702, 1071, and 2,920 respondents borrowed food on credit from shops frequently (3–7 days/week), sometimes (1–2 days/ week), once in a while (2–3 days a month) and never in the past three months, respectively. Therefore, based on this aspect, 7.0%, 13.9%, 21.2%, and 57.9% of rural agricultural women workers in the UT of Puducherry are most insecure, insecure, secure, and most secure, respectively.

Table 7 shows the frequency distribution among different categories with the number of respondents who do not eat to ensure enough food for children and their percentage. Out of 5,044 respondents, 87, 593, 928, and 3,436 respondents do not eat/restrict food to ensure enough food for children frequently (3–7 days/week), sometimes (1–2 days/week once in a while (2–3 days a month) and never in the past three months, respectively. Therefore,

Table 6. ***Frequency Distribution of the Number of Times Respondents Borrowed Food on Credit from a Shop***

Q5. How many times have you borrowed food on credit from a shop in the past three months?	Category	Number of Respondents	Percentage
(A) Frequently (3–7 days/week)	Most Insecure	351	7.0
(B) Sometimes (1–2 days/week)	Insecure	702	13.9
(C) Once in a while (2–3 days a month)	Secure	1,071	21.2
(D) Never	Most Secure	2,920	57.9
Total		5,044	100

Table 7. ***Frequency Distribution of the Number of Times of Shortage of Food to Adults to Ensure Food to Children***

Q6. In the last three months, how often did adult members cut back on their food intake to ensure the kids had enough to eat?	Category	Number of Respondents	Percentage
(A) Frequently (3–7 days/week)	Most Insecure	87	1.7
(B) Sometimes (1–2 days/week)	Insecure	593	11.8
(C) Once in a while (2–3 days a month)	Secure	928	18.4
(D) Never	Most Secure	3,436	68.1
Total		5,044	100.00

Table 8. ***Frequency Distribution of Respondents Sending Children to Live with Relatives***

Q7. How many times have you sent your children to live with relatives in the past three months due to a lack of food?	Category	Number of Respondents	Percentage
(A) Frequently (3–7 days/week)	Most Insecure	90	1.8
(B) Sometimes (1–2 days/week)	Insecure	571	11.3
(C) Once in a while (2–3 days a month)	Secure	868	17.2
(D) Never	Most Secure	3,515	69.7
Total		5,044	100.00

based on this aspect, 1.7%, 11.8%, 18.4%, and 68.1% of rural agricultural women workers in the UT of Puducherry are most insecure, insecure, secure, and most secure, respectively.

Table 8 shows the frequency distribution among different categories with the number of respondents who have sent children to live with relatives and their percentage. Out of 5,044 respondents, 90, 571, 868, and 3,515 respondents sent their children to their relatives because of lack of food frequently (3–7 days/week), sometimes (1–2 days/week), once in a while (2–3 days a month) and never in the past three months, respectively. Therefore, based on this aspect, 1.8%, 11.3%, 17.2%, and 69.7% of rural agricultural women workers in Puducherry are most insecure, insecure, secure, and most secure, respectively.

Table 9 shows the frequency distribution among different categories with the number of respondents based on their responses to the seven questions, aggregates, and percentages. Based on the aggregate method, it can be seen that the status of food security of 3.51%, 16.01%, 17.44%, and 63.04% of rural agricultural women workers in the UT of Puducherry are most insecure, insecure, and most secure, respectively.

Table 9. ***Frequency Distribution of Aggregate of Responses for the Seven Questions***

Response	Category	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Aggregate	% of Aggregate
A)Frequently (3–7days/week)	Most Insecure	239	187	153	132	351	87	90	1,239	3.51
B) Sometimes (1–2 days/week)	Insecure	964	1375	777	672	702	593	571	5,654	16.01
C) Once in a while (2–3 days a month)	Secure	848	450	999	993	1,071	928	868	6,157	17.44
D) Never	Most Secure	2,993	3,032	3,115	3,247	2,920	3,436	3,515	22,258	63.04
Total		5,044	5,044	5,044	5,044	5,044	5,044	5,044	35,308	100

Table 10. ***Scores are Given for the Responses***

S. No.	Response	Score
1	(A) Frequently (3–7 days/week)	1
2	(B) Sometimes (1–2 days/week)	2
3	(C) Once in a while (2–3 days a month)	3
4	(D) Never	4

Table 11. ***Frequency Distribution of Scores and Respondents***

Scores	No. of Respondents
7.00	7
9.00	1
10.00	2
11.00	3
12.00	12
13.00	17
14.00	92
15.00	61
16.00	90
17.00	96
18.00	132
19.00	193
20.00	367
21.00	226
22.00	394
23.00	289
24.00	691
25.00	360
26.00	375
27.00	287
28.00	1,349
Total	5,044

The Likert scale technique scores are applied to the replies and are shown in Table 10. A respondent's score under this grading system might range from 7 to 28. Table 11 displays the respondents who received scores between 7 and 28.

The respondents who scored between 7 and 12 (<12.25) are categorized as the most insecure, followed by 13 to 17 (>12.25 & <17.5), 18 to 22 (>17.5 & 22.75), and 23 to 28 (>22.75) as the most secure, using the uniform

quartile technique (Table 12). Table 12 calculates the frequency and percentages of respondents for each of the four groups in this context.

Table 12 displays the percentage, the number of respondents, and the frequency distribution of a range of scores in their category. Based on the Likert scaling method, it can be seen that the food security status of 0.5%, 7.1%, 26.0%, and 66.4% of rural agricultural women workers in UT of Puducherry are the most insecure, insecure, secure, and most secure, respectively.

Table 13 provides the percentage of respondents in each group by question, under both the aggregate and the Likert scaling techniques, to calculate the percentage of respondents in the four groups using the least standard method and the highest common way.

The most insecure group varies from 0.5% (LSM) to 7.0% (Q5), the insecure group varies from 7.1% (LSM) to 27.3 (Q2), the secure group varies from 8.9% (Q2) to 26.0% (LSM) and most secure group varies from 57.9% (Q5) to 69.7%(Q7).

Using the least common method (LSM), the food security status of at least 0.5%, 7.1%, 8.9%, and 57.9% of rural agricultural women workers in UT of Puducherry is the most insecure, secure, and most secure, respectively. Similarly, using the most common method, the food security status of 7.0%, 27.3%, 26.0%, and 69.7% of rural agricultural women workers in UT of Puducherry is the most insecure, insecure, secure, and most secure groups, respectively.

The frequency distribution for the four food security categories was obtained using the uniform quartile method for the Likert scaling method. Table 12 shows the relationship between the food security status and other parameters like the type of ration card, daily wages, number of days of employment in a month, and monthly income.

Table 14 shows the frequency distribution, number, and percentage of respondents holding different types of ration cards among food security categories. Among the respondents categorized as most insecure, 8.0% hold AAY ration cards, 88.0% hold below-poverty line (BPL) ration cards, and only 4.0% hold APL ration cards. In the insecure category, 7.0% of respondents hold AAY ration cards, 87.4% hold BPL ration cards, and 5.6% hold APL

Table 12. ***Frequency Distribution of Range of Scores***

S. No.	Scores	Category	Number of Respondents	Percentage
1	7–12	Most Insecure	25	0.5
2	13–17	Insecure	356	7.1
3	18–22	Secure	1,312	26.0
4	23–28	Most Secure	3,351	66.4
		Total	5,044	100.0

Table 13. ***Percentage of Respondents***

Category	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Aggregate Method	Likert Scaling Method
Most Insecure	4.70	3.7	3.0	2.6	7.0	1.7	1.8	3.51	0.5
Insecure	19.20	27.3	15.4	13.3	13.9	11.8	11.3	16.01	7.1
Secure	16.80	8.9	19.8	19.7	21.2	18.4	17.2	17.44	26.0
Most Secure	59.30	60.1	61.8	64.4	57.9	68.1	69.7	63.04	66.4
Total	100	100	100	100	100	100	100	100	100

Table 14. ***Frequency Distribution and Percentage of Respondents Holding Different Types of Ration Cards Among Respondents Grouped into Four Categories of Food Security***

Type of Ration Card	Most Insecure		Insecure		Secure		Most Secure		Total	
	Number of Respondents	Percentage	Number of Respondents	Percentage	Number of Respondents	Percentage	Number of Respondents	Percentage	Number of Respondents	Percentage
AAY	2	8.0	25	7.0	52	4.0	48	1.4	127	2.5
BPL	22	88.0	311	87.4	1,159	88.3	3,024	90.3	4,516	89.5
APL	1	4.0	20	5.6	101	7.7	279	8.3	401	8.0
Total	25	100	356	100	1,312	100	3,351	100	5,044	100

ration cards. For the secure category, 4.0% of respondents hold AAY ration cards, 88.3% hold BPL ration cards, and 7.7% hold APL ration cards. In the most secure category, the distribution is 1.4% for AAY ration card holders, 90.3% for BPL ration card holders, and 8.3% for APL ration card holders.

Overall, most respondents across all food security categories hold BPL ration cards, with percentages ranging from 87.4% to 90.3%. A smaller proportion holds APL ration cards, ranging from 4.0% to 8.3%. The number of respondents with AAY ration cards is relatively low, varying from 1.4% to 8.0%. This indicates that BPL ration cards are predominant among all categories, reflecting their purpose of providing subsidized food to individuals below the poverty line.

Table 15 shows the frequency distribution, number, and percentage of respondents based on daily wages among different food security categories. Among the respondents categorized as most insecure regarding food security, the majority (60.0%) earn a daily wage of less than ₹150. Additionally, 28.0% earn between ₹150 and ₹200, 12.0% earn between ₹200 and ₹300, and no respondents in this category earn more than ₹300 as their daily wage. In the insecure category, 63.5% of respondents earn less than ₹150 as their daily wage, followed by 23.0% earning between ₹150 and ₹200, 12.6% earning between ₹200 and ₹300 and 0.9% earning more than ₹300. For

Table 15. ***Frequency Distribution and Percentage of Daily Wages Among Respondents Grouped into Four Categories of Food Security***

Daily Wages in Rupees	Most Insecure		Insecure		Secure		Most Secure		Total	
	Number of Respondents	Percentage	Number of Respondents	Percentage	Number of Respondents	Percentage	Number of Respondents	Percentage	Number of Respondents	Percentage
<150	15	60.0	226	63.5	698	53.2	1,459	43.5	2,398	47.5
150–200	7	28.0	82	23.0	355	27.1	1,232	36.8	1,676	33.2
200–300	3	12.0	45	12.6	216	16.4	560	16.7	824	16.3
>300	0	0	3	0.9	43	3.3	100	3.0	146	3.0
Total	25	100	356	100	1,312	100	3,351	100	5,044	100

the secure category, the distribution is as follows: 53.2% of respondents earn less than ₹150, 27.1% earn between ₹150 and ₹200, 16.4% earn between ₹200 and ₹300, and 3.3% earn more than ₹300. In the most secure category, 43.5% of respondents earn less than ₹150, while 36.8% earn between ₹150 and ₹200, 16.7% earn between ₹200 and ₹300 and 3.0% earn more than ₹300.

Most respondents across all food security categories earn less than ₹150 as their daily wage, ranging from 53.2% to 63.5%. The percentage of respondents earning between ₹150 and ₹200 varies from 23.0% to 36.8%, while those earning between ₹200 and ₹300 range from 12.6% to 16.7%. The proportion of respondents earning more than ₹300 is relatively low, ranging from 0.9% to 3.3%. This indicates that most individuals in the most insecure and insecure categories earn lower daily wages. In comparison, the proportion of respondents earning higher daily wages increases as we move toward the secure and most secure categories.

Table 16 shows the frequency distribution, number, and percentage of respondents based on employment days among different food security categories. We are classified as the responders with the greatest food insecurity; most (60.0%) work fewer than 15 days per month. Furthermore, 12.0% of work is completed after 25 days, 4.0% between 21 and 25 days, and 24.0% between 16 and 20 days. In the insecure category, 68.8% of respondents work less than 15 days a month, followed by 20.5% working between 16 and 20 days, 4.5% working between 21 and 25 days, and 6.2% working more than 25 days. For the secure category, the distribution is as follows: 69.6% of respondents work for less than 15 days, 19.3% work between 16 and 20 days, 5.9% work between 21 and 25 days, and 5.2% work more than 25 days. In the most secure category, 75.5% of respondents work less than 15 days a month, while 13.8% work between 16 and 20 days, 6.4% work between 21 and 25 days, and 4.3% work more than 25 days.

Overall, most respondents across all food security categories work for less than 15 days a month, ranging from 60.0% to 75.5%. The percentage of respondents working between 16 and 20 days varies from 13.8% to 20.5%, while those working between 21 and 25 days range from 4.5% to 6.4%. The proportion of respondents working more than 25 days is relatively low, ranging from 4.3% to 12.0%. This suggests that most people in the most precarious and precarious categories work fewer days. In contrast, as we head toward the safest and most secure categories, the percentage of responders who have worked more days climbs.

Table 17 shows the frequency distribution, number, and percentage of respondents based on monthly income among different food security categories. The data presented in Table 17 highlight the distribution of income per

Table 16. ***Frequency Distribution and Percentage of the Number of Days of Employment in a Month Among Respondents Grouped into Four Categories of Food Security***

Number of Days of Employment in a Month	Most Insecure		Insecure		Secure		Most Secure		Total	
	Number of Respondents	Percentage	Number of Respondents	Percentage	Number of Respondents	Percentage	Number of Respondents	Percentage	Number of Respondents	Percentage
<15	15	60	245	68.8	913	69.6	2,531	75.5	3,704	73.4
16–20	6	24	73	20.5	253	19.3	464	13.8	796	15.8
21–25	1	4	16	4.5	78	5.9	215	6.4	310	6.2
>25	3	12	22	6.2	68	5.2	141	4.3	234	4.6
Total	25	100	356	100	1,312	100	3,351	100	5,044	100

Table 17. ***Frequency Distribution and Percentage of Income Per Month Among Respondents Grouped into Four Categories of Food Security***

Income per Month (in rupees)	Most Insecure		Insecure		Secure		Most Secure		Total	
	Number of Respondents	Percentage	Number of Respondents	Percentage	Number of Respondents	Percentage	Number of Respondents	Percentage	Number of Respondents	Percentage
<3000	2	8	31	8.7	129	9.8	304	9.1	466	9.2
3,000–5,000	8	32	134	37.6	525	40.0	1,319	39.3	1,986	39.4
5,000–10,000	11	44	141	39.6	501	38.2	1,387	41.4	2,040	40.4
>10,000	4	16	50	14.1	157	12.0	341	10.2	552	11.0
Total	25	100	356	100	1,312	100	3,351	100	5,044	100

month among respondents grouped into four categories of food security. Among those classified as most insecure regarding food security, 8% have a monthly income of less than ₹3,000, while 32% fall within the ₹3,000 to ₹5,000 income range. Additionally, 44% earn between ₹5,000 and ₹10,000, and 16% have an income exceeding ₹10,000. For the insecure category, 8.7% have an income below ₹3,000, 37.6% fall within the ₹3,000 to ₹5,000 range, 39.6% earn between ₹5,000 to ₹10,000 and 14.1% have an income above ₹10,000. Among respondents categorized as secure, 9.8% have an income below ₹3,000, 40% fall within the ₹3,000–₹5,000 income range, 38.2% earn between ₹5,000 and ₹10,000 and 12% have an income exceeding ₹10,000. In the most secure category, 9.1% have a monthly income below ₹3,000, 39.3% fall within the ₹3,000–₹5,000 income range, 41.4% earn between ₹5,000 and ₹10,000, and 10.2% have an income exceeding ₹10,000.

Most respondents across all food security categories have a monthly income ranging from ₹3,000 to ₹10,000. Notably, the percentage of respondents with an income below ₹3,000 is relatively low, ranging from 8% to 9.8%. Similarly, the proportion of individuals earning above ₹10,000 is modest, varying from 10.2% to 16%. They indicate a predominant concentration within the middle-income range of ₹3,000 to ₹10,000, with slight variations observed among the food security groups.

Implications and Conclusion

The results reveal the extent of food insecurity among rural women in Puducherry, with varying levels of vulnerability. The data underscores the reliance on external sources for food, sacrifices made for children, and the importance of socioeconomic factors. The utilization of different methodologies emphasizes the complexity of the issue. The results guide focused interventions and improved policies to address issues related to food security successfully.

This study encompasses various aspects, including a literature review to provide a comprehensive understanding of food security in India and Puducherry and data analysis to explore specific factors related to food security among respondents. The literature review reveals that food security is a critical issue in India, with several socioeconomic factors contributing to its complexity. It highlights the importance of understanding the food security situation at the national and regional levels to develop targeted interventions and policies.

The analysis of data collected from respondents sheds light on the different dimensions of food security. Based on the aggregate method, 3.51%, 16.01%, 17.44%, and 63.04% of rural agricultural women workers in the UT of Pondicherry are found to be most insecure, insecure, secure, and most secure, respectively. Based on the Likert

scaling method, 0.5%, 7.1%, 26.0%, and 66.4% of rural agricultural women workers in UT of Puducherry are found to be most insecure, insecure, secure, and most secure, respectively. Using the LCM, the food security status of at least 0.5%, 7.1%, 8.9%, and 57.9% of rural agricultural women workers in UT of Puducherry is most insecure, insecure, secure, and most secure, respectively. Similarly, using the most common method, the food security status of 7.0%, 27.3%, 26.0%, and 69.7% of rural agricultural women workers in UT of Puducherry is the most insecure, insecure, secure, and most secure groups, respectively.

Additionally, the relationship between food security and other parameters such as type of ration card, daily wages, number of days of employment in a month, and monthly income are analyzed in detail. It is observed that most individuals in all categories hold the BPL card. The findings also indicate that individuals in the most insecure category had a higher percentage of respondents earning lower wages (<₹150). In contrast, those in the most secure category have a larger proportion of individuals earning higher wages (>₹300), highlighting the significant impact of income levels on food security status.

The analysis also reveals that individuals in the most insecure category have a higher percentage of respondents employed for fewer days (<15). In contrast, those in the most secure category have a larger proportion of individuals employed for more days (>25). This underscores the importance of consistent employment opportunities in achieving higher levels of food security. A substantial proportion of respondents across all food security categories fall within the income range of ₹3,000 to ₹10,000. However, the percentage of individuals earning below ₹3,000 is relatively low across all groups, while those earning above ₹10,000 are modest in number. This indicates the prevalence of middle-income earners' concern about food security.

To conclude, it is recommended (a) to enhance agricultural productivity by providing modern farming technologies, quality seeds, fertilizers, and irrigation facilities while promoting sustainable practices and reducing post-harvest losses, (b) strengthen rural infrastructure through investments in irrigation systems, storage facilities, and transportation networks to aid farmers in remote areas, support smallholder farmers by implementing policies that provide training, credit facilities, and market access, (c) promote diversified farming systems to reduce reliance on a single crop and enhance resilience against risks, (d) strengthen social safety nets with robust programs targeting vulnerable populations, (e) raise nutritional awareness and education through campaigns and programs in schools, communities, and healthcare facilities, (f) foster research and innovation to improve crop varieties, climate resilience, and resource-use efficiency, (g) strengthen food governance and policy coordination among government departments to prioritize the needs of the vulnerable, (h) enhance access to credit and insurance schemes for farmers to manage risks, (i) empowering women in agriculture by providing them with equitable access to chances for decision-making, training, and resources. These recommendations ought to be customized for local circumstances, and sustained increases in food security nationwide would require a cooperative strategy including a range of stakeholders.

Limitations of the Study and Scope for Future Research

The study has limitations even though it offers insightful information about food security among rural agricultural women workers in Puducherry. First, the study only uses self-reported data, which may be biased due to social desirability or recollection issues. Furthermore, the study's narrow geographic emphasis restricts its applicability to other areas. A greater insight might be obtained by looking into the root causes of food insecurity, which is not covered in this study. Subsequent investigations may utilize mixed methodologies to identify fundamental elements and subtleties contributing to food insecurity. Examining the physical, social, and economic components may provide a more comprehensive perspective, enabling more targeted and effective interventions to lower food insecurity among this vulnerable population.

Authors' Contribution

Yasam Lakshmi Narayana Reddy developed the idea for the empirical investigation and the qualitative and quantitative designs. He employed keywords to filter these publications, extracted credible research papers, and generated concepts and codes relevant to the study design. A specially created questionnaire was used to collect the primary data. Dr. R. Rajendiran verified and oversaw the project in its entirety.

Conflict of Interest

The authors certify that they have no affiliations with or involvement in any organization or entity with any financial interest or non-financial interest in the subject matter or materials discussed in this manuscript.

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