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Millet Farming and Food Security of Women: An In-depth Study in Sundargarh District of Odisha

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Abstract

Women play an important role in millet farming and production, contributing significantly to the cultivation and management of these nutritious grains. In millet farming, women are frequently the ones who make important decisions. Millet is a staple food for many tribal communities and it is beneficial for all human being but maximum number of women is participating in millet farming. It is crucial to analyse the role of women in millet farming operations, as they are cultivating majority of on-farm and post-harvest activities. This study has been taken in three selected blocks in Sundargarh district of Odisha, namely Raj Gangapur block, Kutra block and Nuagaon block. The study revealed that socio-economic development on farming operations of millet farming and value addition. Women are involving in various on farm activities such as land preparation, variety selection, manuring, sowing, weeding, and harvesting, as well as production processes including threshing, cleaning, drying of the grain, winnowing, and expanding to value addition and marketing. Additionally, millet farming not only offers food and nutrition to the community but also plays a significant role in the rich cultural heritage of the tribal women. This provides women with a certain level of social and economic empowerment, as well as decision-making authority.

Key wards*: Millet, Staple food, Farming, Social and Economic empowerment.*

INTRODUCTION

Agriculture is fundamental for economic growth and poverty reduction in countries like India, where there is a large number of labour force available. In India, 54.6% of the total workforce is engaged in agriculture and similar activities. Women play a vital role in agricultural activities, with 41.8% of rural and 35.31% of urban females participating in agriculture and farming operations. They are involved in various tasks such as crop production, processing, marketing, livestock production, post-harvest operations, and agro/social forestry. In addition to millet farming, women handle the management and storage of agricultural products, as well as various household duties and income generating activities, at all times to ensure the family's food security and well-being. Women have an important position in agricultural activities and rural areas in today's dynamic economic growth, where social and economic pressures constantly change the agricultural sector. Millet is considered a "women's crop" as they are primarily responsible for decision-making and various farming operations related to millet cultivation. There are differences between regions, subzones, castes and classes in the nature and scope of agricultural operations and women's involvement. However, women are involved in all aspects of farming operations with the exceptions of ploughing. Although women engage in variety of agricultural activities, but some labours are not regarded as "economically active" even they are taken in to consideration for employment accepted and neglected. Millet is one of the staple diets, which is primarily grown for food and fodder in the tribal-dominated region of Odisha. Odisha is largely a tribal

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state, where large number of tribal women living in rural areas have a strong connection to millet farming.

Millet farming plays a crucial role in enhancing food security for women, particularly in rural areas. As a hardy and drought-resistant crop, millet thrives in challenging environments, providing a reliable food source. Women, often primary care givers and agricultural workers, benefit from millet's nutritional value and its contribution to diversified diets. By engaging in millet cultivation, women not only ensure their households' food security but also gain economic empowerment through the sale of surplus produce. So, promoting millet farming can significantly improve the livelihoods and resilience of women, fostering community development and sustainable agricultural practices.

Millet cultivation plays a significant role in the humankind, consumption patterns, and socio-cultural aspects of tribal communities. Particularly tribal women, with their customs and traditional knowledge, more focus on millet cultivation over their husbands' decision for maintaining their cultural values in addition to food and their family's nutritional security. Additionally, millet farming operations also provide a certain level of social and economic empowerment. Millet is a local crop of every tribal people which can improve the important role of women in decision making, income generation, saving practices, and entrepreneurship opportunities. Millets are a valuable crop for farmers and also improve the multiple health benefit of the community because they are rich in minerals and high nutrition's such as iron, magnesium, phosphorus, and potassium. It is one of the most important foods for tribal people of Odisha which can prevent the various number of nutritional issues and affordable treatment for health. Millet production and value addition, which improve agricultural products in to finished goods, also help in creating a viable source of income for the company and tribal women.Millet farming plays a crucial role in ensuring the food security and nutritional well-being of tribal communities, serving as a sustainable and resilient agricultural practice deeply rooted in their cultural heritage and traditional knowledge. Promoting millet farming among tribal communities not only enhances their food security by diversifying their agricultural practices but also contributes to preserving indigenous food cultures and biodiversity. Through cultivating millets, tribes can attain sustainable nutrition sources, resilient to climate fluctuations, thereby reducing dependence on single crops.

REVIEW OF LITERATURE

ON THE BASIS OF AWARENESS ABOUT MILLET FARMING

Dr. A. Kalaiselvi et al, (2016) The purpose of this literature review is to examine the awareness and consumption patterns of millets among women. Despite millets' superior nutritional content and various health benefits, their production and consumption have declined over the past five decades. The review aims to assess existing research on women's awareness of millets and their consumption behavior, shedding light on factors influencing their choices and potential strategies for promoting millet consumption among this demographic.

Aruna Kumar Panigrahy et al, (2023) The literature highlights the significance of millets in Indian agriculture, their nutritional benefits, and their potential to address health issues, food security, and economic challenges. It emphasizes the need for awareness, increased cultivation, and promotion of millets as a sustainable food source, especially during the International Year of Millets.

Gayatri M and K. manimozhi(2024) The literature on millet cultivation highlights its critical role in enhancing food security and promoting sustainable agriculture due to its climate resilience and nutritional benefits. Studies reveal that millets, rich in essential nutrients, offer substantial health benefits and are well-suited for diverse agro-climatic

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conditions, demonstrating resistance to drought and high temperatures. However, a significant decline in millet cultivation has been observed in recent decades, primarily due to a lack of awareness among farmers about its advantages, including economic returns, health benefits, and environmental sustainability. The literature emphasizes the need for targeted intervention programmes, such as workshops, field demonstrations, and educational materials, to bridge this knowledge gap. Research findings indicate that these programmes significantly improve farmers' knowledge and attitudes towards millet cultivation, fostering its adoption and contributing to sustainable agricultural practices, thus supporting global food security and resilience against climate change

ON THE BASIS OF THE ROLE OF WOMEN PARTICIPATING

A.M. Maruthesha et al, (2018) The purpose of the study was to investigate the socio-economic characteristics, food habits, and dietary consumption of rural women in selected villages of Bangalore rural district, Karnataka. The objective was to understand the functioning of self-help groups in these villages, their financial activities, and the participation of women in various income-generating activities such as dairy farming and vegetable marketing. Additionally, the study aimed to assess the impact of training programs on women's engagement in entrepreneurial activities, particularly in value-added products of finger millet.

According to Jeeva et al. (2019) focus on gender analysis provides light on both the roles and responsibilities of men and women in agricultural activities as well as the drudgery that primarily effect women in rural areas. Additionally, an increased awareness of gender roles and how they affect disadvantaged, tribal women will help policymakers and the government in encouraging more increased output, value addition and consumption along with the purpose of this paper analyse the role of women participating in the post -production and processes of millet in Koraput district of Odisha.

Dilip Kumar Bagal, and Lakshmi Prasad Panda (2024) the literature review focuses on investigating the experiences of women engaged in millet farming in Odisha, India. It aims to identify the challenges and opportunities for women's participation in millet cultivation and examines the impact of such involvement on their livelihoods. The research employs in-depth interviews, focus groups, and surveys to uncover cultural, resource-related barriers, while also exploring paths for empowerment such as women's groups, training, and NGO/government assistance. Furthermore, it highlights the significance of millet farming in fostering sustainable agriculture and gender equality.

ON THE BASIS OF SOCIO-ECONOMIC DEVELOPMENT

Lalitha et al. (2022) The literature review aims to explore the role of millet in addressing global agricultural challenges, emphasizing women empowerment.it investigates how promoting millets can enhance economic, environmental, and health sustainability while empowering women in decision making, resource management, and income generation within the agricultural sector.

Gowri M.U and Shivakumar K.M. (2020) The literature review highlights the underutilization of millets despite their significant nutritional and ecological benefits. It underscores the need for increased cultivation and utilization of millets in India. The study aims to analyse the trends in millet production from 1950-51 to 2018-19 and assess the economic viability of millet cultivation compared to other crops. The objective is to identify strategies for improving millet production through optimized cultivation practices, marketing, and processing techniques.

A Thangam Alagarsamy (2019) The literature review focuses on the purpose and objectives of empowering women in India through the utilization of Nutri

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cereals, particularly minor millets. It highlights the role of small and landless farmers, as well as agriculture farm women labour, in promoting socio-economic empowerment. The study emphasizes capacity building involvements to enhance local skills in value addition, leading to increased income generation, improved family welfare, and enhanced self-confidence among women. These study aims to address the marginalization of women in income generation activities and decision-making processes.

The Odisha Millet Mission has made significant contributions to empowering women:

The Department of Agriculture and Farmers' Empowerment of the Odisha Government started the Odisha Millets Mission (OMM) in 2017 with the goal of bringing millets back to fields and plates. It is also known as the Special Programme for Promotion of Millets in Odisha's Tribal Areas. Millets also included as a component of the public distribution system (PDS) and other nutrition-related government initiatives like Integrated child Development Scheme (ICDS), Integrated tribal development Agency (ITDA), Mid-Day Meal (MDM) Supported welfare Hostels etc. The main objectives of the millet mission are production, consumption (both urban and rural), processing, and market linkage to the millet farmers. Therefore, this initiative not only promotes the production of millets but also provides opportunities for a variety of millet-based foods.Local Self-Help Groups (SHGs), particularly women, have been economically and socially empowered by acquiring income-generating sources through the millet-based value chain.To provide highly nutritious millet-based ready-to-eat meals, the WSHGs under OMM developed a millet-based tiffin centre with the help of Mission Shaktiprakti (Table 6).The majority of millet farming operations are performed by women causes of drudgery of millet production activities. Before OMM, women are facing various problem for cultivating millet. But the Odisha Millet Mission supports women and farmers with many production tasks, such as offering various machinery and technologies such as pulverizers, cleaner-graders, stoners, and threshers.In addition, the Odisha Millet Mission's improved agricultural practices and mechanization of the millet grain processing help to make farming easier for women. This will also help for reducing drudgery of women farmers.

Research gaps:

- Limited research on how millet farming affects women's food security in Sundargarh.
- Lack of detailed studies on the economic impact of millet farming on women's livelihoods.
- Insufficient understanding of women's awareness of and adoption rates for modern millet farming practices.

OBJECTIVE OF THE STUDY

- To analyze the socio-economic profile of women millet farmers.
- To examine the impact of millet farming on the food security status of women in terms of availability, accessibility, and utilization.
- To suggest appropriate measures to strengthen millet farming as a strategy for improving women's food security.

HYPOTHESIS OF THE STUDY

H_0: There is no significant relationship between millet farming and the food security status of women.
H_1: Millet farming significantly enhances the food security status of women in the study area.

METHODOLOGY

The present study adopts a descriptive and analytical research design to explore the role of millet farming in enhancing food security among women in Sundargarh district of Odisha. The study area will include selected blocks within the district where millet cultivation is actively practiced under initiatives like the Odisha Millets Mission. A stratified random sampling technique will be employed to ensure representation across different socio-economic and tribal groups, with a proposed sample size of approximately 120 women engaged in millet farming. Data will be collected using a

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structured interview schedule complemented by focus group discussions and field observations to gather both quantitative and qualitative insights. The data collected will be analyzed using descriptive statistics such as percentages, means, and standard deviation, alongside inferential statistical tools like chi-square tests, correlation, and regression analysis to examine relationships and test hypotheses. This methodological approach aims to provide a comprehensive understanding of how millet cultivation impacts the availability, accessibility, and utilization dimensions of food security among women in the region.

DATA ANALYSIS AND INTERPRETATION

Table -1 Gender wise frequency distribution

GENDER	F	%
MALE	32	24.61
FEMALE	98	75.38
TOTAL	130	100

The table presents the gender distribution of the respondents. It shows a clear predominance of female participants, who make up 75.38% of the total sample. In contrast, male respondents constitute only 24.61%.

Table- 2 Women participation from different blocks.

SL. NO	BLOCK	F	%
1	RAJGANGAPUR	59	45.38
2	KUTRA	29	21.53
3	NUAGAON	42	32.30
TOTAL		130	100

The table illustrates the block-wise distribution of women respondents involved in millet farming in the Sundargarh district of Odisha. Out of a total of 130 participants, the majority—**45.38% (59 women)**—belonged to **Rajgangapur block**, indicating a significant concentration of millet farming activities in this area. This was followed by **Nuagaon block**, which contributed **32.30% (42 women)**, reflecting a moderately high participation. The **Kutra block** had the lowest representation, with **21.53% (29 women)** engaged in millet cultivation.

Table-3 Frequency and percentage distribution of educational qualification

SL. NO	QUALIFICATION	FREQUENCY	PERCENTAGE
1	Illiterate	48	36.92
2	Primary	59	45.38
3	Secondary	18	13.84
4	Higher secondary and above	05	3.84
Total		130	100

The data presented in the table highlights the educational qualifications of the respondents. A majority of the participants, accounting for 45.38%, had attained education up to the primary level. This is followed by 36.92% who were illiterate; indicating a significant portion of the population lacks basic literacy skills. A smaller segment, 13.84%, had completed secondary education, while only 3.84% had pursued education beyond the higher secondary level.

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Table -4 Frequency and percentage distribution of social category

SL.NO	Category	FREQUENCY	PERCENTAGE
1	SC	47	36.15
2	ST	72	55.38
3	GEN	11	8.46
		130	100

The table illustrates the distribution of respondents based on their social category. A majority of the participants, 55.38%, belong to the Scheduled Tribes (ST), followed by 36.15% from the Scheduled Castes (SC). Only a small proportion, 8.46%, belong to the General category.

Table- 5 Frequency and percentage distribution of Types of houses

Sl.No	Types of houses	FREQUENCY	PERCENTAGE
1	PUCCA	15	11.53
2	PARTIALLY PUCCA	47	36.15
3	KACHHA	68	52.30
Total		130	100

The table provides information on the types of houses occupied by the respondents. It reveals that a majority, 52.30%, live in kachha houses, which are typically made of temporary or less durable materials. Another 36.15% reside in partially pucca houses, which are semi-permanent structures. Only 11.53% of the respondents live in pucca houses, which are built with durable materials and offer better living conditions.

Table 6. Frequency and percentage distribution Monthly Income of millet farmers

Sl.No	Monthly Income	FREQUENCY	PERCENTAGE
1	20000- 35000	89	68.46
2	35001-40000	30	23.07
3	40001-55000	11	8.46
Total		130	100

The table shows the monthly income distribution of the respondents. A significant majority, 68.46%, fall within the income range of ₹20,000 to ₹35,000, indicating that most families have relatively low earnings. About 23.07% of the respondents have a monthly income between ₹35,001 and ₹40,000, while only 8.46% earn between ₹40,001 and ₹55,000.

Table- 7 Enterprises with WSHGs under OMM

Enterprises with WSHG	2020-21	2021-22	2022-23	Total
Millet Shakti Tiffin Centre	15	81	27	123
Millet Shakti on Wheel	0	1	0	1
Mission Shakti Cafe	0	2	0	2
Millet Shakti Outlet	0	1	1	2
THR Units (under ICDS	59	0	0	59
Total	74	85	28	187

Source: Odisha Millet Mission Dashboard, 2022

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Table- 8 Correlation between Millet Farming and Food Security of Women

Correlations			
		Millet farming	Food security
Millet farming	Pearson Correlation	1	.421
	Sig. (2-tailed)		.001
	N	130	106
Food security	Pearson Correlation	.421	1
	Sig. (2-tailed)	.001	
	N	130	130

The Pearson correlation coefficient between millet farming and food security is **0.421**, indicating a **moderate positive linear relationship**. The significance level (p = **0.001**) is well below the 0.05 threshold, suggesting that this correlation is **statistically significant**. This implies that as millet farming increases, the level of food security among women in the Sundargarh district also tends to improve. The findings highlight the potential role of millet cultivation in enhancing household food security in the region.

Table 9 - Model Summary of Linear Regression between Food Security and Millet Farming

Model Summary				
Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.457[a]	.209	.202	11.49157
a. Predictors: (Constant), foodsecurity				

The regression model reveals a correlation coefficient (**R**) of **0.457**, indicating a **moderate positive relationship** between food security and millet farming. The **R Square** value is **0.209**, which means that **approximately 20.9% of the variation** in millet farming can be explained by food security. The **Adjusted R Square** is **0.202**, which slightly adjusts for the number of predictors in the model and confirms a reasonable model fit. The **standard error of the estimate** is **11.49157**, reflecting the average amount by which the observed values deviate from the predicted values. Overall, the model suggests that food security is a meaningful predictor of millet farming practices among women in the Sundargarh district.

Table 10 -ANOVA for the Regression Model between Food Security and Millet Farming

ANOVA						
Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	4454.496	1	4454.496	33.732	.000
	Residual	16903.204	128	132.056		
	Total	21357.700	129			
a. Dependent Variable: millet arming						
b. Predictors: (Constant), food security						

The ANOVA table shows that the **regression sum of squares** is **4454.496**, which indicates the variation explained by the predictor (food security). The **residual sum of squares** is **16903.204**, representing the unexplained variation. The **total sum of squares** is **21357.700**, representing the total variation in millet farming. The **F-value** is **33.732**, and the corresponding **p-value** is **0.000**, which is less than 0.05, indicating that the regression model is statistically significant. This means that food security

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is a significant predictor of millet farming, and the relationship between them is unlikely to be due to chance.

Table 11 - Coefficients for the Regression Model between Food Security and Millet Farming

Coefficients[a]						
Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	57.648	5.559		10.371	.000
	foodsecurity	-.793	.137	-.457	-5.808	.000
a. Dependent Variable: milletfarming						

FINDINGS

- The majority of the women engaged in millet farming belonged to the age group of 30–50 years and were predominantly from Scheduled Tribes. Most of them had primary to secondary education, and agriculture was their primary source of livelihood.
- Among the three blocks studied, Rajgangapur had the highest number of respondents (45.38%), followed by Nuagaon (32.30%) and Kutra (21.53%), indicating a higher prevalence of millet cultivation in Rajgangapur.
- Women primarily cultivated traditional varieties of finger millet (ragi), little millet (suan), and foxtail millet (kangni). The practice of intercropping millets with pulses and oilseeds was common.
- A considerable number of respondents adopted improved farming techniques such as line sowing, use of organic manure, and timely weeding, especially in areas where the Odisha Millet Mission (OMM) had strong outreach.
- Women reported benefits from schemes like the Odisha Millet Mission, which provided training, seeds, market linkage, and capacity building. However, awareness and access to these benefits varied across blocks.
- Millet farming significantly improved household food security. Women reported year-round food availability, reduced dependency on market-bought grains, and better nutritional outcomes due to increased millet consumption in daily diets.
- Millet cultivation supplemented household income, especially when surplus produce was sold through farmer producer organizations (FPOs) or local markets. Women reported increased control over income and financial decisions.
- Despite benefits, women faced challenges such as lack of irrigation facilities, limited market access, post-harvest losses, and inadequate training in modern farming practices.
- Millets were recognized not just as crops but as part of cultural identity and traditional food habits. Women acknowledged the health benefits of millets, especially for children and the elderly.
- The Pearson correlation between millet farming and food security is 0.421, indicating a moderate positive relationship, meaning that as food security increases, millet farming also tends to increase.
- The correlation is statistically significant with a p-value of 0.001, which is below the 0.05 threshold.
- The R-value of 0.457 and R-squared value of 0.209 suggest a moderate relationship between food security and millet farming, with food security explaining about 20.9% of the variation in millet farming.
- The F-value of 33.732 and p-value of 0.000 in the ANOVA table confirm that the regression model is statistically significant.
- The coefficient for food security is -0.793, indicating an inverse relationship, where increased food security is associated with a decrease in millet farming.

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- The standard error of the estimate (11.49) reflects the average prediction error, showing a moderate level of accuracy in the model.
- The results suggest that food security has a moderate, statistically significant inverse impact on millet farming, explaining some but not all of its variation.

Conclusion

The study on Millet Farming and Food Security of Women in Sundargarh District of Odisha underscores the significant role that millet farming plays in enhancing food security and empowering women in rural areas. The findings highlight that millet cultivation not only improves household food availability but also strengthens nutritional security, providing an affordable and sustainable alternative to rice and wheat. Women, particularly those from tribal communities, have benefited from various government interventions, such as the Odisha Millet Mission (OMM), which has facilitated access to improved seeds, training, and market linkages.

Despite these positive outcomes, several challenges remain. Limited access to irrigation, lack of storage facilities, and inadequate training on post-harvest management and value addition have hindered the full potential of millet farming. Additionally, while government programs have made a positive impact, the reach and implementation of such initiatives need to be expanded to benefit more women farmers.

In conclusion, millet farming offers a dual benefit for women in Sundargarh district: it provides a source of income and nutritional security while promoting women's empowerment through enhanced decision-making power in agricultural activities. To further improve the situation, it is essential to strengthen infrastructure, provide better market access, and continue to raise awareness about the health benefits of millets. This will not only contribute to food security but also enhance the socio-economic status of women, ultimately leading to more sustainable rural development.

RECOMMENDATIONS

- Encourage government and non-governmental organizations to provide training, resources, and financial support to women in Sundargarh for sustainable millet farming. This can enhance their food security while preserving local agricultural practices.
- Include millet as a key component in government food security initiatives, such as the Public Distribution System (PDS), to ensure better availability and accessibility for women, especially in rural areas.
- Conduct awareness campaigns to educate women and communities about the nutritional benefits of millets, highlighting their importance for health and food security, particularly in combating malnutrition.
- Facilitate women's access to local and regional markets by providing infrastructure, transportation, and marketing skills. This will enable them to sell their millet produce at fair prices, improving their economic security.
- Advocate for policy reforms that support the cultivation of millets, including subsidies, insurance, and direct purchasing programs. Special attention should be given to women farmers, recognizing their role in millet cultivation.
- Strengthen agricultural extension services to provide women farmers with the latest research on millet farming techniques, pest management, and climate adaptation strategies, ensuring sustainable practices and improving productivity.

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