ORIGINAL RESEARCH ARTICLE

Knowledge Based Trainings onMillet Advanced Techniques for Sustainable Nutritional Securityin the Tribal Communities of Andhra Pradesh

ABSTRACT:

India, home to the world's largest tribal population of 10.43 crore as per the 2021 census, heavily relies on millet farming for food security in tribal communities. Millets, often termed Nutri-cereals or superfoods, are resilient to poor soil and harsh climates and provide essential nutrients like iron, calcium, and dietary fiber, addressing widespread nutritional deficiencies. Despite their advantages, millet farming faces significant challenges due to climate change, land degradation, water scarcity, and rising food prices. The research sampled with 240 women from three Farmer Producer Organizations (FPOs) in the Alluri Sitharamaraju (ASR) district was included for the study. Structured interview Schedule and a five-point continuum were used to evaluate the tribal women views towards training given on millet cultivation, post-harvest practices, and value addition techniques. Findings revealed a general positive response to the training, particularly in areas like field preparation and nutrient management. However, challenges persist, such as limited access to resources, modern processing equipment, and proper storage facilities. Addressing these issues is crucial for improving the livelihoods of tribal women and promoting sustainable agricultural practices. Enhanced infrastructure, timely financial support, and continuous capacity-building are essential for maximizing the benefits of millet farming in tribal areas, contributing to food security and economic development.

Key words: *Millet Farming, Trainings, Tribal Women, Agriculture, Climate Resilient*

INTRODUCTION:

India has the largest tribal population in the world. The tribal population of the country as per the 2021 census is 10.43 crore (8.6 percent of the total population). Millets are also called as “Nutri-Cereals or CoarseCereals or Cereals of the Poor or Shree Anna”. Millets areamong the oldest cultivated crops in India and classifiedinto two main groups major millets (sorghum and pearlmillet) the minor millets (little millet, barnyard millet, Kodomillet, foxtail millet, finger millet, Proso millet and Browntopmillet).Millets are highly nutritious and has antioxidantproperties which provide balanced nutrition (*Misra et al.,2021*). Millets are the most beneficial for health since they are gluten- free and are good for digestive system as well as protect us from heart diseases (*Issoufou et al., 2013*). According to (*Veena, 2003*), millets possess abundant nutrition and provide health benefits in the management of health issues such as diabetes mellitus, hyperlipidemia, etc. The nutritional value of millets caters mainly towards the healthiness of human society.Millet farming plays a pivotal role in ensuring food security for tribal communities (*Virender et al, 2022*). They are popularly called as Nutri-cereals, smart foods, powerhouse of nutrition, super foods, or the food of the 21st century due to their remarkable ability to thrive in unfavorable soil and climatic conditions. They have a strong nutritional profile with a variety of health benefits (*Sangappa et al, 2023*) including iron, calcium, and dietary fiber, addressing nutritional deficiencies (*Misra et al, 2021*) prevalent in many tribal populations. Therefore, overall agricultural production, including millet, directly contributes to food and nutritional security (*Chowhan, 2021*).

However, in recent times, global challenges such as climate change, the excessive exploitation of agricultural lands (*Oyesola et al,2011*), water scarcity, and escalating food prices have precipitated a crisis in nutritional security.Cultivation of millets (*Selvarani et al, 2020*) provides a reliable source of food, especially in times of environmental uncertainty or erratic climatic patterns. Their ability to grow with minimal water requirements contributes to sustainable agricultural practices in water-scarce tribal areas(*Chapke, 2022*). In tribal areas facing climate variability and environmental challenges (*Suresh et al, 2015*), millet farming contributes to sustainable agricultural practices, reducing the ecological footprint. However, despite their inherent benefits, the cultivation and utilization of millets have faced challenges, especially in the context of tribal communities. Millet farming holds significant importance within the agricultural systems of India (*Rana et al, 2021*), particularly for small and marginal landholders. In the face of a rising human population in this region (*Meena et al., 2012*), rural families experience challenges(*Mahesh et al., 2017*) in accessing adequate land, capital, and labor for farming endeavors. Simultaneously, opportunities for generating income from off-farm activities become increasingly scarce. The confluence of these factors underscores the intricate dynamics shaping the livelihoods of small and marginal landholders engaged in millet farming in India. Tribal women engaged in millet farming confront a spectrum of challenges(*Kumar et al, 2023*) across cultivation, post-harvest, and value addition practices. They often face difficulties due to inadequate storage facilities, resulting in post-harvest losses that undermine the overall yield and economic returns. The engagement of tribal women (*Dhansreeet al., 2014*) in value addition through millet processing can have significant positive effects, providing opportunities for entrepreneurship and economic diversification. However, there are also notable constraints that tribal women may face in this endeavor (*Asha et al, 2022*). Tribal women may face challenges (*Chatterjee,P. 2014*) in accessing resources such as modern processing equipment (*Dave 2019*), quality packaging materials, and sufficient working space, hindering the efficiency of value addition processes (*Chapke et al., 2015*). Inadequate infrastructure, including transportation and storage facilities, can create logistical challenges in getting the processed millet products to markets efficiently. Lack of access to modern processing technologies and training in advanced techniques may limit the scale and efficiency of millet processing among tribal women

METHODOLOGY:

The study was conducted with the tribal women of 3 FPOs promoted by ICAR-IIMR, Hyderabad in Andhra Pradesh.Lambasingi Tribal Products FPCL, Giri Siri Tribal FPO MACS LTD and Sri Matsya Devatha FPMACS LTD are the 3 FPOsselected purposively for the present study as they are from tribal and hilly areas.These three FPOs were located in Chintapalli, Paderu and G.Madjula blocks of ASR district. From each FPO, 80tribal women members were selected randomly for the study and thus making to a total sample of 240 members. To study the perception of tribal women towards millet trainings a well framed interview schedule was developed covering on the various aspects of millet cultivation, post-harvest and value additionetc (*Dhanasree et al 2014, Oyesola&Obabire2011*).The questionnaire was carefully developed to meet the study's objectives and data requirements. It was pretested with the help of experts, and modifications were made based on their feedback. To calculate the responses of tribal women towards training program given by ICAR-IIMR, Hyderabad the questionnaire included several statements rated on a five point scale: ‘strongly agree’, ‘agree’, ‘neutral’, ‘disagree’ and ‘strongly disagree’. These

ratings were assigned scores of 5, 4, 3, 2, and 1, respectively. The responses were then ranked based on the average scores, with higher scores indicating more significant issues. Additionally, the questionnaire contained statements about constraints faced by tribal women towards training programswas also calculated through frequency analysis.Descriptive statistics (mean, frequencies)and percentage analysis were employed for analyzing the perception of tribalwomen trainings.Further constraintanalysis (Garett Ranking)was used for ranking the mean scores towards constraints faced by the tribal women towards millet trainings.

Application of the Henry Garett ranking technique

The Garrett ranking technique was employed to assessthe preferences, alterations in the prioritization ofconstraints, and the quantification of advantages throughnumerical scores. An attempt was made to recognize theconstraints faced.The identified constraints were ranked by using Garett's ranking technique. In thistechnique, the respondents have been asked to rank the givenattributes (constraints) according to the magnitude of theproblem. The orders of merit given by the participants wereconverted into ranks by using the following formula.

Per cent position = $100/(R_{ij} - 0.5)/N_j$

where,

R_{ij} = Rank given for the i^{th}factor by the j^{th} respondents

N_j = Number of factors ranked by j^{th} respondents

Figure-1: Map Showing the Selected Blocks of the Study

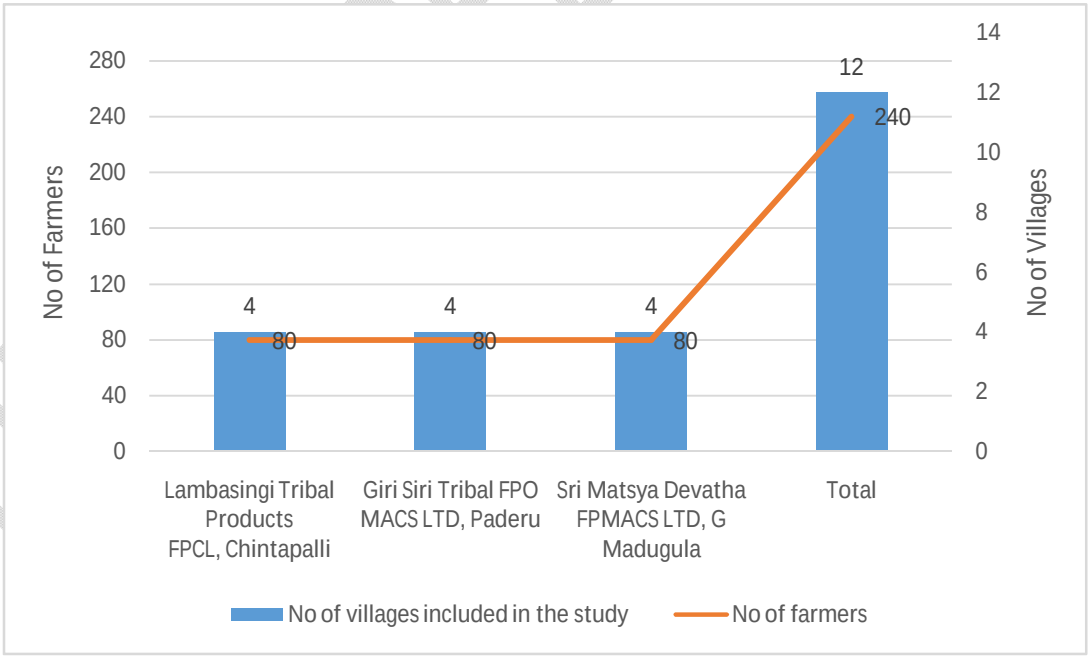


Figure-2: Graph Showing the Distribution of Samples used for the Study

RESULTS AND DISCUSSION

The comprehensive overview of the socio-personal characteristics of 240 tribal women, focusing on various demographic, educational, occupational, and agricultural aspects was shown in Table-1.Age distribution shows that the majority of tribal women fall within the middle age range (26 to 50 years), constituting 62.5% of the total, followed by the young group (up to 25 years) at 20%, and the older group (above 50 years) at 17.5%. Educational attainment varies, with half of the population being classified as illiterate (50%), followed by those with up to primary education (24.17%), secondary school certificate (SSC) holders (8.33%), intermediate education (16.25%), and a smaller percentage with a degree (1.25%). In terms of agricultural practices, tribal women predominantly cultivate spices (45.83%), followed closely by millets (41.67%) and plantation crops (12.50%). Farming experience among tribal women ranges from up to 5 years (34.16%) to 6-10 years (48.75%) and over 10 years (17.08%). Regarding occupation, farming is the major occupation among tribal women (37.08%), followed by wage earners (18.33%), self-employed individuals (15.00%), and those engaged in both farming and business (29.58%). Land tenure reveals that a majority of tribal women own their land (61.25%), while others operate on rental land (38.75%). Farming practices among tribal women predominantly involve natural methods (71.25%), followed by organic (16.67%) and chemical-based methods (12.08%). Finally, the distribution of tribal women based on landholding size shows that a majority are classified as small and marginal farmers (51.67%), followed by medium-sized farmers (28.75%) and tenants (19.58%).

Table 1: Socio Personalcharacteristics of Tribal women

Category	Number (N=240)	Percentage (%)
Age		
Young (up to 25)	48	20
Middle (26 to 50)	150	62.5
Old (Above 50)	42	17.5
Education		
Illiterate	120	50
Upto Primary Education	58	24.17
SSC	20	8.33
Intermediate	39	16.25
Degree	3	1.25
Crops cultivated		
Spices	110	45.83
Millets	100	41.67
Plantation crops	30	12.50
Farming Experience		
Up to 5 years	82	34.16

6-10 years	117	48.75
>10 years	41	17.08
Occupation		
Farming	89	37.08
Wage earners	44	18.33
Self-Employed	36	15.00
Farming and business	71	29.58
Type of land		
Owned	147	61.25
Rental	93	38.75
Farming type		
Organic	40	16.67
Natural	171	71.25
Chemicals	29	12.08
Type of farmers		
Small & Marginal	124	51.67
Medium	69	28.75
Tenant	47	19.58

Perception of tribal women towards cultivation practices:

The perceptions and responses showed in Table 2 are based on tribal women's experiences with training organized by ICAR-IIMR, Hyderabad towards millet cultivation practice. These responses reflect how effectively tribal women perceived the training towards different aspects of millet cultivation. The perceived responses towards usefulness of training showed that 65.93% of the women strongly agreed about field and seed bed preparation followed by sowing methods (73.33% strongly agreed), cropping patterns (62.50% strongly agreed), farm operations (58.33% strongly agreed), nutrient management (69.17% strongly agreed), pest and disease management (47.50% strongly agreed), irrigation requirements (45.83% strongly agreed), and harvesting methods (68.33% strongly agreed). These perceptions are crucial in understanding the impact of training programs on tribal women's agricultural practices and thereby identifying the areas where further support or improvement is required to meet their needs and enhance their agricultural productivity (*Pawar et al 2020*).

Table 2: Perception of tribal women towards cultivation practices

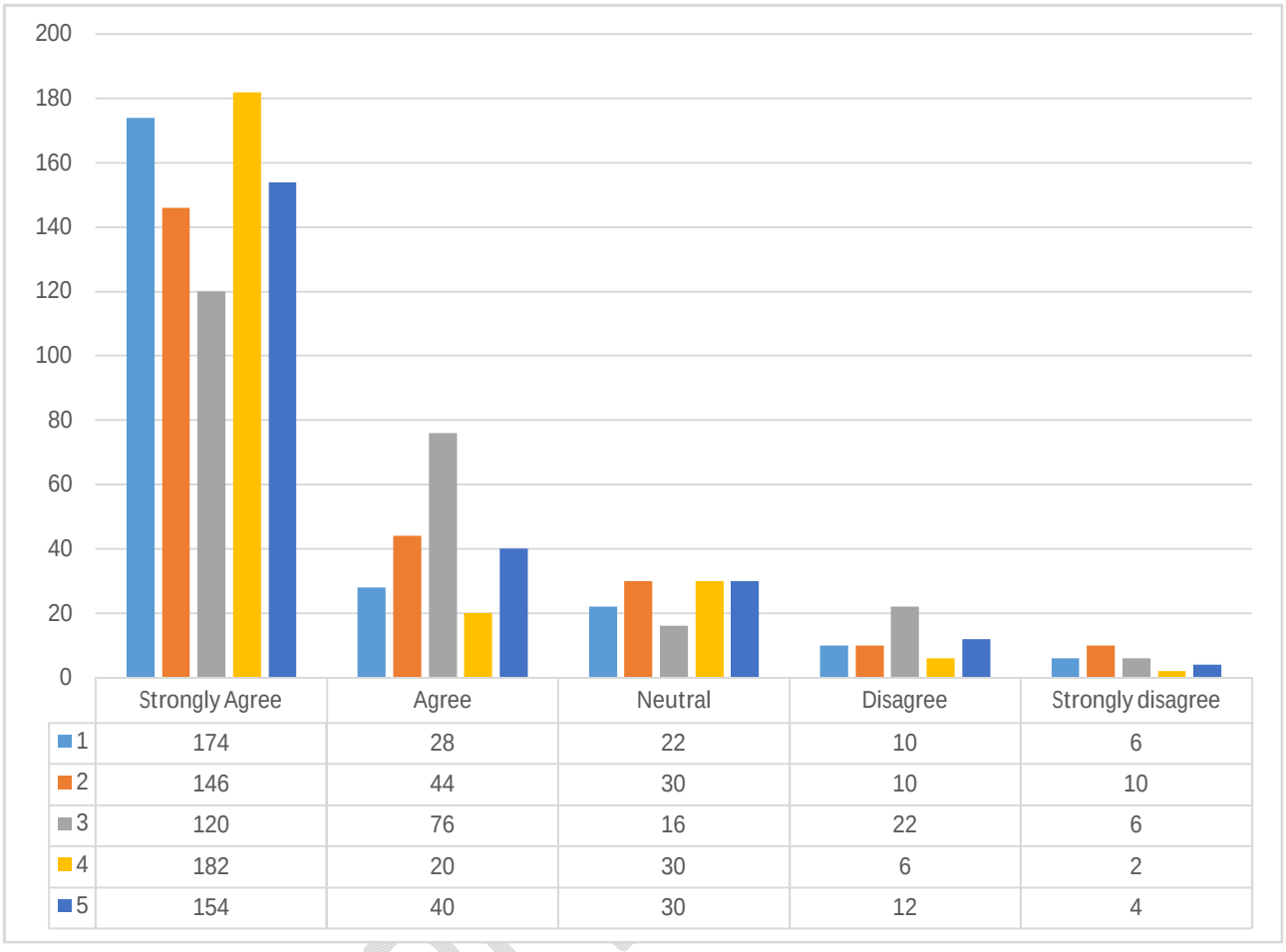
S.No	Statement	Strongly Agree	Agree	Neutral	Disagree	Strongly disagree
1	Field and seed bed preparation	158 (65.93)	60 (25.00)	10 (4.17)	10 (4.17)	2 (0.83)
2	Sowing methods in millets	176	40	10	10	4

		(73.33)	(16.67)	(4.17)	(4.17)	(1.67)
3	Cropping pattern of millets	150 (62.50)	50 (20.83)	20 (8.33)	10 (4.17)	10 (4.17)
4	Farm operations methods in millets	140 (58.33)	60 (25.00)	10 (4.17)	16 (6.67)	14 (5.83)
5	Nutrient Management in millets	166 (69.17)	38 (15.83)	22 (9.17)	10 (4.17)	4 (1.67)
6	Pest and disease management in millets	114 (47.50)	70 (29.17)	40 (16.67)	12 (5.00)	4 (1.67)
7	Irrigation requirements in millets	110 (45.83)	78 (32.50)	30 (12.50)	20 (8.33)	2 (0.83)
8	Harvesting methods in millets	164 (68.33)	34 (14.17)	42 (17.50)	0	0

Figures in parenthesis represents percentages

Perception of tribal women on training towards post-harvest practices:

Figure-3 outlines the perceptions of tribal women regarding post-harvest practices, focusing on various aspects like processing techniques, efficiency of machines, moisture content and processing period, steps in processing millet grains, and the availability of the best machineries for millet processing. The data revealed that a significant percentage of tribal women expressed strong agreement with processing techniques in millets (72.50%) followed by steps in processing millet grains (75.83% strongly agree), and the efficiency of machines (60.83% strongly agree). Additionally, there are varying levels of consensus on other aspects, such as moisture content and processing period, where 50.00% strongly agreed, and 31.67% agreed. The table also highlighted areas where there is less agreement, such as the availability of the best machineries for millet processing, with 64.17% expressing strong agreement, while 16.67% agree and 12.50% as neutral. This data underscores the importance of understanding tribal women's perspectives on post-harvest practices to enhance efficiency and effectiveness in millet processing.



	Strongly Agree	Agree	Neutral	Disagree	Strongly disagree
1	174	28	22	10	6
2	146	44	30	10	10
3	120	76	16	22	6
4	182	20	30	6	2
5	154	40	30	12	4

Figure-3: Perception of tribal women towards post-harvest practices

Perception of tribal women on training towards Millets value addition techniques:

The results in Table 3 highlighted the importance of tribal women towards millets value addition techniques, covering various statements such as millet value-added techniques developed by ICAR-IIMR, hands-on training towards cooking with millets, shelf life improvement techniques, packing standards, FSSAI standards in millets, proper branding of millets, and quality control techniques. The data revealed that a significant proportion of tribal women strongly agreed with several aspects. For instance, 69.17% strongly agreed with millet value-added techniques developed by ICAR-IIMR, while 52.50% strongly agreed with hands-on training towards cooking with millets. Moreover, there is notable support for other aspects such as shelf life improvement techniques (64.17% strongly agree) and FSSAI standards in millets (75.83% strongly agree). However, there are areas where opinions are more divided, such as proper branding of millets, with 45.83% strongly agreeing and 32.5% agreeing and 13.33% being neutral. Additionally, quality control techniques in millets received mixed responses, with 35.00% strongly agreeing and 35.00% agreeing, and 21.66% being neutral.

Table 3: Perception of tribal women towards millets value addition techniques

S.No	Statement	Strongly Agree	Agree	Neutral	Disagree	Strongly disagree
1	Millet value added techniques developed by ICAR-IIMR	166 (69.17)	42 (17.50)	22 (9.17)	6 (2.50)	4 (1.67)
2	Hands on training towards cooking with millets	126 (52.50)	66 (27.50)	18 (7.50)	20 (8.33)	10 (4.17)
3	Shelf life improvement techniques in millets	154 (64.17)	54 (22.50)	12 (5.00)	10 (4.17)	10 (4.17)
4	Packing standards	164 (68.33)	22 (9.17)	30 (12.50)	10 (4.17)	14 (5.83)
5	FSSAI standards in millets	182 (75.83)	32 (13.33)	16 (6.67)	8 (3.33)	2 (0.83)
6	Proper Branding of millets	110 (45.83)	78 (32.5)	32 (13.33)	14 (5.83)	6 (2.5)
7	Quality control techniques in millets	84 (35.00)	84 (35.00)	52 (21.66)	4 (1.66)	16 (6.66)

Note: Figures in parenthesis represents percentages

Constraints faced by tribal women in cultivation of millets:

The constraints encountered by tribal women in millet cultivation and value was shown in Figure-3. The most critical hurdle, according to the data is the difficulty in accessing crucial information on cultivation aspects (83.5%), ranking as the number one constraint. Lack of knowledge on best practices, pest control, and crop management of milletsmade the respondents to rank first. Furthermore, limited access to resources (78.83%), ranking second as this encompassed limited access to land, water, seeds, fertilizers, and equipment. Infrastructure and technology gaps (74.17%) ranked third as these gaps limited the access to irrigation systems, storage facilities and processing machinery. These challenges are further compounded by a lack of knowledge on adding value to their harvest as they lack awareness in grading and packaging (ranking fourth at 71.33%) and skills for value addition (ranking eighth at 56.33%). This restricted their ability to fetch better prices and expand their market reach. Financial constraints also play a major role. Difficulty in obtaining timely credit ranked fifth at 67.50%as this restricted in establishing processing units and their ability to process and sell value-added millet products. Time management is another hurdle that balances the agricultural work and household chores creating a constraint (ranking sixth at 63.3%). Limited access to training and capacity building programs ranked seventh at 61.6%as this restricted their knowledge and skills in modern millet cultivation practices. Finally, the absence of a well-defined millet business plan (ranking ninth at 52.50%) hinders their ability to approach the market strategically and maximize profits. These challenges contribute to a situation where tribal women struggle to optimize their millet cultivation efforts and achieve financial empowerment.

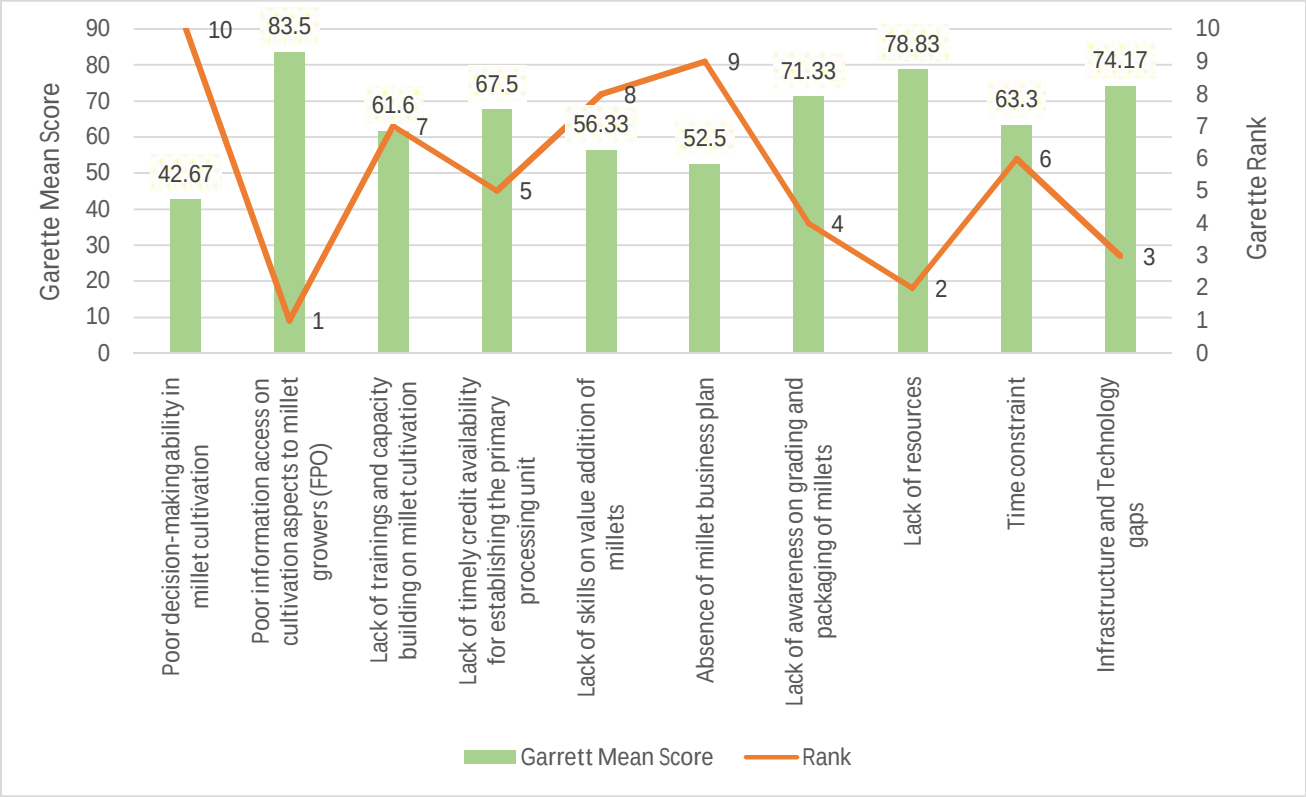


Figure- 4: Constraints Faced by Tribal Women

CONCLUSION:

Small and marginal farmers, particularly in tribal areas, struggle with limited land, capital, and labor, compounded by scarce off-farm income opportunities. Tribal women involved in millet farming encounter difficulties across cultivation, post-harvest, and value addition processes. Inadequate storage facilities lead to post-harvest losses, and limited access to modern processing equipment, quality packaging, and proper workspace hampers efficiency. Infrastructure deficiencies and lack of training further constrain their efforts. However, engaging tribal women in millet value addition can foster entrepreneurship and economic diversification. In conclusion, although tribal women exhibit strong potential for agricultural productivity, significant barriers must be addressed. Overcoming these multifaceted challenges through targeted support and training is essential for improving the livelihoods of tribal communities and ensuring sustainable millet farming practices.

Disclaimer (Artificial intelligence)

Authors hereby declare that NO generative AI technologies was used while preparing the manuscript.

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