A Study on Constraints Faced by Millet Stakeholders in Tamil Nadu, India

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Authors' contributions

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

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ABSTRACT

Millets, highly nutritious grains, are crucial for food security and nutrition due to their resilience in challenging agricultural conditions and rich nutritional content. This study investigates the constraints faced by stakeholders involved in the millet industry in Tamil Nadu, The research focuses on farmers, market intermediaries, and consumers, highlighting their challenges within the millet supply chain. A purposive sample of 90 millet-growing farmers and various market intermediaries was selected from key millet-producing districts. Data collection involved structured interviews and analysis using descriptive statistics and Garrett Ranking Technique. Results reveal significant production constraints for farmers, including price fluctuation, high seed costs, and pest and disease occurrence. Market intermediaries face challenges such as supply-demand imbalance and high transportation costs. Consumers encounter issues like limited availability and high prices of millet-based products. These findings underscore the multifaceted challenges within the millet industry, emphasizing the need for targeted interventions to address constraints and enhance the sustainability and accessibility of millets in Tamil Nadu.

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1. INTRODUCTION

Millets are highly nutritious grains that have been a fundamental part of human diets for centuries. They serve as the primary cereal grain for many households [1]. In regions like Africa and Asia, millets are the mainstay food for about one third of the population [2]. Compared to rice, millets are rich in protein, dietary fiber, energy, and minerals. They can be processed into various food products such as flakes, quick cereals, snacks, fortified foods, cooking ingredients, malt-based items, weaning foods, and especially health foods [3].

Millets are seen as important crops for ensuring food security due to their ability to thrive in challenging agricultural conditions. They contribute significantly to enhancing genetic diversity in the food supply, thus improving overall food and nutrition security [4]. Additionally, millets provide various health benefits and can aid in managing conditions such as diabetes, obesity, and hyperactive lipoedema when included in daily diets [1].

In India, millets are commonly used to prepare traditional foods and beverages such as idly, dosa, pappad, porridges, breads, and infant foods [5]. India is the leading producer and consumer of millet crops and their value-added products. Grain and fodder yielding 'dual-purpose' millets are produced essentially to guarantee the food and fodder security in rainfed agriculture [6].

Cumbu in the total, Rajasthan ranked first by contributing 43 per cent of the Indian Cumbu production. It is cultivated with an area of 42.64 lakh ha with 37.86 lakh tonnes of production followed by Uttar Pradesh, Maharashtra, Gujarat, Madhya Pradesh, Karnataka, Tamil Nadu, and so on respectively in the year 2017-18 (Table 2).

Maharashtra ranked first in the area cultivation of sorghum 34.64 lakh ha with the production of 23.89 lakh tonnes, followed by Karnataka, Rajasthan, Tamil Nadu, Madhya Pradesh, and so on respectively in the year 2017-18 (Table 3).

The cultivation and consumption of millets present a multifaceted landscape with diverse stakeholders facing various challenges. Farmers encounter obstacles related to agricultural practices, market intermediaries grapple with fluctuating demand and supply dynamics, and consumers contend with limited accessibility and awareness of millet-based products [7]. The overarching goal of ensuring food security and nutritional well-being, particularly in regions where millets serve as a primary food sources faces several challenges. In this study, we will explore the constraints faced by these stakeholders in the millet supply chain.

Table 1. State-Wise Area, production and productivity of Cumbu, 2017– 18

State	Area (000' ha)	Production (000' tn)	Yield (tn/ha)
India (2017-18)		CUMBU	
Rajasthan	4264.30	3756.80	0.88
Uttar Pradesh	925.40	1795.10	1.94
Maharashtra	787.80	669.20	0.85
Gujarat	397.20	964.90	2.43
Madhya Pradesh	309.90	754.70	2.44
Karnataka	231.60	367.30	1.59
Tamil Nadu	63.00	143.50	2.28
Andhra Pradesh	48.40	93.20	1.93
Jammu and Kashmir	12.60	7.40	0.59
Telangana	8.80	9.30	1.06
Others	7.30	7.30	8.97
Total	7056.20	8568.80	24.96

Source: Department of agriculture and cooperation, (DACNET, 2018)

Table 2. State-Wise Area, production and productivity of sorghum, 2017 – 18

State	Area (000' ha)	Production (000' Tn)	Yield (Tn/Ha)
India (2017-18)		SORGHUM	
Maharashtra	3464.20	2389.70	0.69
Karnataka	1088.10	1264.00	1.16
Rajasthan	516.00	300.80	0.58
Tamil Nadu	385.60	430.70	1.12
Madhya Pradesh	270.00	653.40	2.42
Uttar Pradesh	169.10	214.80	1.27
Andhra Pradesh	139.70	332.70	2.38
Gujarat	91.20	125.30	1.37
Telangana	67.30	73.40	1.09
Chhattisgarh	3.70	4.70	1.26
Others	10.20	9.90	10.52
Total	**6201.50**	**5794.70**	**22.6**

Source: Department of agriculture and cooperation, (DACNET, 2018)

Table 3. District-Wise area, production and productivity of ragi, 2017 – 18

State/District	Area (ha)	Production (tn)	Yield (tn/ha)
Tamil Nadu (2017-18)		RAGI	
Krishnagiri	41272	120446	3.89
Dharmapuri	16723	62301	3.73
Sivagangai	7307	25625	3.51
Vellore	6782	23974	3.53
Erode	5488	12028	2.92
Tiruvannamalai	4839	18572	3.84
Villupuram	2261	6949	3.07
Perambalur	538	1977	3.67
Salem	330	1471	4.46
Tiruchirappalli	320	1381	4.32
Others	492	1981	66.67
Total	86513	321332	3.71

Source: Department of agriculture and cooperation, (DACNET, 2018)

Table 4. Selection of respondents

	Farmers	Traders	Wholesalers	Processors	Retailers	Consumers
Dindigul	20	1	2	-	2	10
Namakkal	20	1	2	-	2	10
Dharmapuri	20	2	3	3	4	10
Krishnagiri	30	1	3	2	2	10
Total	90	5	10	5	10	40

2. MATERIALS AND METHODOLOGY

Ragi, Sorghum and Cumbu are the most demanded millets among the consumers, because of its convenience to use and nutritive value [8]. Hence these three millets are purposively selected for the present study. Millet is grown largely in the districts of Krishnagiri, Dharmapuri, Dindigul and Namakkal in Tamil Nadu. Hence the above four districts are purposively selected for the present study.

Convenient sampling technique was used for the present study. The details of the millet growing farmers were collected from FPOs and Department of Agriculture. 90 millet growing farmers from the districts were selected. During the data collection from the farmers, the list of local traders, commission agents, wholesalers, processors, and retailers who were in contact with the farmers were collected. Five commission agent, 10 wholesaler, 10 retailer, 5 processor and 40 consumers are selected for the present study.

A well - organized and pre-tested interview schedule was used to fetch primary data. The interview schedules for the study were designed considering the physical, cultural, and socio-economic environment of millets production, processing, and marketing in the study area The interview schedule for farmers-covered aspects such as general farm and household characteristics, details on cultivation practices and technologies adopted in cultivation and cost of cultivation, details on the marketing of millets, and problems in production and marketing.

2.1 Descriptive Statistics

The percentages and averages were utilized as suitable statistical tools to evaluate the democratic and socio- economic variables such as age, education, family size, experience in farming, experience in millets farming, farm size, income, landholding pattern, the number of millets produced, the number of millets marketed, etc., for the sample farmers.

2.2 Garrett Ranking Technique

To identify the major constraints encountered by farmers in millets cultivation technique developed by Garratt (1966) was used. In Garrett's scoring technique [9], the respondents were asked to rank the factors or problems and these ranks were converted into percent position by using the formula.

$$\text{Per cent position} = \frac{100 \, x \, (Rij - 0.5)}{Nj}$$

where,

Rij = Rank given to the ith constraints by the jth individualNj = Number of constraints ranked by the jth individual.

By referring to Garrett's table, the per cent positions estimated were converted into scores. Thus, for each constraint, the scores of the various respondents were added and the mean value was estimated. The mean thus obtained for each constraint was arranged in descending order. The constraints with the highest mean value were considered as the most important ones and the others followed in that order.

3. RESULTS AND DISCUSSION

3.1 General Characteristics of Sample Farmers

The General characteristics of the sample respondents such as age, educational status,

income, farming experience, landholding pattern, source of seeds, etc., would serve as the prerequisite for a better understanding of farmer participation in the major millet value chain, were presented in the following Table 5.

3.2 General Characteristics of Market Intermediaries

The market intermediaries like commission agent/ local trader, wholesaler/mandi, processor, retailer shows their characteristics such as age, educational status, experience, ownership, storage facility, and their constraints, etc. were collected and analyzed.

3.2.1 Age wise distribution of market intermediaries

The age of the sample intermediaries have significant influence on the decision making to handle the market. Hence, the details were collected, analyzed and the results are presented in Table 6.

It is explicit from Table 6, 50 per cent of the market intermediaries were in the age group between 41 to 50 years. About 40 per cent of the market intermediaries were in the age group between 31 to 40 years, and 67 per cent of the market intermediaries comes under the age group of below 30 followed by 3.33 per cent of them are in the age group of above 50.

3.2.2 Educational Status of market intermediaries

Education plays a major role in influencing the market intermediaries in purchasing the output from the producers. The education level of market intermediaries were categorized into illiterate, primary, higher secondary, diploma and graduate. The data on the educational status of the market intermediaries were analyzed and the results are presented in Table 7.

From Table 7, majority of the intermediaries (33 per cent) had higher education followed by 30 per cent of them are illiterate.

3.2.3 Experience of market intermediaries

Experience is the main factor directly involved in influencing the decision- making behaviour of the market intermediaries. The experience of the market intermediaries are categorized into less than 10 years, 11 to 20 years, 21 to 30 years and

above 30 years. The data on the experience of market intermediaries were analyzed and the results are presented in Table 8.

From Table 8, it could be inferred that 43 per cent of the market intermediaries had 11 to 20

years of experience and 40 per cent of them had 21 to 30 years of experience, followed by 16.67 per cent of them comes under the category of less than 10 years of experience, and 3.33 per cent of the market intermediaries were under the category of above 30 years of experience.

Table 5. Demographic characteristics of sample farmers

Factors	Frequency	Percentage
Age		
Less than 30	15	16.70
31 - 40	18	20.00
41 - 50	23	25.60
Above 50	34	37.80
Education		
Illiterate	45	50.00
Primary	15	16.67
Higher secondary	27	30.00
Diploma/Graduate	1	1.11
Post Graduate	2	2.22
Employment pattern		
Farming	61	67.78
Both farming and non-farming	29	32.22
Income		
Less than 90,000	48	53.33
90,001 - 2,00,000	18	20.00
2,00,001 - 5,00,000	15	16.67
More than 5,00,000	9	10.00
Large (Above 5)	4	10.00
Farming experience		
Less than 10	10	11.11
11 – 20	19	21.11
21 – 30	28	31.11
More than 30	33	36.67
Operational Land Holding		
Marginal farmer (<1 Ha)	48	53.33
Small farmer (1 to 2 Ha)	22	24.44
Medium farmer (2 to 4 Ha)	15	16.67
Big farmer (> 5 Ha)	5	5.56
Ownership		
Owned	86	95.56
Leased in	4	4.44

Table 6. Age wise distribution of market intermediaries

Sl.No.	Age (Years)	Number of Market Intermediaries				Overall
		CA*	WH*	PR*	RT*	
1.	Below 30	0	0	0	2(20.00)	2(6.67)
2.	31 – 40	3(60.00)	4(40.00)	2(40.00)	3(30.00)	12(40.00)
3.	41 – 50	2(40.00)	5(50.00)	3(60.00)	5(50.00)	15(50.00)
4.	Above 50	0	1(10.00)	0	0	1(3.33)
	Total	5(100.00)	10(100.00)	5(100.00)	10(100.00)	30(100.00)

(Figures in parentheses indicate percentage to total)
*(*CA – Commission Agent, WH- Wholesalers, PR- Processors, RT- Retailers)*

Table 7. Educational Status of market intermediaries

Sl. No.	Educational status	Number of Market Intermediaries				Overall
		CA	WH	PR	RT	
1.	Illiterate	1(20.00)	3(30.00)	0	5(50.00)	9(30)
2.	Primary	1(20.00)	0	2(40.00)	1(10.00)	4(13.33)
3.	Higher secondary	2(40.00)	4(40.00)	2(40.00)	2(20.00)	10(33.33)
4.	Diploma	1(20.00)	2(20.00)	1(20.00)	2(20.00)	6(20.00)
5.	Graduate	0	1(10.00)	0	0	1(3.33)
Total		5(100.00)	10(100.00)	5(100.00)	10(100.00)	30(100.00)

(Figures in parentheses indicate percentage to total)

Table 8. Experience of market intermediaries

Sl.No.	Experience (Years)	Number of Market intermediaries				Overall
		CA	WH	PR	RT	
1.	Less than 10	1(20.00)	2(20.00)	-	2(20.00)	5(16.67)
2.	11 – 20	2(40.00)	5(50.00)	2(40.00)	4(40.00)	13(43.33)
3.	21 – 30	2(40.00)	3(30.00)	3(60.00)	4(40.00)	12(40)
4.	Above 30	-	1(10.00)	-	-	1(3.33)
	Total	**5(100.00)**	**10(100.00)**	**5(100.00)**	**10(100.00)**	**30(100.00)**

(Figures in parentheses indicate percentage to total)

Table 9. Storage facility of market intermediaries

Sl.No	Storage facility	Market intermediaries				Overall
		CA	WH	PR	RT	
1.	Owned	0	10(100.00)	5(100.00)	7(70.00)	22(88.00)
2.	Hired	0	0	0	3(30.00)	3(12.00)
	Total	**0**	**10(100.00)**	**5(100.00)**	**10(100.00)**	**25(100.00)**

(*Figures in parentheses indicate percentage to total*)

Table 10. Price difference based on variety

Sl.No.	Price difference based on variety	Market intermediaries				Overall
		LT / CA	WH	PR	RT	
1.	Yes	5(100.00)	10(100.00)	5(100.00)	10(100.00)	30(100.00)
2.	No	-	-	-	-	-
	Total	5(100.00)	10(100.00)	5(100.00)	10(100.00)	30(100.00)

(*Figures in parentheses indicate percentage to total*)

Table 11. Value addition by the market intermediaries

Sl. No	Is value addition done	Market intermediaries			Overall
		CA	WH	PR	
1.	Yes	0	0	5(100.00)	5(25.00)
2.	No	5(100.00)	10(100.00)	0	15(75.00)
	Total	**5(100.00)**	**10(100.00)**	**5(100.00)**	**20(100.00)**

(*Figures in parentheses indicate percentage to total*)

3.2.4 Storage facility of market intermediaries

The storage facility is also an important factor in storing the sourced products from the producers. The produce has to be stored in a well-maintained place to avoid the spoilage and pest, fungal attack. The intermediaries like local trader/ commission agent, wholesaler, processor and retailer are categorized and presented in Table 9.

From Table 9, it evident clearly that, 88 per cent of the intermediaries were owned the storage facility for storing the sourced produce from the

producers. 12 per cent of the intermediaries (retailers) were using the hired storage facility for storing the sourced produce.

3.2.5 Price difference based on variety

The intermediaries fix the price of the produce. The price may vary according to the variety, quantity and quality based on certain parameters followed by them. The price difference can be based on the variety categorized the market intermediaries is done by them or not. The results were presented in Table 10.

It could be observed from table 10, that the price difference based on the variety was accepted by all the market intermediaries. It clearly states that the prices were varied based on the variety available/preferred in the market by the market intermediaries.

3.2.6 Value addition by the market intermediaries

The value addition is the process, done to the product to increase the value of it by changing its form, according to the consumer's needs. The respondents were asked about processing and the results are presented in Table 11.

From the above table 11, it could be inferred that all the processors were involved 100 per cent in the value addition process, they actively take part in changing the form of the raw millets. The Commission agent and Wholesalers are not involved in this value addition process.

3.2.7 Retail format of the market intermediaries

The wholesalers sold the processed products to retailers. The retailers facilitated the marketing of produce by packaging, transportation etc. In this the retailer's format are classified into departmental stores, convenience stores, specialty stores (organic) and local market. The results were presented in Table 12.

It could be seen from table 12, that about, 50 per cent of the retail format were specialty stores (organic) and 40 per cent of the retailer's format of selling were departmental stores, 10 per cent of them were sell through the format of local market. It is evident that specialty stores (organic) were the most used retail format in selling millet products.

3.3 Demographic Factor of the Consumers

The general characteristics of the sample respondents included the age, educational status, marital status, family type, family size, educational level, occupation, monthly income. The data on the general characteristics of the respondents were analysed to understand their buying behaviour. The end users (consumers) are also played a major role in the value chain such as category of millets consumed, source of awareness on health benefits of the millet products, frequency of consumption of millets, form of consumption, place of purchase, factors influencing the purchase of millet-based products etc., which are all the most influencingfactors on decision-making.

The Table 13, shows the demographic profile of the respondents who have purchased the millets and millet-based products. The Descriptive statistics reveal that most of the consumers are women (66 per cent) and most of them are between the age group of 25 – 30 (50 per cent). While 57.5 per cent are married, 52.5 per cent are nuclear family status and 90% of them are medium-sized family. In addition, 67.5 percent of them are studied Undergraduate, while 37.5 per cent of the respondent are Private Employee. Annual incomes of the respondents purchasing the millet and millet-based products range between Rs 20001 – Rs 30000/- (47.5 per cent).

3.4 Constraints Faced by the Stakeholders

In this, constraints faced by the stakeholders were identified, ranked and the results are presented in this section.

3.4.1 Production Constraints faced by the farmers

Constraints were seen in all the sectors, to overcome that, the constraints factors must be known. The main reasons seen in production constraints are high cost of seeds, lack of technical knowledge, occurrence of pest and diseases, lack of sufficient rainfall, unavailability of HYV, labor unavailability, high cost of fertilizers and high cost of plant protection chemicals. Garett's ranking techniques was used to analyze the production constraints faced by the farmers among the sample respondents. The results were presented In Table 14.

Table 12. Retail Format of the market intermediaries

Sl. No	Retail format	Number of retail outlets	Percentage
1.	Departmental stores	4	40.00
2.	Specialty stores (Organic)	5	50.00
3.	Local Market	1	10.00
Total		10	100.00

Table 13. Demographic factor of the sample consumers

Factors	Frequency	Percentage
Gender		
Male	14	35.00
Female	26	65.00
Age		
25 and below	15	37.50
26-35	20	50.00
36-45	3	7.50
46-55	2	5.00
Above 55	-	-
Marital Status		
Married	23	57.50
Unmarried	17	42.50
Family Type		
Joint Family	19	47.50
Nuclear Status	21	52.50
Family Size		
Small (Below 3)	0	0
Medium (3-5)	36	90.00
Large (Above 5)	4	10.00
Educational Level		
Illiterate	0	0
Elementary	0	0
High School	3	7.50
Higher Secondary	2	5.00
Undergraduate	27	67.50
Post Graduate	8	20.00
Occupation		
Government Employee	9	22.50
Entrepreneur	1	2.50
Agriculture	2	5.00
Professional	3	7.50
Self – Employed	11	27.50
Private Employee	15	37.50
Monthly Income		
Rs 20000 and below	11	27.50
Rs 20001 – Rs 30000	19	47.50
Rs 30001–Rs 40000	4	10.00
Rs 40000-50000	4	10.00
Above Rs50000	2	5.00

Table 14. Constraints faced by the farmers

Sl. No	Constraints	Average Score	Rank
1.	Price fluctuation	108.83	1
2.	High cost of seeds	104.73	2
3.	Occurrence of pest and diseases	101.32	3
4.	Lack Of Sufficient Rainfall	98.93	4
5.	Lack of market information	96.05	5
6.	Labor unavailability	94.15	6
7.	High cost of fertilizer	86.83	7
8.	Transportation	85.76	8
9.	Lack of technical knowledge	83.95	9

Table 15. Constraints faced by the intermediaries

Sl.No	Reasons	Average Score	Rank
1.	Imbalance in supply and demand	120.00	I
2.	Unavailable of skilled labour, for processing	100.58	II
3.	High transportation costs	100.52	III
4.	Strikes and Curfew	98.65	IV
5.	Market Competition	97.68	V
6.	Fluctuation in raw materials	88.84	VI
7.	Financial Support required to scale up	87.10	VII
8.	During production, more electricity is needed for drying purpose.	76.97	VIII

Table 16. Problems faced by the millet consumers

Sl. No	Statements	Average Score	Rank
1.	Lack of availability	101.27	1
2.	High price	104.05	2
3.	Brand unavailability	87.37	3

From the above Table 14, it states that, the farmers see the first main factor as the production constraint were price fluctuation, high cost of seeds, followed by the occurrence of pest and diseases, lack of sufficient rainfall also plays a major in the production constraints due to the insufficient rainfall affects the yield of the crops. Lack of market information, labor unavailability, high cost of fertilizer and transportation and lack of technical knowledge also were the followed constraints faced by the farmers and the results were supported by Pushpa and Kumar [10].

3.4.2 Constraints faced by the intermediaries

The market intermediaries in transferring the product from one place to the end place also face constraints. Imbalance in supply and demand, labour scarcity and high transportation costs are the major constraints faced by them. The results are presented in Table15.

From the above Table 15, it states that, majority of the market intermediaries felt that imbalance in supply and demand were the major constraints followed by labour scarcity, high transportation costs, and strikes, curfew. Market competition, Fluctuation in raw materials, financial support required to scale up, during production, more electricity is needed for drying purpose, were the constraints faced by the intermediaries.

3.4.3 Problems faced by the millet consumers

The consumers were asked about the problems faced in consumption of millet-based products and the results were presented in Table 16.

From Table 16, majority of the consumers felt that lack of availability (millets are not available in all the stores) and price of the products high. Brand unavailability also a major problem faced by the respondents and the results were supported by Shah et al. [11-12].

4. CONCLUSION

The study delved into the multifaceted constraints faced by stakeholders involved in the millet industry in Tamil Nadu. Farmers encounter challenges such as price fluctuations, high seed costs, pest and disease outbreaks, and inadequate rainfall, which hinder production. Market intermediaries grapple with issues like supply-demand imbalances, labor scarcity, and high transportation costs, affecting the efficient transfer of products. Consumers, on the other hand, encounter problems including limited availability of millet-based products, high prices, and a lack of diverse brands in the market. These constraints intersect with the overarching goal of ensuring food security and nutritional well-being, highlighting the need for targeted interventions and policy measures to address them effectively. Our findings underscore the importance of collaborative efforts among stakeholders to overcome these challenges and foster a more resilient and inclusive millet value chain in Tamil Nadu. Some efforts should be made to enhance market transparency and information dissemination to empower farmers and market intermediaries with timely and accurate data on demand, supply, and pricing dynamics. Interventions are needed to improve infrastructure and logistics to address transportation bottlenecks and reduce post-harvest losses. There is a crucial need to invest in skill development programs to address labor shortages and enhance the capacity of market intermediaries in processing and value addition.

5. LIMITATIONS OF THE STUDY

The study aims to shed light on the constraints faced by stakeholders involved in the millet industry in Tamil Nadu, it's important to acknowledge certain limitations. Firstly, the study's scope is confined to a specific geographical area, potentially limiting the generalizability of findings to other regions. Additionally, the sample size of stakeholders, including farmers, market intermediaries, and consumers, though carefully selected, may not fully represent the diverse perspectives within each group. Moreover, the study relies primarily on self-reported data obtained through interviews, which could be subject to biases or inaccuracies. Furthermore, the study predominantly focuses on production and marketing constraints, potentially overlooking other important factors influencing the millet supply chain, such as policy interventions or cultural practices.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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