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Research Article

Perceived constraints and suggestions of marine fisherwomen towards seaweed culture in Ramanathapuram district of Tamil Nadu

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Abstract

Seaweed culture can significantly improve the quality of life in coastal communities. The availability of seaweed resources on the South East Coast of Tamil Nadu and Gujarat; hence, Ramanathapuram district in Tamil Nadu was purposively selected for study. Seaweed culture become the best livelihood option for the women in the Gulf of Munnar of Rameswaram Coast. A total of 120 women seaweed producers were interviewed to identify the women's profile, constraints in seaweed culture, and suggestions to overcome the limitations encountered by the women. Garrett ranking method was used to analyze and rank the constraints. The various constraints faced by women seaweed producers were environmental, management, financial, input and personal. Considering all the different categories of constraints, the primary constraints were lack of seed availability, poor growth of seaweed, bad weather, low price of seaweed, and risk in diving sea. The significant suggestions given by women were to increase the seed availability and reasonable prices for their produce. The seaweed sector has all the prospects to uplift the fisherwomen's livelihood by providing high employment opportunities. By overcoming the constraints mentioned in the paper, the industry will best suit women for their income generation.

Keywords: Constraints, Environment, Management, Marine fisherwomen, Seaweed

Highlights

- Among 38 districts of Tamil Nadu, the study was conducted in the Ramanathapuram district.
- Various categories of constraints encountered by the women seaweed producers were collected.
- The final ranking was made based on the Garrett Ranking method.
- Constraints encountered were categorized into environmental, managemental, input, finance, and personal constraints.

INTRODUCTION

Seaweed, a marine macroscopic alga, holds significant commercial importance in various industries such as food, pharmaceuticals and biotechnology. Traditionally harvested from the wild, seaweeds became subject to overexploitation due to their commercial value. Cultivation efforts have been initiated in response to the growing demand for seaweed resources, with successful experiments focusing on economically viable species like *Gelidella acerosa*, *Gracilaria edulis*, *Kappaphycus alvarezii* and *Hypnea valentiae*. Notably, *K. alvarezii* has been successfully cultivated in the coastal waters of Tamil Nadu, India (Rameshkumar and Rajaram, 2019).

Over the years, global algal production has witnessed a remarkable 60-fold increase, reaching 35.82 million metric tons in 2019, with 97 per cent of this production sourced from cultivation. India, particularly in cultivating miscellaneous red seaweed, has significantly contributed to 99.9 per cent of the global production with 5,300 metric tons. Among seaweeds, red seaweeds dominate global cultivation, contributing 18.25 million metric tons, or 52.54 per cent of the total production (FAO, 2021). *Kappaphycus* sp., especially *K. alvarezii*, stands out as a commonly used raw material in the food and food polymer industries, with its commercial cultivation originating in the Philippines in 1960 and later in India, specifically in Tamil Nadu, from 2003 (Doty and Alvarez, 1975; Johnson and Gopakumar, 2011).

Crucially, a significant portion of the global seaweed production occurs on small-scale farms, often managed by women (Gopal *et al.*, 2020). This not only contributes to ecological services but also positively impacts the well-being of coastal and rural communities on cultural and economic levels. Women, in particular, play pivotal roles in seaweed cultivation, from knotting seedlings to harvesting biomass, contributing to their economic independence. The involvement of women in seaweed farming has empowered them to lead better lives and enhance their families' livelihoods (Msuya and Hurtado, 2017; Rameshkumar and Rajaram, 2019; World Bank, 2023).

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In the context of Ramanathapuram district in Tamil Nadu, the success of seaweed production has been facilitated by forming Women Self Help Groups (SHGs) supported by corporate entities such as Aqua Agri and Pepsi Co. The financial and institutional support provided by these corporations has led to the proliferation of seaweed farming through women SHGs, starting in the early 2000s and expanding to neighbouring coastal districts (Krishnan and Kumar, 2010; Narayanakumar and Krishnan, 2011).

However, challenges persist for women seaweed producers in Ramanathapuram district despite the evident success. This study aims to identify and address the perceived problems faced by women engaged in seaweed production, thus contributing to a more comprehensive understanding of the sector's growth dynamics in the region.

Objectives of the study are: 1. To analyze the socioeconomic profile of women seaweed producers in the Ramanathapuram district of Tamil Nadu; 2. To perceive the constraints and suggestions of marine fisherwomen towards seaweed culture using the Garrett ranking method.

MATERIALS AND METHODS

Among 38 districts of Tamil Nadu, the study was conducted in the Ramanathapuram district, which was selected purposively due to the large number of women involved in seaweed cultivation. *Ex post facto* research design was utilized for the present study. A total of 120 respondents were selected by simple random sampling without replacement technique from the villages of Sambai, Mangadu, Vadakadu, Chinnapalam, Thoppukaadu in Rameshwaram region and Nambuthalai, Solliyakudi, Pudhukudi in Thondi region.

Various categories of constraints encountered by the women seaweed producers in the study area were collected as reported by the respondents. Experts further evaluated the list. After this, respondents were asked to rank the constraints: rank 5 for 'most severe' constraint, rank 4 for 'moderately severe' constraint, rank 3 for 'severe', rank 2 for 'not so severe,' and rank 1 for 'least severe' constraint. The final ranking was made up based on the Garrett Ranking method. As per this method, respondents have been asked to assign the rank for all factors, and the outcomes of such ranking have been converted into score value with the help of the following formula:

$$\text{Percentage position} = \frac{100(Rij - 0.5)}{Nj}$$

Where,

Rij = Rank given for i^{th} item j^{th} individual

Nj = Number of items ranked by j^{th} individual

Using Garrett's Table, the estimated percentage positions were transformed into scores. Subsequently, the scores for each factor were summed for each individual, and the total value of scores, along with the mean values, was computed. The factor with the highest mean value was regarded as the most significant.

RESULTS

The majority of the respondents (70%) were in the middle age group, followed by the old (17.5%) and young age group (15%). A good number of respondents were illiterate, 22.5 per cent had their high school, 16.67 per cent of women had their primary school, 13.3 per cent had their middle school, and only 1.6 per cent were graduated. Majority of the respondents (70.8%) had medium level of annual income followed by low and high with the percentage of 15.83 per cent and 13.33 per cent, respectively, women of 75 per cent had high level of experience with more than 10 years followed by medium of 16.67 per cent women and low of 8.33 per cent women. Most of the respondents had nuclear family with less than 5 members. 80.83 per cent of the respondents had medium level of social cohesion and 85.83 per cent had low level of fatalism. Mass media exposure and political participation were medium among the respondents (Table 1).

Table 1. Profile of the women seaweed producers (N= 120)

Sl. No.	Variable	Category	Frequency (Nos.)	Percentage (%)
1.	Age	Young age group (<33)	15	12.5
		Middle age group (33 to 54)	84	70
		Old age group (>54)	21	17.5
2.	Level of education	Illiterate	47	39.16
		Primary school	20	16.67
		Middle school	16	13.33
		High school	27	22.5

Cont. Table 1.

Table 1., Cont. ...

Sl. No.	Variable	Category	Frequency (Nos.)	Percentage (%)
		Higher Secondary	8	6.67
		Graduate	2	1.67
3.	Annual income	Low (<Rs. 66,260)	19	15.83
		Middle (Rs. 66,260 to 1,32,198)	85	70.83
		High (>Rs. 1,32,198)	16	13.33
4.	Family type	Nuclear family	74	61.67
		Joint family	46	38.33
5.	Family size	Less than 5	86	71.67
		More than 5	34	28.33
6.	Social cohesion	Low	11	9.17
		Medium	97	80.83
		High	12	10
7.	Fatalism	Low	103	85.83
		Medium	17	14.17
		High	0	0
8.	Mass media exposure	Low	12	10
		Medium	93	77.5
		High	15	12.5
9.	Political participation	Low	26	21.67
		Medium	75	62.5
		High	19	15.83
10.	Experience	Low (<5 years)	10	8.33
		Medium (5 to 10 years)	20	16.67
		High (>10 years)	90	75

Constraints

The women seaweed producers encountered various constraints, categorized into environmental, management, input, finance, and personnel constraints.

Constraints related to environment: The various environmental constraints perceived by the women seaweed producers are listed in Table 2 and Fig.1.

Table 2. Constraints related to environment as perceived by the women seaweed producers

Name of the constraints	Mean score	Rank
Damage of bamboo raft	45.775	IV
Grazing by fishes	52.8	II
Disease	43.15	V
Bad weather (fluctuation in temperature)	72.8	I
Effluent from shrimp industry	45.86	III
Epiphytism during culture	32.575	VI

Bad weather (fluctuation in temperature) was perceived as the major constraint, with a mean score of 72.8. The other constraints were grazing by fishes, waste effluents from the shrimp industry, damage to bamboo rafts, and disease, with the mean score of 52.8, 45.86, 45.775 and 43.15, respectively. Epiphytism during culture also hindered the culture, and it was ranked as sixth with a mean score of 32.575.

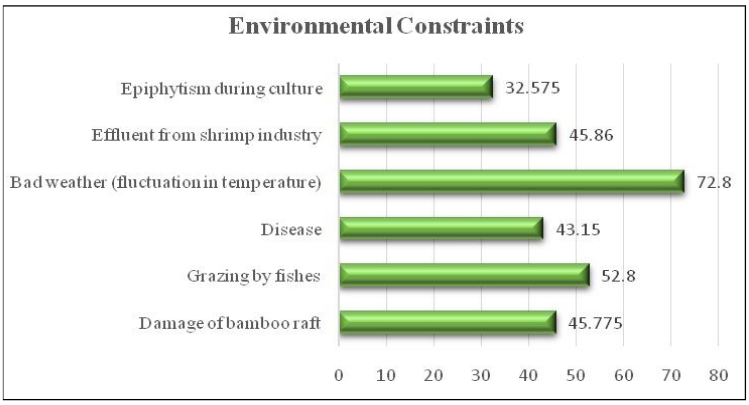

Fig. 1. Constraints related to environment as perceived by the women seaweed producers

Table 3. Constraints related to management as perceived by the women seaweed producers

Name of the constraints	Mean score	Rank
Poaching	27	IV
Epiphytism during drying	44	III
Lack of shed for drying	56	II
Poor growth of seaweed	73	I

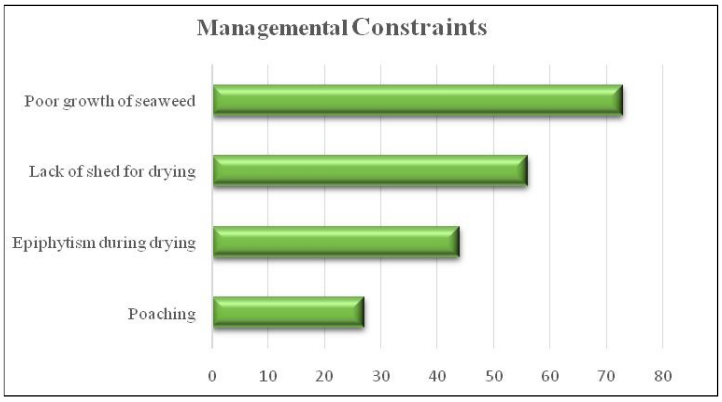

Fig. 2. Constraints related to management as perceived by the women seaweed producers

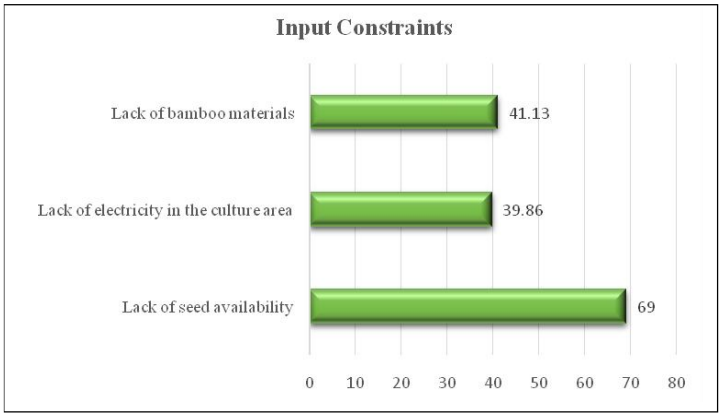

Fig. 3. Constraints related to input as perceived by the women seaweed producers

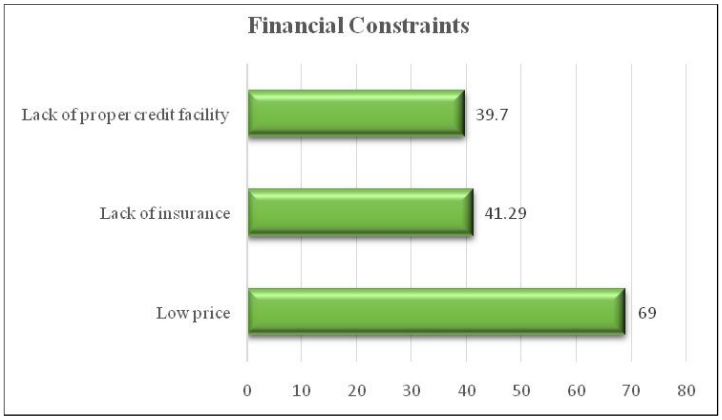

Fig. 4. Financial constraints perceived by the women seaweed producers

Table 4. Constraints related to input as perceived by the women seaweed producers

Name of the constraints	Mean score	Rank
Lack of seed availability	69	I
Lack of electricity in the culture area	39.86	III
Lack of bamboo materials	41.13	II

Constraints related to management: The various management constraints perceived by the women seaweed producers are listed in the Table 3 and Fig. 2.

Poor seaweed growth was considered the most severe constraint perceived by the women farmers within the mean score of 73. The second management constraint was the lack of a shed for seaweed drying, with a mean score of 56. The problem of epiphytism during drying ranked third with a mean score of 44. Poaching was perceived as a fourth-ranked constraint.

Constraints related to input: In case of input, various constraints perceived by the women seaweed producers were listed in Table 4 and Fig. 3.

Lack of seaweed availability was the severe constraint related to the input given as first rank with the mean score of 69. Lack of bamboo materials for raft ranked second with a mean score of 41.13. Lack of electricity in the culture area was ranked third with a mean score of 39.86.

Table 5. Financial constraints perceived by the women seaweed producers

Name of the constraints	Mean score	Rank
Low price	69	I
Lack of insurance	41.29	II
Lack of proper credit facility	39.70	III

Constraints related to finance: The low price of the seaweed (Rs. 35/kg in the case of dry seaweed) was ranked as a significant constraint by the respondents, with a mean score of 69. The second-ranked constraint was lack of insurance (mean score 41.29), followed by lack of proper credit facility with a mean score of 39.7 (Table 5 and Fig. 4).

Personal constraints: The seaweed producers perceived the risk of diving into the sea as a significant constraint (mean score 61.84). The

Table 6. Personal constraints perceived by the women seaweed producers

Name of the constraints	Mean score	Rank
Health problems (eye irritation and skin problems)	59.94	II
Lack of proper road facility from village to the culture area	48.9	IV
Harassment of women	34.43	VI
Risk in diving in the sea	61.84	I
Lack of men's support	54.74	III
COVID lockdown	41.14	V

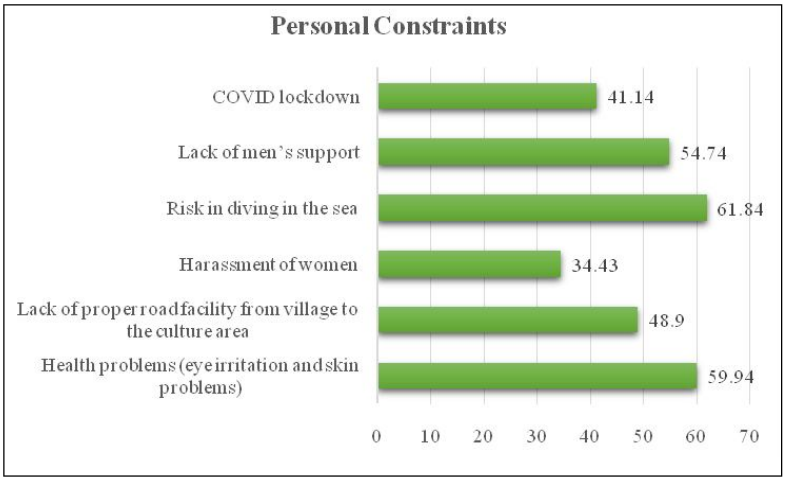

Fig. 5. Personal constraints perceived by the women seaweed producers

other constraints were health problems (eye irritation and skin problems), with a mean score of 59.94, lack of family support (mean score of 54.74), lack of proper road facility from the village to the culture area (mean score of 48.9) and COVID lockdown (mean score 41.14) which made a heavy loss for them in recent years. The last but heart-breaking constraint was harassment for women, which made them afraid to go for culture (mean score 34.43) (Table 6 and Fig. 5).

DISCUSSION

Constraints related to seaweed cultivation by women: The findings of constraints related to environment are in line with the findings of Johnson and Gopakumar (2011), Hamad and Mtae (2012) and Johnson *et al.* (2017). The findings of constraints related to management are in consonance with the findings of Kaladharan and Jayasankar (2003). The findings of constraints related to input are in consonance with the findings of Jayasankar (2009) and Hamad and Mtae (2012). The findings of constraints related to finance are in line with the findings of Kaladharan and Jayasankar (2003) and Jayasankar (2009). The findings of constraints related to personal are similar to the findings of Hamad and Mtae (2012).

Suggestions of women seaweed producers to overcome the constraints: By considering the constraints faced by the women seaweed producers, some suggestions were collected from the women and ranked from the most preferred suggestions to the least preferred (Table 7 and Fig. 6).

Within the suggestion, it was found that the most severe constraints related to input, 'low seed availability' presented in the table, can be overcome by 'providing of proper and adequate seeds by the companies or government' (mean score 78.3). Low price of financial constraints can be overcome by 'providing good price for the seaweed' (mean score 62.75). The third-ranked suggestion was 'proper loan should be provided by the bank and government institutions', with a mean score of 57.23; the fourth-ranked suggestion was 'insurance facility for the seaweed culture' with a mean score of 54.35, and the fifth-ranked suggestion was 'proper shed should be constructed for seaweed drying'. The other

Table 7. Suggestions by women seaweed producers to overcome constraints

List of suggestions	Mean score	Rank
Proper road facility should be provided by the government	42.9	VII
Men should support women	44.8	VI
Proper loan should be provided by the bank and government institutions	57.23	III
Companies should provide good price for the seaweed	62.75	II
Insurance facility for the seaweed culture	54.35	IV
Skill based training programmes should be arranged	37.67	VIII
Proper shed for seaweed drying should be constructed	47.7	V
Pathology lab should be arranged to test the disease in seaweed	24.5	IX
Seed should be properly and adequately provided by the companies or government institutions	78.3	I

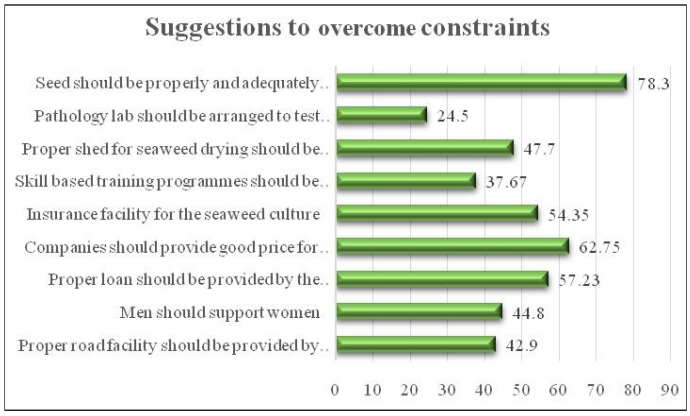

Fig. 6. Suggestions by women seaweed producers to overcome constraints

suggestions were that men should support women (mean score 44.8), proper road facilities should be provided by the government (mean score 42.9), skill-based training programs should be arranged (mean score 37.67), and a pathology lab should be arranged to test the disease in seaweed (mean score 24.5).

The study has shed light on the multifaceted constraints faced by women seaweed producers in Ramanathapuram district. The identified challenges span environmental, management, input, finance, and personnel constraints collectively influencing the growth dynamics of the seaweed production sector in the region. The most pressing constraints are related to input issues, particularly the low availability of seeds. The suggested remedy of providing proper and adequate seeds by companies or government intervention holds the highest potential for alleviating this challenge. Additionally, addressing the low prices for seaweed, offering proper loans, introducing insurance facilities, constructing suitable sheds for seaweed drying and providing essential infrastructure such as roads were among the key suggestions to mitigate financial and environmental constraints.

Practical implications of these findings highlight the crucial role of policymakers and the government in crafting targeted interventions. By addressing these constraints, there exists a significant opportunity to enhance the socioeconomic status of women seaweed producers. The study underscores the importance of a holistic approach, recognizing that resolving constraints requires a collaborative effort involving governmental bodies, private companies, and the community. Implementation of the suggested measures has the potential not only to improve the economic standing of women seaweed producers but also to contribute to the overall growth and sustainability of the seaweed production sector in Ramanathapuram district.

Conflict of interest: There is no conflict of interest among the contributors.

Author's contributions: SKS: Carried out the data collection and analysis; SSD: Participated in the design of the study; SS: Helped to draft the manuscript; AHM, MRS: Contributed to collection of references.

Data availability statement: Raw data of this study are available from the corresponding author.

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