



Segmentation Analysis of Consumer Perception Towards Seaweed Incorporated Functional Foods — A case study of Kerala

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The influence of consumer perception on acceptability of new seaweed incorporated functional foods was studied by collecting responses from consumers across Kerala. The factors influencing consumers to try novel functional foods based on seaweed were identified through a survey of respondents frequenting popular shopping malls, super markets, discount stores and traditional retail shops in Ernakulam and Palakkad districts of Kerala. Respondents belonged to Low : <₹0.5 million (38%) , Medium : ₹0.5 million – ₹1 million (49%) and High : >₹1 million (13%) annual income groups. Factor analysis performed to examine the existence of relationship between study variables and consumer acceptance of new seaweed based functional foods indicated scores above 0.6 for each of dimensions tested. The study pointed out that marketing strategy should concentrate on consumer's focus on health, purchase habits, interest in novel products and knowledge of functional foods in general and seaweed products in particular. Popularization efforts through exhibitions and news coverage will widen the consumer base for the seaweed products. Consumer segmentation performed using cluster analysis revealed that, although Kerala consumers were divided on the acceptance of seaweed products, they have exhibited perception of linking their diet with health which can be useful in promoting demand for these food products. Segmentation analysis underscores existence of consumer groups characterized by distinct outlook towards food products with seaweed as functional ingredients. The results of this study highlights that immense opportunities exists for establishment of seaweed based small scale food processing industry.

Keyword: Cluster analysis, Consumer characteristics, Consumer purchase behavior, Consumer segmentation, Innovativeness

Introduction

The cosmopolitan life of people accelerated by rapid urbanization has brought a transformation in consumers' food choices and improved purchasing power from limited to varied affordability for premium food products. In future, segments such as packaged food and drinks are anticipated to account for sizeable share in the food market. As per National Sample Survey Organisation¹ survey on per capita household expenditure on various goods and services in India, the urban household spends more than (84%) compared to their rural counterpart in a month. The urban consumer typically looks for market convenience, product assortment, nutritional importance, service delivery system, convenience products, quality and shelf life while shopping for food.²⁻⁴

Processors have started experimenting with new techniques of production, packaging, encapsulation with nutritional compounds to catch up with the market trend. Seaweeds are considered as good source

of anti-oxidants, dietary fibre, essential amino-acids, phytochemicals, vitamins and several minerals. Seaweed is seen as medicinal food of the 21st century. It contains 1000 times as much iodine as cod fish (per unit of edible content).⁵ Because of their strong, anti-oxidant properties, they are even comparable to antioxidants such as ascorbic acid and tocopherol.⁶ Globally, the commercial seaweed market is projected to reach US\$ 21.11 billion by 2023 at a compounded annual growth rate of 8.4% in terms of value⁷ and the food segment is projected to dominate the commercial seaweed market.

Seaweed Production in India

Seaweeds, are commonly classified as brown (Phaeophyta), red (Rhodophyta), and green (Chlorophyta) seaweeds⁸ based on their pigmentation. India with a coastal line of more than 8000 km is rich in seaweed resources. A standing crop of 16,000 Metric Tonnes (MT) of *Sargassum* and *Laminaria* has been reported from Indian waters every year. Unlike Southeast Asian countries, Indian seaweed industries rely heavily on wild harvests for phycocolloid production. *Gelidiella acerosa* (Forsskal) and Feldmann

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& Hamel and *Gracilaria edulis* (S.G. Gmelin) P.C. Silva are harvested for agar production, while *Sargassum* spp. and *Turbinaria* spp. are the source material for alginate production. Harvesting of *Gelidiella acerosa* and *Gracilaria edulis* from 2005 to 2016 resulted in a gradual depletion of natural resources due to over exploitation, whereas *Sargassum* spp. and *Turbinaria* spp. landings exhibited an irregular value trend.⁹

The total production of seaweed from India peaked at 60,000 MT during 2000 (Fig. 1). The annual production of dry agar ranges from 110 to 132 MT whereas the algin production ranges between 360–540 MT. Culture production of seaweed on a large commercial scale by women Self Help Groups (SHGs) is carried out along Tamil Nadu coast, which augments the total seaweed production from India. Seaweed mariculture has now become a potential employment generating and income earning activity, which is practiced by more than thousand members of SHGs in Ramanathapuram District alone and marching ahead in the other coastal districts of the country with the support of private investments, industries, financial institutions like National Bank for Agriculture and Rural Development (NABARD), (through scheduled commercial banks), National Fisheries Development Board (NFDB) and NGOs led by Aquaculture Foundation of India.¹⁰

Seaweed based Functional Foods

Noteworthy functional foods in the market which claim health benefits through fortification are beverage products, health mix (powder), energy drinks and health supplements for various age groups. In India, Food Safety and Standards Authority of India (FSSAI, New Delhi), the Council for Scientific and Industrial Research-Central Food Technological Research Institute (CSIR-CFTRI, Mysore, Karnataka) and similar institutions take care of certifying the

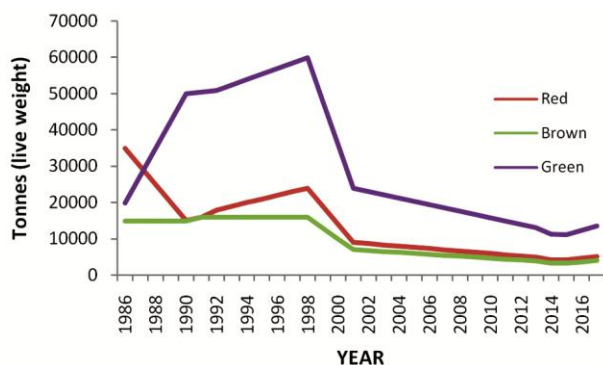


Fig. 1 — India - Seaweed capture production (Source :FAO, 2018)

quality, composition and health aspects of food products sold in the market. Quality Council of India has launched two Certification schemes namely “IndiaGHP” and “IndiaHACCP” based on globally accepted Codex Standards for adoption by food manufacturers and supply chain operators.

Indian Council of Agricultural Research-Central Institute of Fisheries Technology (ICAR-CIFT, Cochin) has developed seaweed based functional food products which are either ready-to-eat or ready-to-cook like nutridrinks, yoghurt, noodles, biscuits, soup powder etc. which possess health promoting attributes like antioxidant, anti-inflammatory, anticancer and cardio-protection properties. Few of the products have already been commercialized. Dry seaweed fetches ₹40 to ₹100 per kg on site of production. Further value addition to seaweed by bringing out ready-to-eat product forms will fetch increased earnings. This technology has been adopted by The Amalgam Groups Pvt. Ltd., Cochin, Kerala. Seaweed incorporated biscuits offer a palatable way of consuming seaweeds and ICAR-CIFT has commercialized Organic seaweed cookies with ZCorp Pvt. Ltd., Cochin. These biscuits are priced at ₹240 for a 140-gm pack. Seaweed Nutridrink developed by ICAR-CIFT is a seaweed extract-based beverage developed by blending *Sargassum* extract with grape juice in certain proportion and 100 ml of the drink provides 500 mg of Fucoidan, which has anti-oxidant, anti-inflammatory and anti-diabetic activity and can be stored for six months without any spoilage. Fucoidan capsules are used in preparation of nutridrink which are manufactured at the rate of Rs.500 per 30 capsules. Therefore value addition of dry seaweed may bring enhanced revenue to the farmers. Further, Government of India is giving focused attention to seaweed and seaweed products under the recently announced, Prime Minister Matsya Sampada Yojana (PMMSY). In this context, it was felt important to study and understand the consumer perception of these new products fortified with seaweed.

Consumer Perception

Literature shows that functional food users are more educated.^{11–13} Also consumers often link their diet to health while making food choices and functional foods can play a major role in satisfying their needs.^{14,15} Despite these general social and behavioural trends, which may favour acceptance of new seaweed incorporated functional foods, there are

specific challenges in marketing of such products. Seaweed is a relatively unknown product to many consumers which makes its introduction in market for consumption challenging. Consumers may have different concerns and opinions towards seaweed owing to their varied levels of knowledge and purchase behaviour.

Consumer acceptance of seaweed incorporated functional foods and better understanding of its determinants are key factors for market orientation, as also for the development and successful negotiation of market opportunities. The present study focused on identification of factors influencing consumer perception and consumer purchase behavior of functional food products with ingredients from seaweed, and to suggest appropriate consumer communication strategies for achieving this objective. The importance of this study lies in the fact that so far no attempt has been made to analyze the factors influencing consumer perception towards novel functional food fortified with seaweed.

Materials and Methods

The consumer behavior was studied using a questionnaire based survey eliciting responses from 320 respondents belonging to varied socio-economic sections of Ernakulam (65%) and Palakkad (35%) districts of Kerala. In order to analyze the factors influencing consumers to try novel functional foods incorporated with seaweed, pre-tested schedules were used prompting responses on a 5-point evaluation scale (Strongly Disagree SDA: 1, Disagree DA: 2, Neutral N: 3, Agree A: 4, Strongly Agree: 5). The consumer segments which may be important while promoting seaweed based novel food products were also identified. To achieve these research objectives, this study adopted focus group interviews and segmentation analysis methods to deduce clusters of consumers which isolate the aspects of functional food products considered important by them. Based on the analysis of data, collected through the survey, potential consumer reactions towards novel seaweed based food products could be projected. From these findings, industry practitioners can acquire more information regarding the marketing strategy to be adopted for making the seaweed products more appealing to the consumers.

The sampling method adopted was convenience sampling which is a popular non-probabilistic sampling technique adopted for studying consumer perception.^{16,17} The consumers belonging to Low,

Medium and High income groups (annual) were covered in the study. The questionnaire used for the survey had two parts. The first part addressed general particulars like socio-demographics of consumers as also their income and educational status. The second part of the questionnaire dealt with the consumer perception and various dimensions which influenced consumer's intention to purchase food products with seaweed as functional ingredient.

Choice of Variables

In India, the Food Safety & Standards Act 2006 defines functional foods along with the foods for special dietary uses, nutraceuticals and health supplements as those which may contain plants, botanicals, extracts as well as vitamins and minerals etc. and may either be in food form or in the form of powder, tablets etc. A consumer should be in possession of the Knowledge on the health benefits of any new functional food introduced in the market^{18,19} for making a favourable food choice. Consumer's knowledge about seaweed and its nutritional benefits was identified as first and foremost important variable to be studied.

Seaweed, despite being a source of protein, amino acids, minerals and vitamins, and being part of traditional cuisine in a few Southeast Asian countries, has not widely reached Indian consumer's plate.²⁰ Therefore the intentions behind acceptance or non-acceptance of new functional foods like seaweed incorporated products were considered as a criteria while formulating the variables. Further, price, taste and brand^{21,22} are a few relevant factors which influence the purchasing behavior of consumer of food products in general. Even if a consumer is aware about the health benefits of seaweed, there may be an apprehension about its taste and flavor which could hinder the overall acceptance of the product. It is well known that food consumption is habitual and if the consumer is not familiar with the ingredients of food product, apprehension will prevent its ready acceptability.²³ Even though a consumer will give more weightage to health benefits arising out of an ingredient in the food product, he/she may or may not be willing to pay the price premium for such an authentic health product.²³ Income, education, family size, composition of family and availability of food choices in nearby outlets also influence the consumer's intention to go for new food products which promise health benefits. Further, endorsement of the functional food by an authentic food quality certifying agency²⁴ will strongly influence the consumer's purchase decision.

Therefore, apart from food purchase in general, 'knowledge', 'cultural barrier', 'consumer innovativeness', 'perceived quality', 'culinary value', 'peer influence', 'family choice', 'price', 'brand image' were chosen as study variables to assess consumer perception towards seaweed incorporated functional foods.

The questionnaire used for the survey had 38 statements, which could be organized into five parts that examine consumer knowledge on functional food linking it to health benefit, general food purchasing pattern and consumption, perception and willingness to purchase seaweed based functional food, consumer's view on quality endorsement of food products available and influence of family, culture/religion and friends on food purchase of new functional foods.

Coverage of Consumers

For studying the consumer perception towards functional foods fortified with seaweed, a survey was conducted at Ernakulam and Palakkad districts of Kerala covering 320 consumers. These two districts represented adequately the consumer mindset of Kerala state owing to their varied demographics in respect of food, culture and terrain. Palakkad is the largest district in Kerala forming 11.5% of the total geographical area. It is a non-coastal district where food consumption behavior is largely influenced by the neighbouring state, Tamil Nadu. Ernakulam being a coastal district has a bigger population on fish based diet with a comparative cosmopolitan behavior.

To ensure various types of consumer in the sample the survey was conducted at different outlets viz., Hyper mart, super markets, discount store (Margin free market) and traditional retail shops. Adequate geographic coverage in the sample was also ensured by covering two big supermarkets and one hyper mart to cover city consumers, whereas the peri-urban consumers were covered from the numerous Margin free outlets. Ten *kirana* shops from six selected locations in Ernakulam and six *kirana* shops from Palakkad were covered to record consumer behavior from around 30% of the total respondents. Overall, in this study, 50% of the respondents were contacted from super markets, 10% for hyper markets, 10% from discount stores and 30% from the *kirana* shop outlets. All of respondents contacted were responsible for food purchase within their household.

Statistical Analysis

Segmentation analysis is a widely adopted technique in consumer surveys, to analyze the preferences towards new functional foods related to diverse consumer segments. Segmentation analysis of consumers will give insights for effective marketing.^{25-27,14} As a first step, descriptive analysis was carried out on the variables pertaining to the socio-economic status to explore the degree of association between the characteristics under study. The knowledge on the distribution of consumer preferences forms the basis for product differentiation and market segmentation and for assessing it, the next step of identification of underlying factors is important. Consumer segmentation based on socio-demographic attributes will be less relevant for predicting consumers' buying behavior compared to psychological and life style oriented aspects.¹⁴ Therefore, the third step in the study was factor analysis of data to identify the underlying broad reasons to buy or refuse functional food and their trust in actors (key players in the food supply chain). Using factor analysis, the different profiles of consumers were identified and Principal Component Analysis (PCA)²⁸ was used to extract the factors. In order to facilitate the understanding and interpretation of results, the factors were rotated using Varimax method. Kaiser-Meyer-Olkin (KMO) index is a statistical measure to find out how suited the data is for factor analysis. The index was utilized to verify the sample adequacy for carrying out the analysis. Last part of analysis was performing consumer segmentation, using cluster analysis by non-hierarchical k-means method on the PCA results. The R software (ver. 3.5.3) was used to perform all statistical analysis.

Results and Discussion

Ernakulam is a cosmopolitan city with a sea coast and a mixed population with bustling commercial activities where consumer mindset is more urbane. On the other hand, Palakkad district is located in proximity to neighbouring Tamil Nadu state and is a non-coastal district. The per capita income of Ernakulam and Palakkad districts during 2016-17 was put at ₹1,62,297 and ₹1,03,855 respectively.²⁹ Accordingly, the survey was conducted among consumers classified based on their annual income into three categories viz., low (less than ₹ 0.5 million), medium (₹ 0.5 to 1 million) and high (more than ₹1

million). About 27.3% of the consumers surveyed belonged to the low income group, 35.3% fell under medium income group and 37.4% were in the high income group.

Profile of Sample Respondents

The overall sex ratio of Kerala state is 1084 females to 1000 males (2011 Census). The gender distribution in the sample reflects this aspect with 61.3% female and 31.7% male indicating the involvement of women in grocery purchase for food.^{30,23} The distribution of education and marital status of the respondents perfectly aligns with the population as Kerala boasts 94% literacy rate as per 2011 Census. Consumers relatively older (more than 55 years) tend to spend more on functional foods³¹ and elderly consumers perceive that balanced food consumption plays a role in prevention of disease compared to the younger lot.³²

As shown in Table 1, the demographic profile of the sample indicated 32.8% belonging to elderly group (more than 55 years), 10.6% of young adults who are yet to form a strong consumption pattern and 56.6% in the age group of 35 to 55 years who have tendency to spend for themselves and family towards functional food. The sample of respondents also adequately represented various income categories

Table 1 — Socio-economic profile of respondents (n = 320)

Variable	Category in the variable	% constitution in sample surveyed
Gender	Male	38.7
	Female	61.3
Age	Upto 35 years	10.6
	35 to 55 years	56.6
	More than 55 years	32.8
Marital Status	Married	80.3
	Divorcee	8.1
	Single	11.6
Annual (family) Income	Less than ₹5 lakhs	27.3
	>₹5 lakhs and <=₹10 lakhs	35.3
	>₹ 10 lakhs	37.4
Employment	Unemployed	3.5
	Self-employed	15.3
	Housewife	26.0
	Retired	6.0
	Employee	40.6
	Others(part-time job, students)	8.6
Education	Post-graduate/ PG Diploma	10.0
	Under-Graduate/UG Diploma	80.0
	Higher Secondary	2.7
	High School	7.3

recording varied food choices and affordability from various socio-economic segments.

The variables that affect perception of consumer for seaweed based foods is depicted in Fig. 2 and upon analysis, it is quite evident that the consumers consider such products useful for improving their health (45.7%) even if they are doubtful about the taste of these products (30.3%). In contrast, it can be noted that 53.1% of the consumers also strongly agree that the product price matters the most even if health claims are attractive. The intention to buy seaweed based foods is not much influenced by culture/religion as more than 67% of the respondents have disagreed to their faith influencing their perception. This may be because the staple food of Kerala is influenced by history and trade related invasions in the past.³³ The results also point out that one of the main concerns of consumers is product certification regarding food safety with more than 75% agreeing on it.

Factors Influencing Consumer Perception towards Seaweed Incorporated Functional Food

The simultaneous evaluation of the complex responses on several variables collected through the survey was subjected factor analysis to reduce the variables into underlying factors influencing purchase preferences to buy or refuse new functional foods incorporated with seaweed. Extraction method used was principal component analysis and rotation was conducted by Varimax with Kaiser Normalization. In Table 2 the matrix of rotated components is presented from which it emerges that the first factor summarizes up to five variables related to the knowledge on seaweed *per se* and health benefits from functional food in general. Factor analysis performed to examine the existence of relationship between study variables and consumer acceptance of new seaweed based functional foods indicated scores above 0.6 for each of dimensions tested.

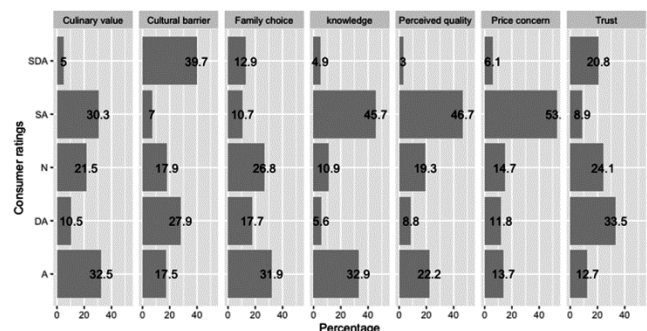


Fig. 2 — SDA-“Strongly Disagree”; DA-“Strongly Agree”; N-“Neutral”; SA-“Strongly Agree”; A-Agree

Table 2 — Matrix of rotated components

Variables	Factors			
	1	2	3	4
1. There are a plenty of functional food products in market and their health claims are confusing	0.312	-0.441	—	—
2. I am aware of the various symbols/ certifications/ other identifiers which indicate the food product as certified	-0.786	—	—	—
3. I have heard of seaweed and its applications in food industry	0.655	—	—	—
4. Seaweed contains anti-oxidants whose consumption has health benefits like reducing the risk of heart disease, anti-cancer properties, etc.	0.633	—	—	—
5. I never knew that seaweed is consumable	0.733	—	—	—
6. I am aware of a few products developed from seaweed	-0.333	—	—	—
7. I will purchase seaweed products if I have information, which confirms their health benefits	0.679	—	—	—
8. Before purchase of a new product like seaweed based food, I compare its price with a parallel product in market	—	0.866	—	0.162
9. While purchasing seaweed products, I prefer to consider features of the product like : its shape, color, convenience or use and taste	—	—	-0.333	-0.201
10. I will purchase seaweed products when my family members desire	—	—	-0.130	—
11. I am particular about cost and avoid high priced items even if they claim health benefits	—	—	0.208	—
12. I would not mind paying little extra if am convinced that the food product is nutritious and is healthy	—	0.743	—	—
13. I always try to make healthy food choices and ensure food items which supplement diet with nutrition	—	0.679	—	—
14. I always read the nutrition label on the food product packing before making purchase	-0.259	—	0.116	—
15. Functional food forms a considerable part our monthly household food purchase	—	-0.642	—	—
16. My purchase of novel food items relies on how it is advertised in TV or radio channels	—	—	—	-0.174
17. I will consider the quality endorsement from agencies certifying its safety before going for a food purchase	—	—	—	0.364
18. Any new product purchase will depend on whether its available in the retail outlets I personally believe as I trust them	—	-0.688	—	0.193
19. Brand names matter to me	—	—	0.019	-0.548
20. I prefer buying seaweed products when price discounts are offered	-0.188	—	0.158	—
21. Price is the first thing I look into before purchase of a new product	—	0.835	—	—
22. Consuming functional foods will delay onset of health problems which come with aging	0.203	—	—	-0.131
23. I am afraid of side effects that may arise out of consumption of functional foods	—	—	0.632	—
24. Functional foods are for those who have health problems	—	—	0.783	—
25. I have an aversion about seaweed	—	-0.487	—	—
26. My culture/religion also affects my intention to buy seaweed products	—	.255	—	—
27. I am doubtful about the taste of seaweed products	—	.583	—	—
28. Claims about the health benefit from seaweed are usually exaggerated	—	—	0.875	—
29. Paying a premium price for such special products is a waste of money	—	—	—	0.275
30. Using such niche products is a status symbol	—	—	—	0.333
31. These are niche products which will be available only in selected outlets	—	—	—	0.171
32. While purchasing new food products, I thoroughly read label to ensure safety for consumption	—	—	0.234	-0.687
33. I am eager to try new products	—	—	-0.412	0.807
34. I am cautious about trying out new food products	—	—	—	0.712
35. I always try novel products recommended by my peer group	—	—	—	0.689
36. I strongly consider response of people who have already used new food products before purchasing them	—	—	—	-0.655
37. I would purchase seaweed based products if they are easily available in nearby outlets	—	—	—	0.509
38. It is essential to supplement our diet with functional foods	—	—	0.687	—

Thus the first factor can be considered as ‘information’. The second factor summarizes variables pertaining to consumption, purchase habits, concern for price in the food budget. The analysis could bring out six variables which reflect the consumers’ food purchase habits and consumption pattern. The third column of the rotated component matrix describes the belief of consumer towards seaweed products and functional foods in general and importance given for health in the diet. Finally, the fourth factor summarizes the inherent consumer preference for new food products, the concerns and apprehension related to them which can be considered as “innovativeness”.

Segmentation Analysis

Based on these four factors, which delineate the characteristics of a consumer namely ‘information’, ‘food consumption & purchase habit’, ‘health in food choice’, and ‘belief /perception towards new food products’, a segmentation of the sample was created to confirm whether homogeneous groups of consumers exist in the population with a different perception towards new products with seaweed as functional ingredient. For this purpose, a cluster analysis was carried out using the K-means method which is a non-hierarchical algorithm widely used for analogous studies.³¹ The non-hierarchical k-means algorithm splits the sample into a predefined number of clusters to maximize the ratio between external variance (between groups) and internal variance (in groups) using grouping variables. The number of clusters was three and a look at the cluster centers obtained through the segmentation analysis (Table 3) reveals that the clusters which could be named as “health conscious”, “innovative”, “willing but price sensitive”.

The first cluster represents 135 individuals (42.2%) who have put forth health as the important factor which they consider while making food choices, confirmed by the high concentration of consumers who give importance to diet and purchase of

functional food as a part of their food purchase. With respect to the socio-demographic variables, this cluster was characterized by higher number of respondents belonging to ‘elderly’ population (58%) of the total. The second cluster comprises of 30.3% of consumers who have strong interest in trying new seaweed based functional foods. This cluster was represented by higher concentration of female consumers (68%) and dominated by high income group (43% to total). The 3rd cluster reveals high dominance of consumers following purchase habits dictated by the importance that they give to certain attributes like price, availability in favourite shops and purchase towards planned diet. These consumers were trying to balance healthy food purchase with a fixed budget. When the individual clusters which have been derived out of the analysis were examined and mapped against the socio-demographic background with a chi-square test, it was found that between age, gender, education, income and marital status, there was significant difference between the single segments (p<0.01).

From the multivariate analysis it was seen that interesting indications for development of novel products fortified with seaweed has emerged. The consumers were aware of the link between diet and health and exhibited high level of concern for nutritional and health aspects in their food choices. Similar findings were found in studies conducted in a few Western countries.^{27,14} One of the segment that emerged out of the analysis is the value conscious consumer who prefer less expensive healthy foods. The manufacturers should weigh profits between premium pricing and wider reach of the products across consumer base.³⁴ The curiosity and willingness to try novel food products among consumers belonging to a segment of the sample respondents indicates the higher level acceptability of seaweed based functional foods. Innovativeness is considered to be a personality trait¹⁷ and in this study the consumer segment related to this aspect was dominated by women in the younger age bracket. Considering that women are still the decision makers in food choices in households of Kerala, the marketing of seaweed based functional food has a brighter side.

Furthermore, seaweed is considered as a vegetarian food which will also be definitely acceptable food by the “vegan” consumer segment. Iodine is usually found in foods such as fish, milk, yoghurt, eggs and

Table 3 — Segmentation analysis-Cluster centers

	I Cluster 42.2%	II Cluster 30.3%	III Cluster 27.5%
Information	2.53	2.74	2.57
Purchase habits	2.72	3.17	4.72
Health in food choice	4.56	2.63	3.67
Belief / perception towards new products	2.75	3.96	1.06

the vegan consumers do not consume these foods. It is therefore difficult for a vegan to get balanced mix of diet as iodine is a key mineral for making thyroid work properly. Iodine deficiency leads to lack of energy, weight gain or weight management issues, thin and dry skin, acne, feeling cold, constipation, inability to concentrate, and general aches and pains in muscles and bones. Iodine is also key mineral for brain development of babies, and vital for pregnant and breastfeeding mothers. Seaweed is the best source of iodine, containing greater quantities than any other food.

Indians have been using spices and herbs in cooking for centuries and so the daily diet of an average Indian contains functional foods^{35,36} and there is a good scope for new, safe functional foods among consumer when introduced with proper health benefit information. Unlike other states, 47.7% of population in Kerala is urban. The most striking common feature across consumers belonging to various socio-economic sections in the state is health consciousness with highest expenditure for health care among all states in the country.³⁷ Novel seaweed based functional foods offer promising opportunity in the food market of Kerala state as the three main aspects of promotion *viz.*, growing health consciousness, cosmopolitan nature of cities and food market opportunities are conducive in the state.

Seaweed can be used as an easy addition to enrich dishes with deep and intense flavours, an element sometimes missing in home vegan cooking. It can be integrated into recipes to add flavour, nutrition, and can be used as a salt replacement. The human pallet can taste sweet, salty, bitter, sour and the fifth flavour-umami. Seaweed satisfies umami cravings whilst also being good for health.

Coastal fisherwomen are engaged in seaweed collection and farming which is an important livelihood option to support their families. Particularly, seaweed culture farming has taken a new impetus along Tuticorin and Ramanathapuram coast due to the efforts of Department of Fisheries, Tamil Nadu and crucial inputs like seed and rafts for farming were provided to women Self Help Groups which has helped in increasing seaweed production. At present the produce is marketed only for industrial use and the value addition option has not been explored. The fisherwomen involved in seaweed sector can be given training in functional food product development and marketing. The products developed

can be marketed as certified food with proper packaging and branding targeting the consumer segments like in Kerala where acceptability will be more.

Conclusions

The present study has analyzed the consumer perception towards new functional food incorporated with seaweed across Kerala consumers. The analysis of the data could bring out four distinct factors which are behind the food choices the consumers perform, namely, information, purchase habits, importance to health in food choice and intention to try new products. Further segmentation of the consumers has resulted in emergence of three clusters representing health conscious, innovative and willing but price sensitive consumers of the population.

Based on this study, it can be concluded that consumer assigned high level of importance to information sourced from a trusted, credible agency which endorsed the functional food product. If this aspect is taken care by the manufactures of new seaweed based functional foods, higher acceptance among consumers can be achieved for such products. Therefore, popularization of seaweed incorporated functional foods should focus mainly on campaigns and communications from public authorities like in the case of poultry sector where public awareness drive for egg consumption was undertaken.

At present, India is undergoing a transformation from a production centric to demand centric growth and has envisaged many reforms announced in the wake of COVID lockdown. The lockdown and the prevailing conditions have seen increased demand for food which augurs the opportunity for packaged food. Especially the Pradhan Mantri Sampath Yojana (PMSY) which has been formulated with a total outlay of ₹20,000 crore for next five years. It has earmarked ₹640 crore for investment in seaweed sector.³⁸ Women empowerment was seen as one of the main areas where thrust is laid upon. Opportunities are seen immense in the food sector with advantages like technology backup, market drivers like strong domestic demand and favourable raw material supply which will play a positive role in promotion of seaweed products thereby generating employment at local level.

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