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A study on dietary intake of millet-based food products in Coimbatore city

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Abstract
Millets are highly nutritious grains with a high amount of protein, dietary fibre, and necessary minerals, but in present diets, other cereal grains like rice and wheat have replaced them. Including millet-based food products is an alternative way to incorporate millets into your diet. With this background, studying consumer dietary intake of millet-based food products is essential. The goal of the study is to explain the consumption pattern, constraints, and factors influencing the dietary intake of millet-based products and investigate the reasons behind them. The primary data was collected through an online questionnaire survey from Coimbatore consumers. The data were collected and analyzed using percentage analysis, factor analysis, and Garrett's ranking. It could be inferred from the result that health-oriented factors were primarily influencing the consumption of millet-based food products. The results provide insights into current dietary practices, including consumer preferences for millet- based food products. In order to encourage millet- based food, policymakers, nutritionists, and the food industry may all benefit from understanding consumption trends. The study also intends to give insights that might help resolve these challenges and propose solutions to overcome them by understanding the constraints.

Introduction
Indian millets are a kind of nutrient-rich, drought-resistant crop that grows mostly in arid or semi-arid climates. They are from the Poaceae family, which are small-seeded grasses. They play a crucial role in feeding and providing food to millions of resource-scarce farmers. These millets are also known as "coarse cereals" or "poor man cereals." Indian millets are a better alternative to wheat and rice since they are high in vitamins, minerals, and protein. The United Nations General Assembly (UNGA) announced 2023 as the "International Year of Millets" on March 5, 2021 (FAO, 2021). In the global scenario, in Asia, the area under cultivation is 489 lakh Ha and production is 423 lakh tonnes (FAOSTAT, 2021). India ranks among the top 5 countries in the world for millet exports. According to the ITC trade map, in comparison to the previous year, India exported millets worth $75.46 million in 2022–23, compared to $62.95 million in 2021–22 (APEDA, 2023). Additionally, millet-based value- added goods have a very small market share. In this study, millet-based food products are categorized into millet instant mix products, millet breakfast cereals, millet baked products, millet snack products, millet pasta and noodles, and millet-based beverages. The current study was carried out with the following objectives.

Objectives
- To study the awareness level and consumption pattern of Millet-based Food Products.
- To determine the factors influencing the consumption of Millet-based Food Products.
- To study the constraints faced by consumers for consumption of Millet-based Food Products.

Review of Literature
- Rajesh Reddy *et al.* (2023) [1] described that at present, millets are increasingly becoming more popular due to people's increasing awareness of their health benefits as well as government initiatives to encourage millets in both production and consumption
- Amal George *et al.* (2021) [6] stated that three primary determinants of millet consumption are percfeived value, essential nutrients, and a healthy lifestyle, and they found that unawareness served as the main reason for non-consumption. They also suggest a number

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of strategies, such as the introduction of various kinds of millet-based snacks by food manufacturing businesses.

- Anjali Devi (2020) [3] described that regarding millet consumption, each high-income sample respondent regularly consumes millets, and the switch from rice to millet consumption led to a rise in millet prices that eliminated millet from the diets of low- income groups. They also discovered that although millets are becoming more popular, cereal consumption has not decreased much.
- Alekhya and Shravanthi (2019) [5] described that income and consumption of millet-based products were not correlated, but the number of purchases varied depending on the product's price. Health benefit was the main factor influencing the consumption of millet-based food products, and the majority of the sample respondents ranked flavour as a major attribute for consumer acceptance of millet-based food products.
- Harshitha and Jayaram (2019) [4] stated that customers gave the nutritional and health value of the food a higher rating when choosing value-added finger millet products, reflecting the growing awareness of the value of added millet products.
- Patil and Sankangoudar (2019) [8], in their study, found that none of the respondents consumed small millets on a regular basis, despite the fact that most of them were aware of their health advantages. The Public distribution system made fine grains (rice and wheat) available for free or at a cheap cost, and the ease of cleaning and cooking rice may

have contributed to the drop in use of minor millets.
- Kalaiselvi and Fatima (2016) [2] stated that millets are a rich source of several nutrients, and regular eating of millets may have a positive impact on one's health.
- Patil (2013) [7] found in their study that millets health benefits are the major factor that influences consumers to consume millets.

Materials and Methods
In this Study, the sample respondents were selected from different regions of Coimbatorecity who consumed millet-based food products. Convenience sampling was used to collect primary data from sample respondents in this study. The survey was carried out through an online questionnaire for primary data. For this study, a total of 150 sample respondents were selected who consumed millet-based food products. Tools used for analysis were percentage analysis to analyze consumption pattern and consumer preferences, factor analysis was used to find out factors influencing the consumption of millet-based food products, and Garret's ranking technique was used to identify the constraints faced by consumers while consuming millet-based food products.

Results and Discussion
Coimbatore is the state's second-largest city after the capital, Chennai, and India's sixteenth- largest urban region. The third-most populated city in Tamil Nadu is Coimbatore. The demographic details are given in Table 1.

Table 1: Demographic details of sample respondents

S. No.	Characteristics	Category	No of Sample respondents(n=150)	Percentage to Total
1	Gender	Male	86	57.3
		Female	64	42.7
	Total		150	100.0
2	Age (In years)	Less than 20 years	11	7.3
		21-30 years	48	32.0
		31-40 years	25	16.7
		41-50 years	36	24.0
		More than 50 years	30	20.0
	Total		150	100
3	Education	Illiterate	3	2
		Primary Education	2	1.3
		Secondary Education	6	4.0
		Higher Secondary Education	12	8.0
		Undergraduate	41	27.3
		Postgraduate	80	53.3
		Ph.D.	6	4.0
	Total		150	100
4	Profession	Private sector	33	22.0
		Public sector	27	18.0
		Student	54	36.0
		Business	23	15.3
		Retired	0	0.0
		Housewife	11	7.3
		Unemployed	2	1.3
	Total		150	100.0
6	Family Income	Up to 20000	29	19.3
		20001-30000	25	16.7
		30001-40000	12	8.0
		40001-50000	25	16.7
		Above 50000	59	39.3
	Total		150	100.0

In Table 1, the demographic characters include gender, age, education, profession, family income are given. From Table 1, we could infer that the majority of the samples are male

respondents (57.3 percent) followed by Female (42.7 percent). Then in age category, the majority of the respondents were 21-30 years (32 percent) followed by 41-50 years (24

percent), more than 50 years (20 percent), 31-40 years (16.7 percent) and less than 20 years (7.3 percent). In case of education, the majority of the sample respondents are postgraduate (53.3 percent) followed by undergraduate (27.3 percent), higher secondary education (8 percent), secondary education (4 percent), illiterate (2 percent) and primary education (1.3 percent). In case of profession, majority of the respondents were students (36 percent) followed by private

sector (22 percent), public sector (18 percent), business (15.3 percent), housewife (7.3 percent), unemployed (1.3 percent) and no respondents were retired people. In case of family income, most of the respondents had family income of above 50000 (39.3 percent) followed by up to 20000 (19.3 percent), 40001-50000 (16.7 percent), 20001-30000 (16.7 percent) and 30001-40000 (8 percent).

Table 2: Level of awareness about Millet-based food products

S. No	Particulars	No of Sample respondents(n=150)	Percentage to Total
1	Highly aware- I regularly consumes millet- based food products and have good knowledge of their health and nutritional benefits	56	37.3
2	Moderately aware- I occasionally consumes millet-based food products and have some knowledge of their health and nutritional benefits	80	53.3
3	Less aware- I rarely consumes millet-based food products and have no knowledge of their health and nutritional benefits	14	9.3
	Total	150	100.0

It could be evident from the Table 3 that in most of the families, the purchase decision of millet-based food products was taken by head of the family (46 percent) followed by joint together (38 percent), wife (13.3 percent) and children (2.7 percent).

Table 3: Purchase decision of Millet-based food products

S. No	Particulars	No of Sample respondents(n=150)	Percentage to Total
1	Head of the Family	69	46.0
2	Wife	20	13.3
3	Children	4	2.7
4	Joint together	57	38.0
	Total	150	100.0

It is observed from the Table 2 that most of the sample respondents were moderately aware about millet-based food products (53.3 percent) followed by highly aware (37.3 percent) and less aware (9.3 percent). It is concluded that most of the sample respondents were aware about millet-based food products.

It could be inferred from Table 4 that the majority of the sample respondents were purchased millet-based food products in supermarkets and hypermarkets (44 percent) followed by departmental stores (24.67 percent), local merchant (22.67 percent), bakeries (4.67 percent) and online shopping (4 percent).

It could be concluded from the Table 5 that most of the sample respondents were consumed millet-based food products for more than 3 years (29.33 percent) followed by less than 6 months (24.67 percent), last 1 year (23.33 percent), 1 year to 2 years (13.33 percent) and 2 years to 3 years (9.33 percent)

Table 4: Purchase location of Millet-based food products

S. No	Particulars	No of Sample respondents(n=150)	Percentage to Total
1	Local Merchant	34	22.67
2	Supermarket/Hypermarket	66	44.00
3	Bakeries	7	4.67
4	Online Shopping	6	4.00
5	Departmental Stores	37	24.67
	Total	150	100.00

Table 5: Period of consumption of Millet-based food products

S. No	Particulars	No of Sample respondents(n=150)	Percentage to Total
1	Less than 6 months	37	24.67
2	Last 1 year	35	23.33
3	1 year to 2 years	20	13.33
4	2 years to 3 years	14	9.33
5	More than 3 years	44	29.33
	Total	150	100.00

Table 6: Most preferred Millet by sample respondents

S. No.	Millets	No of respondents preferred
1	Pearl Millet-Kambu	104
2	Sorghum-Cholam	67
3	Finger Millet-Kezhvaragu	76
4	Foxtail Millet-Thinai	48
5	Barnyard Millet-Kuthiraivali	45
6	Kodo Millet-Varagu	37
7	Proso Millet-Panivaragu	21
8	Little Millet-Samai	33

Table 7: Most preferred Millet-based food products by sample respondents

S. No.	Millet-based Food Products	No of respondents preferred
1	Millet Instant Mix Products	102
2	Millet Breakfast Cereals	68
3	Millet Bread and Baked Products	60
4	Millet Pasta and Noodles	24
5	Millet Snacks	76
6	Millet based Beverages	39

It could be concluded from the Table 6 that most of the sample respondents firstly preferred pearl millet (104 respondents) followed by finger millet (76 respondents), sorghum (67 respondents), foxtail millet (48 respondents), barnyard millet (45 respondents), kodo Millet (37 respondents), little millet (33 respondents) and finally least preferred millet is proso millet (21 respondents).

It is inferred from the Table 7 that majority of the sample respondents preferred millet instant mix products (102 respondents) followed by millet snacks (76 respondents),

millet breakfast cereals (68 respondents), millet bread and baked products (60 respondents), millet based beverages (39 respondents) and the least preferred is millet pasta and noodles (24 respondents).

Factors Influencing consumption of Millet-based food products

Statements used for Factor analysis
- Price
- Taste
- Quality
- Health Conscious
- Nutritional Content
- Availability
- Advertisement and Promotions
- Culture and Traditions
- Friends and Relatives

Table 8: KMO and Bartlett's Test

KMO and Bartlett's Test		
Kaiser-Meyer-Olkin Measure of Sampling Adequacy	0.642	
Bartlett's Test of Sphericity	Approximate Chi- square	575.610
	Sig.	0

It could be inferred from the Table 8 that KMO measure of sampling adequacy is 0.642 which is large (greater than 0.5). Bartlett's test of sphericity with chi-square value of 575.610 which is significant at 0.000 levels. It could be concluded that for further analysis of data, factor analysis is recommended as suitable technique.

It could be concluded from the Table 9 that 68.63 percent was explained by the first three factors of total variables. Eigen values greater than one are taken. From this table it is clear that 3 components are formed with Eigen values of 3.52, 1.40,

1.25 had the percentage variance of 39.14, 15.57 and 13.92 respectively.

It could be concluded from the figure that after third component the screen plot has become straight line and the Eigen values also less than one. The first three principal component has Eigen values greater than one and it accounts for major influential factors of consuming millet-based food products. Remaining components are relatively unimportant as their Eigen values are close to zero

Table 9: Total Variables Explained (Principal Component Analysis)

Component	Initial Eigenvalues			Extracted sums of Square Loading		
	Total	Variance %	Cumulative %	Total	Variance %	Cumulative %
1	3.523	39.140	39.140	3.523	39.140	39.140
2	1.402	15.575	54.715	1.402	15.575	54.715
3	1.253	13.924	68.639	1.253	13.924	68.639
4	0.880	9.778	78.417			
5	0.690	7.662	86.079			
6	0.532	5.915	91.994			
7	0.404	4.484	96.478			
8	0.199	2.207	98.685			
9	0.118	1.315	100.000			

Screen Plot
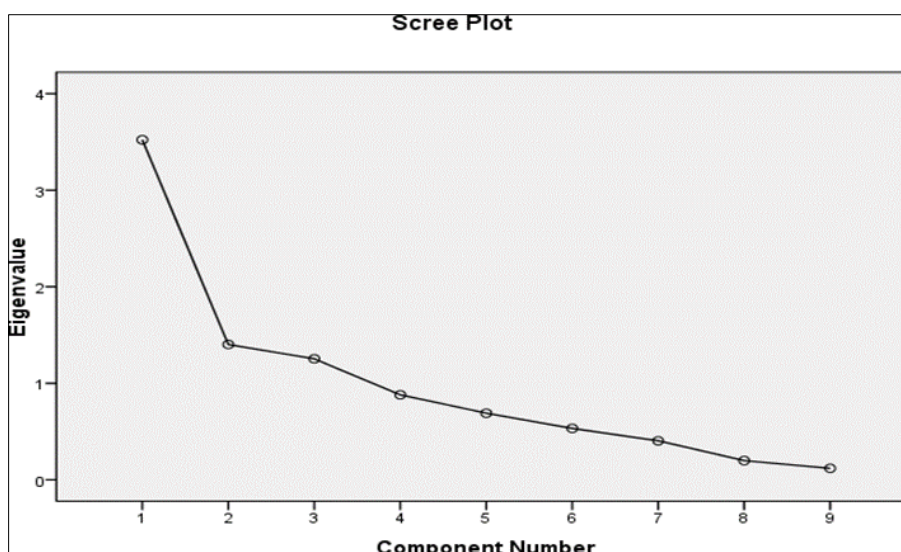
Fig 1: Component number

Table 10: Component Matrix

Factors	Components		
	1	2	3
Health Conscious	0.778	-0.125	-0.504
Taste	0.719	-0.388	0.407
Nutritional Content	0.668	-0.117	-0.585
Price	0.617	-0.418	0.502
Culture and Traditions	0.605	0.457	0.360
Availability	0.591	-0.278	0.104
Quality	0.547	-0.087	-0.300
Advertisement and Promotions	0.562	0.619	0.075
Friends and Relatives	0.493	0.609	0.047

It could be concluded from the Table 10 that component matrix was came up with cross loadings. For getting a valid conclusion, varimax rotation was performed with Kaiser normalization.

Table 11: Rotated Component Matrix

Factors	Component		
	1	2	3
Health Conscious	0.893	0.218	0.174
Nutritional Content	0.884	0.100	0.106
Quality	0.586	0.186	0.135
Price	0.078	0.892	0.082
Taste	0.210	0.878	0.137
Availability	0.340	0.559	0.093
Advertisement and Promotions	0.190	0.049	0.816
Culture and Traditions	0.029	0.334	0.770
Friends and Relatives	0.170	-0.003	0.766

It could be inferred form the Table 11 that factor loadings are arrived after varimax rotation. Factor loadings having values equal to or greater than 0.5 are considered. First component had 3 factor loadings with Eigen value greater than 0.5. Second component with 3 factor loadings and Third component with 3 factor loadings with Eigen value greater than 0.5. These components are assigned with suitable component names on the basis of their factors.

Table 12: Components and Factors

Components	Variance %	Factors
Health-oriented Factors	39.14	Health Conscious
		Nutritional Content
		Quality
Economic Factors	15.575	Price
		Taste
		Availability
Social and Cultural Factors	13.924	Advertisement and Promotions
		Culture and Traditions
		Friends and Relatives

It could be inferred from the Table 12 that first component was named as health- oriented factors which comprises of health conscious, nutritional content, quality with variance of 39.14 percent and second component was named as economic factors which comprise of three factors such as price, taste, availability with variance of 15.575. The third component was named as social and cultural factors which comprise of advertisement and promotions, culture and traditions and friends and relatives with the variance of 13.924. It could be inferred from the factor analysis that health-oriented factors with variance of 39.14 percent was the most influenced

factors in consumption of millet-based food products.

Constraints faced by consumers while consuming Millet-based food products
Statements used for Garett's Ranking technique
- High Price
- Digestive Issue\Allergenic potential
- Limited Availability
- Taste and Familiarity
- Lack of cooking skills
- Limited Product variety

Table 13: Constraints faced by consumers while consuming Millet-based food products

S. No.	Constraints	Garett's Score	Rank
1	High Price	53.96	I
2	Digestive issue/Allergenic Potential	49.19	IV
3	Limited Availability	51.02	II
4	Taste and Familiarity	50.35	III
5	Lack of Cooking skills	47.24	VI
6	Limited Product Variety	48.21	V

In Table 13, it is concluded that high price (53.96) was the major constraint faced by the sample respondents while consuming millet-based food products because millets are highly priced when compared to other cereal grains (like rice and wheat). It cannot be purchased and consumed by families with low incomes. Limited availability (51.02) was the second most constraint faced by sample respondents while consuming Millet-based food products because of the unawareness of people about millet products and the limited retail presence even in urban areas too. The third constraint faced by sample respondents was taste and familiarity (50.35) because millets usually have a unique flavour that can differ from other commonly consumed grains like rice and wheat and it may take time for individuals to develop a taste for millet-based food products if they are not familiar with the flavour. While the fourth constraint was Digestive issue/Allergenic (49.19) potential because it contains certain carbohydrates known as FODMAPs (fermentable oligosaccharides, disaccharides, monosaccharides, and polyols) that can cause digestive discomfort with irritable bowel syndrome (IBS) or other digestive disorders. The fifth constraint faced by consumers while consuming millet-based food products was Limited product variety (48.21) because it leads to Monotony in the individual's diet and if there are only few choices available, consumers may become bored with the limited choices and may beless motivated to incorporate millet-based food products into their diet followed by the sixth constraint faced by sample respondents was lack of cooking skills (47.24).

Conclusion

Most of the sample respondents were moderately aware of the Millet-based food products in Coimbatore city. Due to the fact that the study was carried out in an urban area, the majority of sample respondents preferred to purchase millet-based food products in supermarkets and hypermarkets. Among the millet's varieties, the most consumed millet was Pearl millet, and the least consumed was Proso millet. Among the millet-based food products, the most consumed were Millet instant mix products, and the least consumed were Millet pasta and noodles. From the factor analysis, the factors are categorized into three components: health-oriented factors (Health consciousness, Nutritional content, Quality), Economic factors (Price, Taste, Availability), and social and Cultural factors (advertising and promotions, Friends and relatives, culture, and Traditions). The health-oriented factors were primarily influencing the purchase of millet-based food products, which indicates that there was an increase in health consciousness among the Coimbatore consumers. The constraints faced by consumers while consuming Millet-based food products are ranked in the order of High price, Limited availability, Taste and Familiarity, Digestive issues or allergenic potential, Limited product variety, and lack of cooking skills.

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