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Consumer awareness and adoption of multi-source edible oils: key influencing factors and barriers

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Abstract

Edible oils are essential to Indian cooking methods and flavour profiles and they have long been a component of human nutrition and culinary traditions. These oils, derived from a range of plant sources, significantly improve the taste, texture and nutritional value of food. In recent years, there has been a surge in interest in Multi-Source Edible Oils (MSEO), also known as blended oils, which combine two or more types of vegetable oils to create products with improved cooking properties and nutritional profiles. Edible oil consumption is influenced by various factors, such as marketing efforts, culinary preferences and health consciousness. As lifestyle-related health conditions such as cardiovascular disease and diabetes become more prevalent, many consumers are becoming more concerned about their cooking oil choices. The purpose of this study is to examine consumer awareness, adoption factors and barriers related to MSEO in Coimbatore, Tamil Nadu. The study uses statistical tools like factor analysis and Garrett ranking to identify the major factors and constraints in adopting MSEO. The study reveals that, while most respondents are aware of MSEO, only a few use it. Product performance emerges as the main factor influencing adoption, while marketing, health and economic variables also play a role. Major barriers include higher prices, preference for traditional oils and lack of knowledge. These findings can aid the development of strategies to enhance MSEO adoption, potentially leading to healthier dietary practices in the region.

Keywords

adoption; awareness; constraints; factors influencing; multi-source edible oil

Introduction

Edible oils have been an integral part of human nutrition and culinary traditions for generations. In India, edible oils play an important role in cooking processes and flavour profiles. The taste, texture and nutritional content of food are all greatly enhanced by these oils, which come from a variety of plant sources and are very essential in cooking (1). The choice of oil defines the unique culinary character and cultural traditions of various regions of India, representing the country's food heritage diversity. Coconut oil adds a rich, tropical taste to Southern Indian dishes, while mustard oil imparts a pungent flavour to meals in Eastern and Northern India. In Western India, particularly in Gujarati and Rajasthani cuisines, sesame oil is favoured for its nutty flavour, impacting both the cooking process and the overall sensory experience of the dish (2). In recent years attention has shifted to multi-source edible oils, often called blended oils, which have become a novel option in

the edible oil industry. These oils blend two or more types of vegetable oils together to produce a product with balanced nutritional profiles and better cooking qualities such as higher oxidative stability, extended shelf life and improved performance at high cooking temperatures, making them ideal for a variety of culinary methods, including deep frying (3). The complementary fatty acid profiles of various oils, which may provide a more balanced nutritional composition, provide the scientific basis for MSEO (4).

As lifestyle-related health issues such as cardiovascular disease and diabetes become more prevalent, consumers are becoming increasingly concerned about the health implications of dietary fats. Global health standards currently advocate for limiting saturated fat consumption. This study on multi-source edible oils looks at how these oils, particularly those with MSEO formulations, fit within these health recommendations. MSEO contains antioxidants, essential fatty acids and other useful elements that aid in the reduction of saturated fat and the rise of unsaturated fat. This aligns with global health recommendations to decrease consumption of saturated fats and enhance consumption of unsaturated fats (5).

Consumer preference for MSEO is being driven by a rising knowledge of the health benefits linked with certain combinations and a need for versatile cooking oil options. A study evaluating the effects of blended rice bran and olive oil on hyperlipidemic patients showed modest improvements in cardiovascular risk factors, including reductions in total cholesterol, LDL cholesterol and blood pressure, suggesting potential heart health benefits with longer-term use. The capacity of MSEO to address dietary requirements, such as improved heart health and cholesterol management, has increased its popularity among customers who are health-conscious (6).

Improved stability, longer shelf life and the possibility of creating personalized nutritional profiles are some advantages of MSEO. These combinations can also have economic benefits because they combine expensive oils with less expensive substitutes (7). Despite these advantages, there is still a lack of consumer awareness and understanding of MSEO and its benefits over single-source alternatives. Perceived health benefits, cooking performance, taste preferences and cost concerns are some of the factors affecting the adoption of MSEO. However, MSEO acceptance is hindered by conventional preferences for single-source oils and a lack of awareness about the benefits of blended oils. Additionally, there is a lack of trust in new products (8).

This study focuses on the Coimbatore region of Tamil Nadu, India, with the goals of determining consumer awareness on multi-source edible oils, identifying factors influencing their adoption and investigating the barriers that consumers encounter while adopting these oils. The findings of this study can be used to develop strategies to increase MSEO acceptance, hence contributing to healthy food habits in the region.

Materials and Methods

Sampling design and size of sample

Convenience sampling was employed to identify 130 frequent edible oil users from various retail shops spread across Coimbatore's five zones. Given the regular use of edible oils, this method allowed for quick and easy access to a diverse sample, ensuring efficient data collection from frequent edible oil users and broad socioeconomic representation across the zones (9). To provide a complete picture of consumer preferences, the sample consisted of 95 females and 35 males, representing the predominant involvement of women in family purchases of culinary items.

Data collection

Coimbatore, the third-largest city in Tamil Nadu, was selected for the study due to its active retail industry and diversified population. Primary data was gathered using a structured questionnaire. This location provided a diverse demographic mix across age, socioeconomic class and education level, allowing for a thorough investigation of customer preferences for MSEO.

Analytical tools

Percentage analysis

To assess consumer awareness and brand preferences for MSEO, percentage analysis was employed (10).

Percentage analysis = (Number of respondents X 100)/ (Total sample size)

Factor analysis

In this study, factor analysis was used to reduce many variables into a smaller set of components by identifying common variance (11). It operates under assumptions of linearity, absence of multicollinearity and true correlation among variables. The most common method in factor analysis, principal component analysis (PCA), mathematically represents variables as linear combinations of underlying factors, describing relationships and patterns. The factors identified in this analysis include perceived health benefits, cooking performance, taste preferences, cost concerns, brand loyalty, availability, packaging, shelf life, nutritional content, advertising influence, cultural influence, environmental impact, ease of use and product variety. These variables were analysed to understand to understand the factors influencing the adoption of blended oils.

Garret Ranking

It is a technique used to rank and prioritize various factors or attributes based on respondents' preferences (12). This method to use to rank the key barriers influencing the adoption of MSEO among the consumers, including conventional preferences for single-source oils, lack of awareness about the benefits of blended oils, mistrust toward new products, perceived health benefits, cooking performance, taste preferences and cost concerns. Ranks were converted into per cent position by using the formula,

Per cent position = 100 x (Rij-0.5)/ Nj * 100

Where,

Rij = Rank given to the ith attribute by the jth individual.

Nj = number of attributes ranked by the jth individual.

By referring to Garret's table, the per cent position estimated was converted into scores. Thus, for each problem, the mean score was estimated. The factor or barrier with the highest mean value was considered the most important one and the others followed in that order.

Results and Discussion

Consumer awareness and usage of multi-source edible oil

The study used percentage analysis to determine the awareness levels of MSEO among respondents. From the bar chart (Fig. 1), we can see that out of 130 participants, 59.23% (77 respondents) were familiar with MSEO, whereas 40.77% (53 respondents) were not. This suggests that while a sizable segment of the population is still ignorant, the majority of those surveyed are aware of MSEO to some extent. Additionally, among those who were aware, not everyone had in-depth knowledge, but at least everyone had basic knowledge of MSEO. The sources of awareness among the 77 respondents who are familiar with MSEO were analysed (Table. 1). Among the respondents, 48.05% (37 respondents) identified in-store displays as their primary source of information, making them the most influential source. Recommendations from friends, family, or experts were reported by 20.79% (16 respondents), while advertisements and social media accounting for 15.58% each (12 respondents).

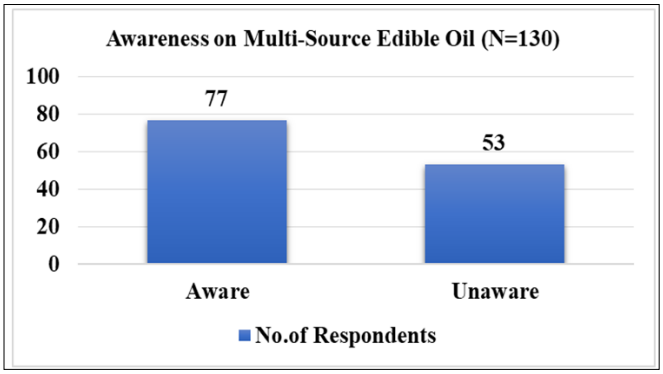

Fig. 1. Consumer awareness on multi-source edible oil.

Table 1. Sources of awareness on multi-source edible oil

Sl. No	Source of Awareness	No. of respondents	Percentage to total (N=77)
1	In-store displays	37	48.05
2	Friends'/Family/ Experts	16	20.79
3	Advertisements	12	15.58
4	Social media	12	15.58
	Total	77	100

Table 2. Current consumption of multi-source edible oils by consumers

Sl. No	Current Consumption	No. of respondents	Percentage to total (N=130)
1	Currently using blended oils	42	32.31
2	Not using blended oils	88	67.69
	Total	130	100

Table. 2 shows the current utilization of MSEO among the respondents. Currently, 32.31% (42 respondents) of the 130 participants use MSEO, but the remaining 67.69% (88 respondents) do not. This suggests that most of the respondents have not yet made MSEO a regular part of their diet. Consumers may prefer traditional oils due to their familiarity, perceived health benefits, cultural significance and unique sensory attributes.

Factors influencing the adoption of multi-source edible oils

This study employed factor analysis to discover the underlying relations between the factors impacting consumer adoption of MSEO. This method was chosen to reduce the dimensionality of the data and highlight critical aspects of customer behaviour. It simplified the dataset while identifying key components driving the adoption of MSEO.

The study's respondents were asked to use a 5-point Likert scale to rate 14 key variables related to the adoption of multi-source edible oils. These variables included product performance, marketing efforts, health benefits, economic factors, brand reputation, price, taste, availability, quality, cultural acceptance, awareness, packaging, shelf life and nutrient balance. Following the collection of these responses, factor analysis was used to identify the main drivers of consumer adoption.

The Kaiser-Meyer-Olkin (KMO) measure and Bartlett's test were used to ensure the sampling adequacy and the suitability of the data for factor analysis. According to Table 3, Kaiser-Meyer-Olkin (KMO) index of sampling adequacy is 0.644, indicating that the data is moderately suitable for factor analysis. Furthermore, the results of Bartlett's Test of Sphericity, which have an estimated Chi-Square value of 376.832 and a significance level of p <0.001, prove to the suitability of the variable correlations for factor analysis.

Table 3. KMO and Bartlett's test

KMO and Bartlett's test		
Kaiser-Meyer-Olkin Measure of Sampling Adequacy		.644
Bartlett's Test of Sphericity	Approx. Chi-Square	376.832
	df	91
	Sig.	.000

The principal component analysis (Table. 4) shows that the contribution of each component to the overall variance and describes the total variance explained by the principal component analysis. Together, the eigenvalues of the first five components-which exceed one-account for 62.572% of the variance. The first component, "Product Performance Factors," accounts for 21.891% of the variation, showing a considerable impact on the dataset. The second component, "Marketing Factors," provides 12.442% of the variation, while the third component, "Health Factors," contributes 11.073% of the variation, improving the overall explanation of the variance. The fourth component, "Economic Factors," accounts for 8.771% and the fifth component, "Brand Factors," provides 8.396%. Together, these five components explain a total variance of 62.572%.

A scree plot (Fig. 2) in factor analysis shows eigenvalues, helping to determine the optimal number of factors. The scree plot the eigenvalues for each principal component, with the greatest drop occurring after the first component. The "elbow" point at the fifth component indicates that the first five components have the greatest influence, accounting for the majority of the variation in the data. Components beyond the fifth have eigenvalues near to zero, indicating a weak contribution to the model and lowered significance.

Table 4. Total variables explained (Principal Component Analysis)

Component	Initial Eigenvalues			Extraction Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	3.065	21.891	21.891	3.065	21.891	21.891
2	1.742	12.442	34.333	1.742	12.442	34.333
3	1.550	11.073	45.406	1.550	11.073	45.406
4	1.228	8.771	54.177	1.228	8.771	54.177
5	1.175	8.396	62.572	1.175	8.396	62.572
6	.958	6.844	69.417			
7	.871	6.219	75.636			
8	.748	5.346	80.981			
9	.621	4.438	85.419			
10	.563	4.019	89.439			
11	.457	3.267	92.706			
12	.369	2.639	95.345			
13	.364	2.603	97.947			
14	.287	2.053	100.000			

Extraction Method: Principal Component Analysis

Table 4. Total variables explained (Principal Component Analysis)

S.No	Factor	Total Variance explained %	Factors	Factor Loadings
1.	Product performance factors	21.891	Better balance of nutrients	.791
			Longer shelf life	.780
			Better taste	.749
			Healthier than single oils	.737
			Suitability for various cooking purposes.	.554
2.	Marketing factors	12.442	Advertisements and marketing efforts	.825
			Attractive and informative packaging	.703
			Recommendations from friends, family or experts	.614
3.	Health factors	11.073	Health-consciousness and dietary considerations	.788
			Curiosity to try new and innovative products	.675
4.	Economic factors	8.771	Affordability and value for money	.770
			Availability and accessibility	.580
5.	Brand factors	8.396	Trust in reputable blended oil brands	.785
			Quality, purity and freshness	.758

Extraction Method: Principal Component Analysis.
Rotation Method: Varimax with Kaiser Normalization.
a. Rotation converged in 5 iterations

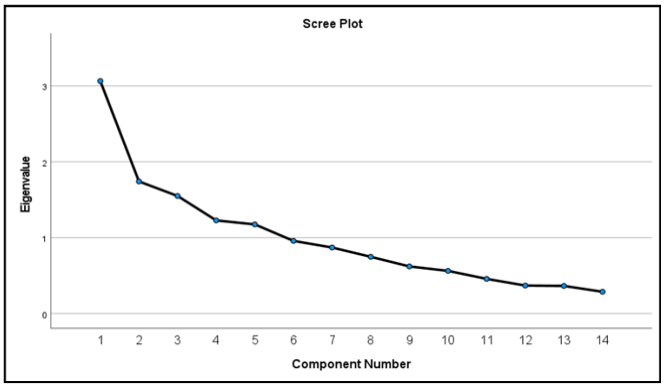

Fig. 2. Scree plot graph.

The primary factors that influence consumer adoption of multi-source edible oil, as well as the variance explained by each element and their factor loadings, are summarized in Table 5. "Product Performance Factors" which include nutrient balance, shelf life, quality and taste, explain the most variance at 21.891%, indicating they have the strongest influence on consumer decisions regarding blended oils. "Marketing Factors," which encompass advertising, promotional efforts and attractive packaging, follow at 12.442%. "Health Factors," including dietary considerations and innovative products, account for 11.073% of the variance. "Economic Factors," covering availability and affordability, account for 8.771%, while "Brand Factors," involving brand reputation, trust and quality, provide 8.396%. Each of these components contributes to consumer preferences in different ways. This research shows that product performance, particularly aspects like nutrient balance and shelf life, significantly influences consumer buying behaviour for MSEO.

Constraints faced by consumers in adopting Blended Oils

Garrett ranking is a method for ranking factors based on consumers priorities, often assessed using a Likert scale. In this study, customers ranked various constraints in adopting MSEO. The scores were analyzed using Garrett ranking to determine the most significant constraints, highlighting the key obstacles customers face when considering MSEO. The constraints are ranked based on Garrett scores (Table. 6), with higher scores indicating more significant barriers. "Higher price compared to regular oils" is the top constraint, scoring 60.72 and ranked first, followed by "Preference for traditional single-source

Table 4. Total variables explained (Principal Component Analysis)

S.No	Constraints	Total Score	Garett Score	Rank
1	Higher price compared to regular oils	7893	60.72	I
2	Preference for traditional single source oils	7755	59.65	II
3	Lack of awareness about multi-source edible oils	7343	56.48	III
4	Uncertainty about health benefits	7044	54.18	IV
5	Concerns about the taste or cooking performance	6467	49.75	V
6	Limited availability in stores	6067	46.67	VI
7	Scepticism about the quality or purity of blended oils	5072	39.02	VII
8	Cultural or familial resistance to change in cooking habits.	4359	33.53	VIII

oils" (59.65). "Lack of awareness" and "Uncertainty about health benefits" rank third and fourth, respectively. Concerns about taste and limited availability rank lower, while "Scepticism about quality" and "Cultural resistance" are the least significant, ranking seventh and eighth.

Conclusion

The study's principal findings show that, while most consumers are aware of MSEO, their use is still relatively low. The analysis identified several key factors influencing consumer adoption, with product performance-such as greater nutrient balance, longer shelf life and improved taste-being the most significant, accounting for 21.89% of the variance. Marketing factors, health factors, economic factors and brand factors were other significant contributors. The biggest challenges to adoption were higher costs compared to traditional oils, preference for traditional single source oils, lack of awareness about multi-source edible oils, uncertainty about health benefits and Concerns about the taste or cooking performance. The adoption of edible oils derived from several sources may be improved by removing these obstacles through focused marketing, consumer education and competitive pricing. The findings are useful for edible oil manufacturers and policy makers looking to promote these oils, which have both nutritional and environmental benefits. To provide broader validation, future research could examine how consumer perceptions evolve with increasing popularity of MSEO, the impact of targeted marketing and educational campaigns on consumer behaviour, the role of social media in shaping consumer attitudes and the effectiveness of different pricing strategies in overcoming adoption constraints.

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Authors' contributions

AG carried out the data collection, conducted the consumer study, and drafted the manuscript. CM coordinated the research process and provided critical revisions. MD assisted with the data analysis and interpretation. VG contributed to the literature review and factor analysis. PE provided guidance on methodology and assisted in statistical analysis. All authors read and approved the final manuscript for the study.

Compliance with ethical standards

Conflict of interest: Authors do not have any conflict of interests to declare.

Ethical issues: None

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During the preparation of this work the authors used QUILLBOT to check Grammar. After using this tool/service, the authors reviewed and edited the content as needed and takes full responsibility for the content of the publication.

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