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A study on consumer preferences towards fortified edible oils in Coimbatore city

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Abstract

This article investigates consumer preferences of fortified edible oils, focusing on the underlying reasons for preferences and constraints faced by the consumers while purchasing and consuming fortified edible oils. Fortified edible oils are becoming more popular in the modern era because of their capacity to bridge nutritional gaps with essential vitamins and minerals. The primary data was collected from the sample respondents through a well-structured interview schedule. The collected data were analyzed using percentage analysis and Garrett's ranking technique. The study revealed that consumers are less aware of the health benefits of fortified edible oils. It could be inferred that Fortune sunflower fortified edible oil was most preferred by the sample respondents. It could be concluded from the result that the primary reason for preferring fortified edible oils was that they were considered to be the most convenient food vehicle to incorporate essential micronutrients into their diet, and the primary constraint faced by consumers while purchasing and consuming fortified edible oils was lack of awareness about food fortification. By focusing on framing solutions to the identified constraints, the acceptance and consumption of fortified edible oils could be increased, which will improve the overall health of consumers.

Keywords: Fortification, consumer preference, constraints, fortified edible oil, consumer awareness, micronutrient deficiencies, health benefits

Introduction

Fortification is the process of adding one or more micronutrients, such as vitamins and minerals, to a food product in order to improve its nutritional content and benefit the public's health with minimal risk to the end user (WHO). Nearly two billion people globally were affected by vitamin and mineral deficiencies, which were recognized as a global health issue prevalent in several low- and middle-income countries. Globally, the struggle against hunger has almost declined in recent years; the global score for the year 2022 was 18.2, a decline from 19.1 in 2014, which represents little improvement. However, the GHI score for the year 2022 is still considered "moderate". Food fortification with micronutrients was ranked among the top three strategies with regard to economic returns on investments due to its high cost-benefit ratio. The fortification of food products seeks to increase micronutrient consumption among the most susceptible groups, particularly young children and pregnant and lactating mothers (FAO). Vitamin A and D deficiencies (VAD) are among the most prevalent micronutrient deficiencies globally. The WHO provides precise guidelines for the fortification of staple food products that are suitable for the target population, which include rice, edible oil, salt, maize flour, and wheat flour. In 1953, vitamin A and D fortification of Vanaspati was implemented in India (Ministry of Women and Child Development, 2017). In India, only salt falls under the mandatory fortification category; edible oil, rice, milk, and wheat fall under the category of voluntary fortified products.

Edible oils have been deliberately fortified over the past few decades in order to prevent vitamin deficiencies. The process of improving the nutrient content of edible oils by adding vitamins externally is referred to as edible oil fortification (FSSAI). The fortification of edible oils and fats with vitamins A and D is an effective way to address micronutrient deficiencies because these vitamins are fat-soluble. In India, the total production of edible oilseeds in 2022–2023 was 379.63 lakh tonnes, an increase from 359.46 lakh tonnes in 2021–2022 (DACNET, 2023). Cooking oil is frequently consumed in households as well as for commercial use, hence, it is considered as a great delivery vehicle for vitamins A and D (BASFNutrition).

Fortified edible oils can be estimated to provide 25% to 30% of the essential daily allowances for vitamins A and D (FSSAI). There are eighty different brands of fortified edible oil available on the Indian market. It is also predicted that extensive vitamin A fortification of food products might safeguard approximately 3 million children from micronutrient deficiencies every year (Keats, E.C., *et al.* 2019) [5]. In Tamil Nadu, the government implemented fortification programmes like the mid-day meal programme (MDM), the integrated child development scheme (ICDS), and the public distribution system (PDS) to alleviate the nutrient deficiencies. Fortified oil was introduced in all districts of Tamil Nadu under these government initiatives, especially RBD (refined, bleached, and deodorized) palm olein oil, which was supplied in all public distribution systems. The current study was carried out with the following objectives:

Objectives

- To assess the consumer awareness and consumer preference of fortified edible oils among the sample respondents.
- To study the constraints faced by the consumers while purchasing and consuming fortified edible oils.

Review of Literature

- Kalimuthu and Gowtham (2023) [1] stated that Gold Winner was the first brand that breaks the misconception that packaged fortified oil would always be expensive, and they introduced packaged oil fortified with Vitamin D2 at an affordable price, so it was considered the most preferred brand in the market by most of the consumers.
- Rani and Virginia (2022) [2] reported that a study conducted in Mumbai among sample respondents aged 18 to 60 found that the majority of the male sample respondents in Mumbai city had a high level of awareness about fortified foods. They gained knowledge about fortification through friends, relatives, internet, and the media. The fortified foods beneficial impacts on health were regarded as the key factor in their consumption.
- Rokeya Begam *et al.* (2021) [3] reported that awareness and consumption of rice and edible oils enriched with vitamin A were lower in rural and slum regions than in urban and semi-urban areas. To help people realize the value of consuming rice and edible oil fortified with vitamin A, several health promotion strategies must be implemented.
- Linda *et al.* (2020) [4] found that the addition of vitamins and minerals to food is well known, but only a few consumers were familiar with fortification. Women were more aware of food fortification than men, and their

knowledge was highly influenced by age, family composition, and occupation level. The study suggests that formal education promotes knowledge of nutritional issues.

- Raghavan *et al.* (2019) [6] stated that food products must be fortified with micronutrients to alleviate dietary deficits. When compared to rural consumers, urban residents were more likely to purchase and consume 23.6 grams per day of fortified edible oil, while rural residents were less likely to purchase and consume only 17.7 grams per day. To prevent or limit vitamin A deficiency, it is recommended to fortify soybean and palm oils on a large scale.
- Darnton-Hill and Nalubola (2018) [7] suggested that political support for food fortification campaigns was crucial to creating consumer awareness about vitamin deficiencies.
- Kar and Kumar (2018) [8] described that consumer and civil rights organizations in Bangladesh agreed to support the implementation of vitamin A fortification of edible oils, and the Vitamin A Fortification of Edible Oil Law of 2013 was enacted and mandates the manufacture, distribution, supply, preservation, and marketing of vitamin A-fortified edible oil.

Materials and Methods

In this study, the sample respondents were selected from the different regions of Coimbatore city who purchased and consumed fortified edible oils. For the purpose of data collection, convenience sampling method, was used to select sample respondents. The survey was carried out through a well-structured interview schedule, and primary data was collected from the sample respondents from different retail stores, supermarkets, and hypermarkets in different zones of Coimbatore city. For this study, a total of 150 sample respondents who purchased and consumed fortified edible oils were selected. Tools used for analysis were percentage analysis to analyze demographic details, consumer awareness, and consumer preference. Garrett's ranking technique was used to analyze the reasons for preferring fortified edible oils by the sample respondents and also to identify the constraints faced by consumers while purchasing and consuming fortified edible oils.

Results and Discussion

The demographic profile of the sample respondents includes gender, age, educational background, occupation, family type, family size, and family income. The demographic data collected among the sample respondents was analyzed, evaluated, and described in the following section for ease of understanding. The demographic details of sample respondents are given in Table 1

Table 1: Demographic Details of Sample Respondents

S. No	Characteristics	Category	No. of Sample Respondents	Percentage to Total (n=150)
1	Gender	Male	58	38.67
		Female	92	61.33
	Total		150	100
2	Age	Up to 20	13	8.67
		21-30	50	33.33
		31-40	46	30.67
		41-50	26	17.33
	Above 50	15	10	
Total		150	100	

3	Educational Qualification	Illiterate	0	0
		Primary Education	0	0
		Secondary Education	0	0
		Higher Secondary Education	10	6.67
		Undergraduate	44	29.33
		Postgraduate	68	45.33
		Ph.D.	28	18.67
Total		150	100	
4	Profession	Private Sector	31	20.67
		Public Sector	48	32
		Business	23	15.33
		Retired	6	4
		Student	31	20.67
		Housewife	11	7.33
		Unemployed	0	0
Total		150	100	
5	Family Type	Nuclear Family	119	79.33
		Joint Family	31	20.67
		Total	150	100
6	Family Size	Less than 3 members	15	10
		3-5 members	104	69.33
		More than 5 members	31	20.67
		Total	150	100
7	Family Income (Rs/Month)	Up to 20000	0	0
		20001-30000	0	0
		30001-40000	6	4
		40001-50000	37	24.67
		Above 50000	107	71.33
		Total	150	100

It could be inferred from Table 1 that female respondents (61 percent) were mostly purchasing fortified edible oils, followed by male respondents (39 percent). In terms of age, the majority of the sample respondents were 21 to 30 years old (33.33 percent), followed by 31 to 40 years (30.67 percent), 41 to 50 years (17.33 percent), above 50 years (10 percent), and up to 20 years (8.67 percent). Then in the education category, the majority of the sample respondents were postgraduates (45.33 percent), followed by undergraduates (29.33 percent), Ph.D. (18.67 percent), and higher secondary education (6.67 percent), and none of the sample respondents falls under the categories of illiterate, primary education, and secondary education. In case of profession, the majority of the sample respondents were working in the public sector (32 percent), followed by both the private sector and some of them were students (20.67 percent), business professionals (15.33 percent), housewives (7.33 percent), retired (4 percent), and none of the sample respondents were unemployed. In the category of family

status, the majority of the sample respondents belonged to a nuclear family (79.33 percent), followed by a joint family (20.67 percent). Then, in the family size category, the majority of the sample respondents had a family size of 3 to 5 members (69.33 percent), followed by more than 5 members (20.67 percent) and less than 3 members (10 percent). In case of family income, most of the sample respondents had an income above Rs. 50,000, with 71.33 percent, followed by Rs. 40,001 to Rs. 50,000 (24.67 percent), Rs. 30,001 to Rs. 40,000, and zero sample respondents from the category of Rs. 20,001 to Rs. 30,000 and up to Rs. 20,000.

Level of Awareness

In this section, the awareness level of sample respondents towards fortified edible oils was focused. Here, the awareness level was classified into three categories such as highly aware, moderately aware, and less aware. The details of the level of awareness of fortified edible oils are given in Table 2.

Table 2: Level of Awareness towards Fortified Edible Oils

S. No	Level of Awareness about Fortified edible oils	No. of Sample Respondents	Percentage to Total (n=150)
1	Less aware	78	52.00
2	Moderately aware	41	27.33
3	Highly aware	31	20.67
Total		150	100.00

It could be inferred from Table 2 that the majority of the sample respondents were less aware (52 percent) about the fortified edible oils, followed by moderately aware (27.33 percent) and highly aware (20.67 percent). It could be concluded from the table that most of the sample respondents were less aware of the fortification method and health benefits of fortified edible oils.

Consumer awareness on different varieties of Fortified Edible Oils available in the market

This section focuses on consumer awareness of the different varieties of fortified edible oils available on the market. At present, almost all the edible oils available on the market are fortified, especially branded edible oils. Most of the local oil manufacturing units didn't fortify the edible oils. In the

southern region, especially in Tamil Nadu, the most consumed edible oil in Tamilnadu was groundnut oil (Govindaraj *et al.*, 2023)^[9], but it is not mostly fortified in the local edible oil producers. Here, the different varieties of fortified edible oils available in the market were listed as

sunflower oil, coconut oil, groundnut oil, mustard oil, soybean oil, rice bran oil, palm olein oil, multisource edible oil, and cotton seed oil. The details of consumer awareness of the different varieties of fortified edible oils available in the market are given in Table 3.

Table 3: Consumer awareness on different varieties of Fortified Edible Oils

S. No	Fortified Edible Oils available in the Market	No. of Sample Respondents	Percentage to Total (n=150)
1	Sunflower oil	139	92.67
2	Coconut oil	20	13.33
3	Groundnut oil	85	56.67
4	Mustard oil	38	25.33
5	Soybean oil	12	8.00
6	Rice Bran oil	67	44.67
7	Palm olein oil	33	22.00
8	Multisource edible oil	31	20.67
9	Cotton seed oil	10	6.67

It could be observed from Table 3 that most of the consumers were aware of and knew about fortified sunflower oil (92.67 percent), followed by groundnut oil (56.67 percent), rice bran oil (44.67 percent), mustard oil (25.33 percent), palm olein oil (22 percent), multisource edible oil (20.67 percent), coconut oil (13.33 percent), soybean oil (8 percent), and cottonseed oil (6.67 percent). It could be concluded that almost 90 percent of the sample respondents were aware of and knew about sunflower oil, which is fortified with vitamins A and D, because it was mostly used by households for cooking purposes after cold-pressed groundnut and gingelly edible

oils.

Source of Information

In this section, the source of information through which the sample respondents came to know about fortification is discussed. The sources of information were listed as television or radio or newspaper, social media, books, word of mouth, online articles or blogs, and health professionals or nutritionists. The details of the source of information are given in Table 4.

Table 4: Source of Information

S. No	Source of Information	No. of Sample Respondents	Percentage to Total (n=150)
1	Television/Radio/Newspaper	5	3.33
2	Social-media	27	18.00
3	Books	47	31.33
4	Word of mouth	34	22.67
5	Online articles/Blogs	25	16.67
6	Health professionals or Nutritionist	12	8.00
	Total	150	100.00

It could be inferred from Table 4 that the majority of the sample respondents knew about the fortification through books in their graduation period (31.33 percent), followed by word of mouth (22.67 percent), social media (18 percent), online articles or blogs (16.67 percent), health professionals or nutritionists (12 percent), and television or newspaper or radio. It could be concluded that nearly 50 percent of the sample respondents heard about fortification through books and word of mouth in their graduation period; thus, it confirms that the source of information influences the awareness level and knowledge of the sample respondents

about the fortified edible oils.

Most Preferred and Purchased Fortified Edible Oil by Sample Respondents

The consumer's preference for different edible oils may vary from region to region. In this section, the fortified edible oils are divided into sunflower oil, groundnut oil, coconut oil, mustard oil, soybean oil, rice bran oil, palm olein oil, multisource edible oil, and cotton seed oil. The details of the most preferred and purchased fortified edible oils are given in Table 5.

Table 5: Most Preferred and Purchased Fortified Edible Oil by Sample Respondents

S. No	Most Preferred and Purchased Fortified Edible Oil	No. of Sample Respondents	Percentage to Total (n=150)
1	Sunflower oil	135	90.00
2	Coconut oil	0	0.00
3	Groundnut oil	75	50.00
4	Mustard oil	15	10.00
5	Soybean oil	0	0.00
6	Rice Bran oil	17	11.33
7	Palm olein oil	0	0.00
8	Multisource edible oil	33	22.00
9	Cotton seed oil	0	0.00

It could be inferred from Table 5 that the majority of the sample respondents preferred and purchased fortified sunflower oil (90 percent), followed by groundnut oil (50 percent), multisource edible oil (22 percent), rice bran oil (11.33 percent), and mustard oil (10 percent), and none of the sample respondents preferred fortified coconut oil, soybean oil, palm olein oil, and cotton seed oil. It could be concluded that fortified sunflower oil was almost always preferred and

purchased by 90 percent of the sample respondents.

Brand Preference

Brand preference takes place when consumers regularly choose and prefer one brand over others. None of the sample respondents preferred coconut oil, palm olein oil, soybean oil, and cottonseed oil. Hence, brand preferences for different fortified edible oils are given in Table 6.

Table 6: Brand Preference of different Fortified Edible Oils

S. No	Fortified Edible Oils	Brand Preference	No. of Sample Respondents	Percentage to Total (n=150)
1	Sunflower Oil	Fortune	50	33.33
		Freedom	2	1.33
		Gold winner	30	20.00
		Dhara	0	0.00
		Patanjali	12	8.00
		Sunland	16	10.67
		Mr. Gold	25	16.67
		Never Purchase	15	10.00
Total			150	100.00
2	Groundnut Oil	Fortune	39	26
		Mr. Gold	36	24
		Dhara	0	0
		Never Purchase	75	50
Total			150	100
3	Mustard Oil	Fortune	4	2.67
		Dhara	0	0.00
		Patanjali	11	7.33
		Never Purchase	135	90.00
Total			150	100.00
4	Rice bran Oil	Fortune	7	4.67
		Freedom	2	1.33
		Dhara	0	0.00
		Mr. Gold	4	2.67
		Patanjali	6	4.00
		Never Purchase	131	87.33
Total			150	100.00
5	Multisource edible oil	Fortune	23	15.33
		Cardia life	4	2.67
		Saffola	4	2.67
		Sundrop	0	0.00
		Sunland	0	0.00
		Never Purchase	119	79.33
Total			150	100.00

It could be inferred from Table 6 that the majority of the sample respondents preferred Fortune brand (33.33 percent) in fortified sunflower oil, followed by Gold Winner (20 percent), Mr. Gold (16.67 percent), Sunland (10.67 percent), Freedom brand (1.33 percent), none of the sample respondents preferred Dhara brand, and nearly 10 percent of the sample respondents never purchased sunflower oil. In case of fortified groundnut oil, the majority of the sample respondents preferred Fortune groundnut oil (26 percent), followed by Mr. Gold (24 percent), none of the sample respondents preferred Dhara brand, and nearly 50 percent of the sample respondents never purchased groundnut oil. In fortified mustard oil category, the majority of the sample respondents preferred Patanjali mustard oil (7.33 percent), followed by Fortune (2.67 percent), none of the sample respondents preferred Dhara brand, and nearly 90 percent of the sample respondents never consumed mustard oil. In case of rice bran oil, the majority of the sample respondents

preferred Fortune brand (4.67 percent), followed by Patanjali brand (4 percent), Mr. Gold brand (2.67 percent), Freedom (1.33 percent), none of the sample respondents preferred Dhara brand, and nearly 87.33 percent of the sample respondents never purchased rice bran oil. In fortified multisource edible oil category, the majority of the sample respondents preferred Fortune brand (15.33 percent), followed by Cardia Life and Saffola, and none of the sample respondents preferred Sundrop and Sunland brand, and nearly 79.33 percent of the sample respondents never purchased multisource edible oil.

Most Preferred Packaging Material

In this section, the most preferred packaging material by the sample respondents was discussed. The packaging materials were classified into four such as packet, bottle, can, and tin. The details of the most preferred packaging materials by the sample respondents are given in Table 7.

Table 7: Most Preferred Packaging Material by the Sample Respondents

S. No	Most Preferred Packaging Material	No. of Sample Respondents	Percentage to Total (n=150)
1	Packet	95	63.33
2	Bottle	39	26.00
3	Can	16	10.67
4	Tin	0	0.00
	Total	150	100.00

It could be inferred from Table 7 that the majority of the sample respondents preferred packet or pouch as a packaging material (63.33 percent), followed by bottle (26 percent) and can (10.67 percent), and none of the sample respondents preferred tin as a packaging material. The packaging material and quantity may vary according to the family size of the sample respondents.

Reasons for Preferring Fortified Edible Oils

The primary reasons for preferring fortified edible oils were

stated in a well-structured interview schedule, and consumers were asked to rank them. The major reasons given by the sample respondents for preferring fortified edible oils were quality assurance, edible oil as a convenient food vehicle to incorporate essential micronutrients, high value for money when compared to non-fortified edible oils, accessibility to all income groups, and reducing nutritional deficiencies. The details of the reasons for preferring fortified edible oils are given in Table 18.

Table 8: Reasons for Preferring Fortified Edible Oils

S. No	Reasons	Garrett's Score	Rank
1	A convenient food vehicle to incorporate essential micronutrients	66.8	I
2	Reducing nutritional deficiencies	61.43	II
3	High value for money when compared to non-fortified oil	49.34	III
4	Quality assurance	41.98	IV
5	Accessible to all income groups	29.44	V

It could be inferred from Table 8 that the majority of the sample respondents primary reason for preferring fortified edible oils was that they were considered as a convenient food vehicle to incorporate essential micronutrients because edible oils are frequently consumed and regularly used in their cooking, so edible oils act as an excellent food vehicle to deliver essential micronutrients and minerals in our diet. The second reason for preferring fortified edible oils was to reduce nutritional deficiencies because most of the essential nutrients were excluded in the traditional oil extraction process, and there was a loss of nutrients in the finally delivered edible oil. But, in the case of the fortification method, additional micronutrients such as vitamin A and D are externally added in the oil extraction process; hence, the micronutrients are retained in the finally delivered edible oil. The third reason given by the sample respondents for preferring fortified edible oils was that they were high value for money when compared to non-fortified edible oils because the cost of fortified edible oils and locally processed edible oils have little difference. The cost of the fortified edible oils may vary among the different brands of fortified edible oils available on the market. The fourth reason for preferring fortified edible oils by the sample respondents was quality assurance because the branded fortified edible oils had a high quality standard and were certified by the Food Safety and Standards Authority of India (FSSAI) when compared to locally processed non-fortified edible oils. The final reason for preferring fortified edible oils was that they were accessible to all income groups because the cost of the branded fortified edible oil was somewhat similar to the locally available non-fortified edible oils, so they could be accessible to all consumers, from low-income to high-income households.

Constraints faced by Consumers while Purchasing and Consuming Fortified Edible Oils

The primary constraints were stated in a well-structured interview schedule, and consumers were asked to rank them.

The major constraints faced by consumers while purchasing and consuming fortified edible oils were lack of awareness, cultural barriers and traditions, non-visibility of the fortification logo, lack of product variety, perception of fortified foods as artificial, dietary restrictions, and limited promotions. The details of constraints faced by consumers while purchasing and consuming fortified edible oils are given in Table 9.

Table 9: Constraints faced by Consumers while Purchasing and Consuming Fortified Edible Oils

S. No	Constraints	Garett's Score	Rank
1	Lack of awareness	71.62	I
2	Limited Promotions	61.88	II
3	Non-visibility of the fortification logo	57.60	III
4	Cultural barriers and Traditions	51.18	IV
5	Lack of Product variety	40.11	V
6	Perception of fortified foods as artificial	39.64	VI
7	Dietary restrictions	27.96	VII

It could be concluded from Table 9 that lack of awareness about food fortification (71.62) was the major constraint faced by consumers while purchasing and consuming fortified edible oils because knowledge about fortification was not prevalent among consumers; even well-educated people were unaware of fortification. At present, the majority of food products are fortified, but consumers are unknowingly purchasing and consuming fortified edible oils. The second constraint pointed out by the sample respondents was limited promotion (61.88) because there is poor promotion of the fortification process by the oil manufacturing companies. The edible oil company's advertisements and promotions were attractive and well-explained about the inclusion of micronutrients; however, they failed to disclose the name of that method in the advertisement, i.e., fortification. The third constraint faced by the sample respondents was the non-visibility of the fortification logo (57.60), due to the fact that

the majority of edible oil manufacturing firms printed the fortification logo on the back side of the oil container (packet, bottle, can, or tin); only a few oil brands printed the fortification logo on the front side but on any corners of the container, and it was not prominently displayed. While the fourth constraint was cultural barriers and traditions (51.18), because most customers preferred cold-pressed edible oils, particularly in the southern region, groundnut and gingelly oil was mostly preferred, but it was mostly not fortified by the local edible oil producers. The fifth constraint was a lack of product variety (40.11) because not all varieties of fortified edible oils are available in the market, and if available, they are less popular and are not purchased and consumed by consumers, particularly mustard oil, cottonseed oil, soybean oil, etc., which are unsuitable for the southern food style and tradition. The sixth constraint was the consumer perception of fortified foods as artificial (39.64), because people in the southern region mostly adhere to traditional methods of extracting edible oils and mostly use cold-pressed edible oils, and they consider fortification to be an artificial process of adding nutrients and minerals. Dietary constraints (27.96) were the last constraint confronted by the sample respondents while purchasing and consuming fortified edible oils because some of the sample respondents did not add edible oils to their food while maintaining a strict diet plan.

Conclusion

In this study, it could be concluded that most of the sample respondents were less aware of fortified edible oils. The sample respondents frequently purchase fortified edible oils, but the fact that they unknowingly purchasing the product. Even though the study was conducted in an urban area, the well-educated consumers themselves were less aware of food fortification. In the case of consumer awareness of different varieties of fortified edible oils, 92.67 percent of sample respondents were aware of fortified sunflower oil, and the least aware fortified edible oil was cotton seed oil (6.67 percent). Here, almost 90 percent of sample respondents preferred and consumed sunflower fortified edible oil, particularly in Fortune brand (33.3 percent). The major reason for preferring fortified edible oil was that it is considered to be a convenient food vehicle to incorporate essential micronutrients into our diet because edible oils are frequently consumed and regularly used in cooking. So edible oils are an excellent food vehicle to deliver essential micronutrients and minerals in our diet. Recently, most of the top oil manufacturing companies have concentrated on the well-being of potential consumers by implementing fortification strategies in all varieties of edible oils. The major constraint faced by consumers while purchasing and consuming fortified edible oils was lack of awareness about fortification (71.62) because knowledge about food fortification was not prevalent among consumers; even well-educated people were unaware of food fortification. At present, the majority of food products on the market are fortified, but consumers are also unknowingly purchasing and consuming fortified edible oils. This indicates that they are indirectly getting health benefits through the fortification strategy.

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