

Assessment of consumer knowledge towards fortified foods

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■ **ABSTRACT** : A study was planned to assess consumer knowledge towards fortified foods. A total of 150 female consumers age 25 and above residing in the Udaipur city were chosen. Various aspects of knowledge were assessed using a self-developed questionnaire. The scoring of questions was done on a two-point continuum *i.e.*, correct or incorrect. Each correct response was awarded a score of one and incorrect a zero. ANOVA was used to compare consumer knowledge among different age groups and education qualifications. Results revealed that overall knowledge regarding fortified foods was poor (52%), followed by 36 per cent had average knowledge, whereas only 12 per cent had high knowledge score. About 51.33 per cent of consumers were aware of the term food fortification. There was a significant difference in knowledge scores between different age groups ($p < 0.01$) namely, group I (25-36), group II (37-48), and group III (49-60). Similarly, a large margin was also seen between educational qualifications of the consumers ($p < 0.01$). Thus, the overall knowledge of fortified foods was reported to be poor.

■ **KEY WORDS**: Knowledge, Fortified foods, Micronutrients, Hidden hunger

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Micronutrient deficiency is a widespread public health problem that adversely affects the nation's productivity. Across the world, more than 2 billion people suffer from vitamin and mineral deficiencies, which is the one-third the population of the entire world (World Health Organisation, 2000). As per the National Family and Health Survey (NFHS-4), over 70 per cent of people in India still consume less than half of their Recommended Dietary Allowance (RDA) of micronutrients. The reason could be a lack of consumption of a balanced diet, faulty cooking practices, diseases, low socio-economic background, lack of

knowledge, etc. These people may not look hungry or malnourished but they are lacking the crucial vitamins and minerals needed to live a fully active lifestyle. For instance, deficiency of iron makes a person feel lethargic and unable to perform efficiently in the workplace. Insufficient Vitamin A weakens the immune system and can lead to blindness. Pregnant women with severe iodine deficiency can give birth to children with permanent lower IQ and insufficient folate is linked with the higher risks of birth defects like Neural Tube Defects, in turn hindering human development. The World Bank estimates that the countries can lose between 2-3 per cent GDP

due to micronutrient deficiencies.

India's urban population, which constitutes about more than 30 per cent, consumes very low amounts of different food groups that are required to stay healthy. Public health concerns like Iron deficiency Anaemia is still prevalent in over 50 per cent of women (15-45 years) and children under 5 years of age. Almost 62 per cent of the Indian population has low serum blood levels of vitamin A and vitamin D (50-94%). Disadvantageous outcomes like stunting, increased sensitivity to infectious diseases, physical disability, cognitive losses, blindness, and premature mortality are caused because of micronutrient deficiency (National Health Family Survey, 2015-16). NNMB Brief Report (2017) on Urban Nutrition of India states that the average consumption of nutrients was inadequate among urban adults (men and women). The average intake of the micronutrients like iron (77.6%), calcium (67%), thiamine (83.3%) and niacin (61.3%) were seen to be below the RDA, whereas the intake of vitamin A (22.8%) and riboflavin (50%) were very much insufficient. The intake of vitamin C (128.3%) and total folic acid (101%) were meeting the RDA.

There are many strategies to combat malnutrition. Food fortification is one such strategy to eradicate this hidden hunger which is low-cost, convenient and effective. It is the process of adding vitamins and minerals in minute quantities to commonly consumed food. Fortification of staple foods like oil, salt, wheat flour, rice, breakfast cereals, and condiments is an effective means of addressing micronutrient deficiencies in the children and adult population as these are consumed daily and by all the sections of the population thus making them the ideal vehicle for food fortification.

Edible Double Fortified Salt (DFS) is now all set to play an important role in population. The formulations are planned to provide 100 per cent of daily dietary iodine requirement and 30 to 60 per cent of the iron requirement. In India, rice and wheat flour are generally fortified with iron, folic acid, and vitamin B12.

Another food group that witnesses fortification is milk, which is fortified with Vitamin A and D. It has the ability to reach out to a significant proportion of the population globally, so the acceptance of dairy products among people is high.

Edible vegetable oil is an important component to cook food and adds taste to it. Fortification of edible oil

with vitamin A and D, are known to provide 25-30 per cent of the RDA requirement. Food Safety and Standards Authority of India (FSSAI) has recently launched the +F logo to aware people of its health benefits. The increment cost of these ranges roughly from 7 paise to 2 rupees, which is affordable by general mass.

Assessing consumer's behaviour towards fortified food is a crucial aspect. Now the consumers are becoming more conscious of diet and health and hence are becoming more motivated to take care of their health by way of consuming healthier food. Increased health consciousness and changes in lifestyle, coupled with awareness about the benefits associated with health and wellness, food have led to significant changes in consumer behaviour towards healthy food consumption in recent years (Quah and Tan, 2009).

The research was intended to interpret how consumers are aware of fortified foods in terms of the meaning of micronutrients (vitamins and minerals), advantages of consuming fortified foods, health benefits of vitamins and minerals, types of staple foods fortified. There are very limited literatures and documents available on the consumer knowledge towards fortified foods. In the long run, if we are building on the capital of our population, it is important that people are healthy and therefore, it is important for people to know about food fortification. The findings of the study will provide information on public awareness. Thus, by creating demand which in turn scale up the production of fortified foods and successively help in combating micronutrient deficiencies.

■ RESEARCH METHODS

The present study was conducted within the municipal limits of Udaipur city of Rajasthan.

A sample of 150 female consumers age 25 and above years was selected and a list of supermarkets located in different parts of Udaipur city was prepared. Thirty consumers from five randomly selected supermarkets were selected by convenience sampling. A questionnaire schedule was used to gather data from consumers. A questionnaire was developed to assess consumer knowledge of fortified foods. Questions regarding the concept, advantages, health benefits and logo, various fortificants, micronutrients deficiencies, the role of micronutrients were included. Scoring of questions was done on a two-point continuum *i.e.*, correct

or incorrect. Each correct response was assigned with a score of one each and incorrect a zero. The total score was divided into 3 knowledge levels; poor, average and good. Frequency, percentage, and ANOVA were used to analyze knowledge. Analysis of variance (ANOVA) one-way classification is used to compare knowledge among different age groups and education qualification of the consumers.

RESEARCH FINDINGS AND DISCUSSION

The results obtained from the present investigation as well as relevant discussion have been summarized under following heads:

Consumer knowledge level:

Fig. 1 depicts that the majority of consumers had poor knowledge (52%) regarding fortified food products, whereas 36 per cent of consumers had average knowledge. Only 12 per cent showed high knowledge about fortified foods. Similar results were reported by Battalwar and Syed (2016) who stated that the overall

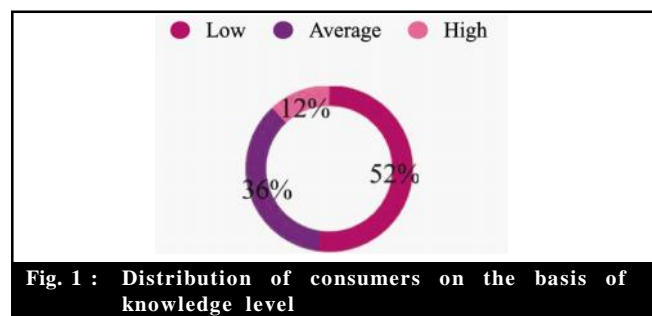


Fig. 1 : Distribution of consumers on the basis of knowledge level

awareness of fortified foods was poor. Truzyan *et al.* (2009) reported that most of the consumers had no idea of food fortification. The majority of health-care professional had poor knowledge about the subject. In a similar study, very few urban Mongolians and Harbin were aware that industrial fortification is practiced in their countries (Bromage *et al.*, 2019).

Knowledge of the consumers regarding fortified foods:

Table 1 gives a very clear picture that 51.33 per cent of consumers were aware of the term food fortification. Very few consumers were familiar with the fortified logo (15.33%), the reason could be the new launch of the logo (2016) by FSSAI or poor label reading practices by the consumers. The similar findings revealed that participants responded that food fortification is the addition or enrichment of food products. Very few stated that the advantages of consuming fortified foods are that it's healthy as well as increases the strength and improves immunity (Battalwar and Syed, 2016). Large-scale food fortification is widely recognized as a cost-effective strategy to improve the micronutrient status of the population and very few consumers believed that it is cost-effective (Hoddinott *et al.*, 2013). A study stated that a very less number of mother/child caretaker was aware of the term food fortification and don't know the types of foods being fortified with vitamins and minerals (Kasankala *et al.*, 2018). The table also showed that more than 50 per cent of consumers were not aware of the health benefits of the micronutrients being added in

Sr. No.	Knowledge about fortified foods	f	%
1.	Aware about the term food fortification	77	51.33
2.	Food fortification logo	23	15.33
3.	Advantages of fortified foods	77	51.33
	Improves nutritional status	60	77.92
	Prevent diseases	53	68.83
	No change in existing food pattern	40	51.94
	Cost effective	9	11.68
4.	Consumption of fortified food decreases the demand of fruits and vegetables		
	Yes	18	12
	No	96	64
	Don't know	36	24
5.	Term fortified foods and organic foods cannot be interchangeably used.	96	64
6.	Malnutrition can be prevented by fortified foods.	97	64.66
7.	Fortification has no effect of shelf life of foods.	25	16.66

food. Term fortified foods and organic foods can not be interchangeably used was accepted by 64 per cent of consumers. About 64 per cent consumers were not in the favour that consumption of fortified food decreases the demand for fruits and vegetables, whereas 20 per cent agreed on it. Food fortification is a complementary strategy, not an alternative or the replacement of a balanced diet. Substituting fortified foods with fruits and vegetables is not a healthy choice since these products fulfill only 30-50 per cent daily requirement of micronutrients. About 64.66 per cent participants agreed that malnutrition can be prevented by fortified foods. Some consumers (16.66%) responded correctly that adding micronutrients in foods has no effect on the shelf life of products, but each micronutrient has its own shelf life which with time decreases.

Consumer knowledge regarding various fortificants:

Table 2 reveals that the majority of consumers (95.33%) had knowledge that iodine is fortified in salt whereas, very few (4.67%) were aware of the double fortified salt. Fortification of wheat with iron, folic acid and vitamin B12 was also known by the fewer consumers (5.33%). Knowledge regarding fortification of rice with iron, folic acid and Vitamin B12 was very poor (2%). Awareness towards the addition of oil with vitamin A

and vitamin D was satisfactory (24%), whereas milk is fortified with vitamin A and vitamin D was known by 17.33 per cent of the consumers. The results are in conformity with the results of a study that reported that 52 per cent of the participants knew that salt is added with iodine while few gave a mixed response with Iodine and Iron (Battalwar and Syed, 2016).

Knowledge of consumers towards micronutrients and micronutrient deficiencies:

The findings of Table 3 reveal that all the consumers had knowledge of various vitamins and minerals. The requirement of micronutrients vary between individuals was agreed by 87.33 per cent of the consumer. About 73.33 per cent believed that they provide energy and helps to fight diseases. They were also familiar with the role of micronutrients in promoting growth and development (67.33%) and to maintain the normal functioning of the body (58%). The majority of them were aware that sunlight is the best source of Vitamin D (96.66%). About 76 per cent knew that calcium and Vitamin D are necessary for teeth and bone development. A large number of consumers were familiar that vitamin A prevents blindness (78%) whereas, 20 per cent believes that it reduces the risks of certain cancers. Very few were acquainted that it improves immunity against diarrhea (6%) and prevent respiratory tract infection

Table 2 : Percent distribution of consumers regarding knowledge of various fortificants (n=150)

Sr. No.	Fortified products	Micronutrients	f	%
1.	Salt	Iodine	143	95.33
		Iron	0	0
		Both	7	4.47
2.	Oil	Vitamin A	20	13.33
		Vitamin D	4	2.67
		Both	36	24
3.	Milk	Vitamin A	5	3.33
		Vitamin D	3	2
		Both	26	17.33
4.	Wheat flour	Iron	7	4.67
		Folic acid	0	0
		Vitamin B12	0	0
		All	8	5.33
5.	Rice	Iron	6	4
		Folic acid	1	0.67
		Vitamin B12	0	0
		All	3	2
6.	Don't know		7	4.67

Table 3 : Knowledge of consumers towards micronutrients		(n=150)	
Sr. No.	Micronutrient knowledge	f	%
1.	Aware about vitamins and minerals	150	100
2.	Requirement of micronutrient vary between individuals.	131	87.33
3.	Role of micronutrient in diet		
	Helps to fight diseases	116	77.33
	Provide energy	116	77.33
	Promote growth and development	101	67.33
	Maintain normal functioning of body	87	58
4.	Sunlight is the best source of Vitamin D	145	96.66
5.	Calcium and Vitamin D for teeth and bone development	114	76
6.	Health benefits of vitamin A		
	Prevent blindness	117	78
	Improves immunity against diarrhoea	9	6
	Prevents respiratory tract infections	11	7.3
	Reduces the risks of certain cancers	30	20
	Don't know	19	12.66
7.	Health benefits of Antioxidants		
	Slows down ageing	103	68.66
	Increases immunity	62	41.33
	Reduces the risk of cataract	37	24.66
	Reduces the risk of stomach diseases	26	17.33
	Don't know	44	29.33

(7.3%).

Antioxidant was not the new term for the consumers, most of them were aware of the term and its benefits. A large percentage of consumers knew that the consumption of antioxidants helps in slowing down aging (68.66%). About 41.33 per cent agreed that they increase immunity.

Antioxidants help in reducing the risk of cataract was known by 24.66 per cent. Very few consumers (17.33%) were aware that antioxidants reduce the risk of stomach diseases. Table 4 elaborates that most of the consumer was aware that deficiency of vitamin A causes

night blindness, contrary results were shown in a study that about 56.66 per cent had knowledge about iodine deficiency in children causes impaired mental development whereas 62 per cent agreed that low intakes of vitamin C cause bleeding gums (Sheth *et al.*, 2016). The research reported that consumers had limited knowledge about the outcomes of iodine deficiency (Charlton *et al.*, 2012). The table also depicts that 72 per cent of consumers were aware that tiredness and irritation are one of the symptoms of anemia, whereas paleness of eyes and skin (51.33%) are due to the low iron status in the body. The low concentration power in

Table 4 : Consumers knowledge regarding micronutrients deficiencies		(n=150)	
Sr. No.	Micronutrient deficiencies	f	%
1.	Deficiency of Vitamin A causes night blindness	117	78
2.	Deficiency of Iodine leads to impaired mental development in children	85	56.66
3.	Deficiency of Vitamin C causes bleeding gums	93	62
4.	Symptoms of anemia		
	Tiredness and irritation	108	72
	Paleness of eyes and skin	77	51.33
	Low concentration	58	38.66
	Spoon shaped nails	35	23.33
	Don't know	15	10

Table 5 : Comparison of consumer knowledge among different age groups and education qualification using ANOVA (n=150)				
Sr. No.	Sample group	Knowledge Mean \pm SD	SE	f-value
1.	Age group			
	Group I (25-36)	21 ^a \pm 8.99	0.89	8.59**
	Group II (37-48)	13.43 ^a \pm 5.46	1.14	
Group III (49-60)	16.57 ^a \pm 9.25	1.89		
2.	Education qualification			
	Secondary	8.27 ^a \pm 1.56	0.47	12.83**
	Senior secondary	13.67 ^a \pm 5.13	2.29	
	Graduate	16.48 ^a \pm 6.57	0.96	
Post graduate	22.01 ^a \pm 9.35	1.00		

SE- Standard Error; SD-Standard deviation; **significant difference; a and b- Different superscript means statistically different

doing work which is a symptom of anemia was reported by 38.66 per cent of the consumer. Only 23.33 per cent consumers knew that spoon-shaped nails are due to anemia. About 10 per cent had no idea about the symptoms of anaemia.

Comparison of consumer's knowledge among different age groups and education qualification:

Age and education qualification are the major factors that influence the awareness level of any individual. Therefore, these two parameters were considered for the comparison. The 3 categories of age viz., 25-26, 37-48 and 49-60 were assigned groups I, group II and group III, respectively. Table 5 depicts the comparison of knowledge scores with 3 categories of age groups and 4 categories of education qualification namely, secondary, senior secondary, graduate and postgraduate.

Age:

The results reveal that overall there was a significant difference in the knowledge levels between different age groups (Table 5). It was observed that there was a large margin between the scores of group I and group II ($p < 0.01$), whereas nothing noticeable appeared in group I and III. Similarly, groups II and III were also non-significant.

Education qualification:

Overall, there was an appreciable difference in all four categories. Statistically, there was a difference ($p < 0.01$) found between the knowledge scores of those who have attained education till secondary, graduation and post-graduation whereas there was no significant

difference found between individuals that have studied up to secondary and senior secondary education. Thus, from the finding, it can be stated that the level of education does affect the knowledge regarding fortified foods. Contrary results were seen in the findings of Kasankala *et al.* (2018) that knowledge and awareness of food fortification are not affected by income, education qualification, and age of the Mother/Child Caretakers.

Conclusion:

From the findings, it can be concluded that the majority of consumers had low knowledge regarding fortified foods. Most of them were unaware of the term food fortification, its logo, and its advantages. Very few were aware of micronutrients that are fortified in food products. The majority of them knew about iodized salt, whereas very less had knowledge about fortified wheat flour, rice, milk, oil, and double fortified salt. The research highlighted that there is a need to have accurate and sufficient knowledge regarding fortified foods, as these products help in preventing multiple micronutrient deficiencies as well as builds up the vitamins and minerals stored in the body. Fortification of food is a very feasible and effective strategy to fight with deficiency diseases like anemia, goiter, rickets, night blindness. Consuming fortified food does not require any change in diet, as vitamins and minerals are added in those food products they are widely eaten by the population such as staple foods. Tackling malnutrition requires a universal approach. Awareness can be created by the distribution of folders in public places, promotion in health centers or a part of the school/ college curriculum. Only integrated and joint efforts at all levels can help us fight malnutrition. With the increasing awareness about the

advantages of fortified foods, India will slowly but surely move towards a country of healthier and happier people.

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■ REFERENCES

Battalwar, R. and Syed, B.F. (2016). A study on awareness and consumption of fortified foods among female adults of Mumbai. P.G. Diploma Thesis, S.N.D.T. Women's University, Mumbai (M.S.) India.

Bromage, S., Gonchigsumlaa, E., Traeger, M., Magsar, B., Wang, Q., Bateer, J., Li, H. and Ganmaa, D. (2019). Awareness and attitudes regarding industrial food fortification in Mongolia and Harbin. *Nutrients*, **11** (1) : 201-223.

Charlton, K., Axford, S., Gemming, L., Houweling, F., Goodfellow, A. and Ma, G. (2012). Poor knowledge and practices related to iodine nutrition during pregnancy and lactation in Australian women: pre- and post-iodine fortification. *Nutrients*, **4** (9) : 1317-1327.

Hoddinott, J., Rosegrant, M., Torero, M., Hunger and Lomborg, B. (2013). Costs and benefits. Cambridge University Press and Copenhagen Consensus Centre. New York. pp. 332-367.

Kasankala, M.L., Kitunda, M., Mushumbusi, D.G., Cyprian, C.M., Meghji, W.P., Mgoba, M.C. and Two, E. (2018).

Knowledge and awareness on food fortification among mother/child caretakers of Kinondoni Municipality, Tanzania. *Asian Food Sci. J.*, **2**: 1- 13.

Quah, S. and Tan, A.K.G. (2009). Consumer purchase decisions of organic food products: An Ethnic Analysis. *J. Internat. Consumer Mktg.*, **22** : 47-58.

Sheth, A.M., Rangoonwala, M.M., Lodhiya, K.K., Zalavadiya, D.D. and Joshi, N.B. (2016). A study on awareness and practice regarding vitamin A intake and its deficiency disorders among mothers of pre-school children in Khirasara village, Rajkot, Gujarat. *National J. Community Medicine*, **7** : 505-509.

Truzyan, N., Grigoryan, R., Crape, B. and Petrosyan, V. (2009). Assessment of population knowledge, perception and attitudes in relation to micronutrient deficiencies and fortified foods. Food Fortification Report. The American University of Armenia.

■ WEBLIOGRAPHY

National Health Family Survey (NFHS) 4 (2015-16). India Fact Sheet. Retrieved from <http://rchiips.org/NFHS/pdf/NFHS4/India.pdf> on 23/11/2018.

National Nutrition Monitoring Bureau (NNMB) (2017). NNMB Brief Report on Urban Nutrition. Retrieved from <http://ninindia.org/NNMB%20Urban%20Nutrition%20survey%2020report-Final%2025-09-2017.pdf> on 05/02/2019.

World Health Organisation (2000). World health report. Geneva: World Health Organisation. Retrieved from <https://ourworldindata.org/micronutrient-deficiency> on 22/11/18.

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