



Journal Homepage: - [www.journalijar.com](http://www.journalijar.com)  
**INTERNATIONAL JOURNAL OF  
 ADVANCED RESEARCH (IJAR)**

Article DOI: 10.21474/IJAR01/5783  
 DOI URL: <http://dx.doi.org/10.21474/IJAR01/5783>



### RESEARCH ARTICLE

#### A STUDY ON AWARENESS AND CONSUMPTION OF FORTIFIED FOODS AMONG MALE ADULTS OF MUMBAI.

**Dr. Rekha Battalwar<sup>1</sup> and Akshata Paresh Chavan<sup>2</sup>.**

1. Associate Professor, Department of Food, Nutrition & Dietetics, Sir Vithaldas Thackersey College of Home Science (Autonomous), S.N.D.T. Women's University, Juhu, Mumbai, India – 400049.
2. Student of Post graduate Diploma in Clinical nutrition and Dietetics, Department of Food, Nutrition & Dietetics, Sir Vithaldas Thackersey College of Home Science (Autonomous), S.N.D.T. Women's University, Juhu, Mumbai, India – 400049.

#### Manuscript Info

##### Manuscript History

Received: 06 September 2017  
 Final Accepted: 08 October 2017  
 Published: November 2017

##### Key words:-

Fortification, Micronutrient deficiency, Awareness, Attitude, Consumption.

#### Abstract

**Introduction:** Micronutrient deficiency has always been the concern to malnutrition but with the help of recent advances in food and technology fortification of food products has gained a great momentum and this will help to overcome the micronutrient deficiency.

**Aim:** To evaluate the awareness, attitude and consumption pattern of males in regards to fortified food products in Mumbai city.

**Methods:** A study was conducted on 100 males between age group of 18 to 67 years using a structured questionnaire. Questions regarding the awareness, attitude and consumption of fortified foods were included in the study. A statistical package of social sciences (SPSS) version 16 was used for analysis.

**Results:** The awareness of participants regarding definition of fortified foods, reading the front side of label to identify fortified foods, fortification being made compulsory by government i.e. fortification of salt with iodine, availability of fortified foods in India, combination of vitamins/ minerals used in fortification of foods was highly significant ( $p < 0.0001$ ). The attitude of participants towards consumption of fortified foods was mainly due to health benefits and affordable prices. Participants reported no difference in taste, texture, appearance and overall acceptability of the fortified foods ( $p < 0.0001$ ). Soy, milk & milk products and beverages were consumed on monthly basis; breakfast cereals, bread, biscuits and snacks were consumed on weekly basis; fats/ oils and miscellaneous products were consumed on daily basis.

**Conclusion:** The awareness of fortified foods was high in majority of male subjects in Mumbai city. They gained the awareness through family members, peers, internet and media. Consumption pattern of the fortified foods was also good and the main reason cited was health benefits of these foods. There is an increasing trend in the consumption of fortified foods in the modern societies.

Copy Right, IJAR, 2017.. All rights reserved.

#### Corresponding Author:- Rekha Battalwar.

Address:- Associate Professor, Department of Food, Nutrition & Dietetics, Sir Vithaldas Thackersey College of Home Science (Autonomous), S.N.D.T. Women's University, Juhu, Mumbai, India – 400049.

## **Introduction:-**

Micronutrient malnutrition (MNM) is widespread in the industrialized nations, but even more so in the developing regions of the world. It can affect all age groups, but young children and women of reproductive age tend to be among those most at risk of developing micronutrient deficiencies. They not only cause specific diseases, but they act as exacerbating factors in infectious and chronic diseases, greatly impacting morbidity, mortality and quality of life. Deficiencies in some groups of people at special risk require supplementation, but the most effective way to meet community health needs safely is by population based approaches involving food fortification (1). The World Health Organization estimates that more than 2 billion people are deficient in key vitamins and minerals. The population groups most vulnerable to these micronutrient deficiencies are pregnant and lactating women and young children, given their increased demands. Food fortification is one of the strategies that has been used safely and effectively to prevent vitamin and mineral deficiencies (2, 3). Fortification defined by the Codex Alimentarius *Principles for the Addition of Essential Nutrients to Foods* defines “fortification”, or synonymously “enrichment”, as “the addition of one or more essential nutrients to a food, whether or not it is normally contained in the food, for the purpose of preventing or correcting a demonstrated deficiency of one or more nutrients in the population or specific population groups” (4). Food fortification has a long history of use in industrialized countries for the successful control of deficiencies of Vitamin A and D, several B vitamins (thiamine, riboflavin and niacin), iodine and iron (5). The concentration of just one micronutrient might be increased in a single foodstuff (e.g. the iodization of salt), or, at the other end of the scale, there might be a whole range of food–micronutrient combinations. The public health impact of food fortification depends on a number of parameters, but predominantly the level of fortification, the bioavailability of the fortificants, and the amount of fortified food consumed. Compared with other interventions, food fortification may be cost-effective and, if fortified foods are regularly consumed, has the advantage of maintaining steady body stores (6). In targeted food fortification programmes, foods aimed at specific subgroups which include complementary foods for infants and young children, foods developed for school feeding programmes, special biscuits for children and pregnant women, and rations (blended foods) for emergency feeding and displaced persons. The majority of blended foods for feeding refugees and displaced persons are managed by the World Food Programme (WFP) and guidelines covering their fortification (including wheat soy blends and corn soy blends) are already available (7). Market-driven fortification is applied to situations whereby a food manufacturer takes a business-oriented initiative to add specific amounts of one or more micronutrients to processed foods. It plays a positive role in public health by contributing to meeting nutrient requirements and thereby reducing the risk of micronutrient deficiency. In the European Union, fortified processed foods have been shown to be a substantial source of micronutrients such as iron, and vitamins A and D (8, 9). In western and northern regions prevalence of Vitamin A would be reduced by fortifying vegetable oil and sugar with Vitamin A (10).

## **Methodology:-**

A detailed awareness, attitude and consumption practice study was conducted in Mumbai on 101 males between age group of 18 to 67 years irrespective of their caste, occupation and educational background belonging to random areas of like Bandra, Santacruz, Vile Parle and Andheri. Males from Nutrition or Dietetics field and females were excluded. Purposive sampling technique was used to enrol the study participants. A structured questionnaire was randomly distributed to subjects who actively and willingly participated which were used to collect information regarding whether they find fortified food products healthy, knowledge regarding the term “fortification”, practice regarding use of fortified foods and which specific food products they consume with the help of a food frequency table. A statistical package of social sciences (SPSS) version 16 was used for analysis.

## **Results and Discussion:-**

### **Basic Characteristics of study participants:-**

In total, 101 males were enrolled in the study. Age of participants ranged from 18 to 67 years with a mean of 33.60 ± 13.20. Sixty-two (61.40%) were Hindu; 69 (68.30%) were Non-Vegetarians. Qualifications of the subjects participated in this study ranged from below high school to post graduates in which 69 (68.30%) were graduates; 84 (83.20%) participants were employed and 77 (76.20%) subjects belonged to middle-socio economic class.

### **Awareness of Food Fortification:-**

The objective of this research was to investigate a range of issues around public awareness. Specific information about consumer’s awareness and understanding of fortification was sought.

**Table 1:-** focuses on the knowledge of males in Mumbai regarding food fortification, in which six questions were asked about definition of food fortification, labelling of fortified foods, food fortification compulsory in India, fortified food products in India, according to them which other mineral should be added in food.

**Table 1:-** Awareness of Food Fortification

<b>Definition of Food Fortification</b>	<b>Frequency (f)</b>	<b>Percent (%)</b>	<b>Chi-square</b>	<b>P- value</b>
<b><i>Addition or Enrichment of Food Product</i></b>	<b>59</b>	<b>58.40</b>	1.37	0.00**
Supplementation of food ingredients	19	18.80		
Addition of an additive	6	5.90		
Good source of a particular vitamin/mineral	7	6.90		
Mixed response	1	1.00		
I'm unsure	9	8.90		
<b><u>Label of Food Product on which Fortification details mentioned</u></b>				
<b><i>Front side along with the Product name</i></b>	<b>38</b>	<b>37.60</b>	47.81	0.00**
Backside of the pack	14	13.90		
Nutrition information Panel	26	25.70		
Ingredient List	5	5.00		
Somewhere else on the pack	0	0.00		
All of the above	10	9.90		
I don't know	8	7.90		
<b><u>Government makes it compulsory for manufacturer to fortify food product</u></b>				
<b><i>Yes</i></b>	<b>72</b>	<b>71.30</b>	65.84	0.00**
No	12	11.90		
I'm unsure	17	16.80		
<b><u>Fortified Food Products in India</u></b>				
Bread	0	0.00	1.37	0.00**
Breakfast Cereals	6	5.90		
Biscuits	0	0.00		
Milk & Milk Products	0	0.00		
Fruit Juices	0	0.00		
Butter/ Oils	0	0.00		
Salt	0	0.00		
Water	4	4.00		
All of them	32	31.70		
I'm unsure	5	5.00		
<b><i>Combination of Food product</i></b>	<b>54</b>	<b>53.50</b>		
<b><u>Vitamins/ Minerals used in Food fortification</u></b>				
Vitamin A	0	0.00	1.19	0.001**
Vitamin D	0	0.00		
Vitamin C	0	0.00		
Vitamin E	3	3.00		
Thiamine	0	0.00		
Riboflavin	0	0.00		
Niacin	0	0.00		
Folic Acid	0	0.00		
Calcium	0	0.00		
Iron	0	0.00		
Iodine	3	3.00		
Zinc	0	0.00		
Omega 3-fatty acid	0	0.00		
Dietary Fibre	1	1.00		
Probiotics	0	0.00		
All of them	42	41.60		

Any other (Specify)	0	0.00		
I'm Unsure	9	8.90		
<b>Mixed Response</b>	<b>43</b>	<b>42.60</b>		
<b><u>One or more Minerals in salt should be added in India</u></b>				
Calcium	4	4.00	75.38	0.00**
<b>Iodine</b>	<b>53</b>	<b>52.50</b>		
Iron	20	19.80		
Mixed Response	17	16.80		
I don't know	7	6.90		

p value <0.05 was considered to be significant

p value <0.001 was considered to be highly significant

When subjects were asked about the definition of food fortification 59 (58.40%) subjects responded addition or enrichment of food product, 19 (18.80%) subjects responded supplementation of food ingredients, 9 (8.90%) subjects were unsure, 7 (6.90%) subjects opted for good source of particular vitamins/minerals, 6 (5.90%) subjects responded addition of an additive and only 1 (1.00%) subject gave mixed response. **These differences were highly significant ( $\chi^2 = 1.37$ ,  $p < 0.01^{**}$ )**. Majority of the participants were aware about the definition of food fortification. When subjects were questioned on which part of the food product pack fortification details are mentioned, 38 (37.60%) responded front side of the pack, 26 (25.70%) nutrition information panel, 14 (13.90%) backside of the pack, 10 (9.90%) all of the above option, 8 (7.90%) they don't know and 5 (5.00%) ingredient list. **These differences were highly significant ( $\chi^2 = 47.81$ ,  $p < 0.01^{**}$ )**. Participants of the study majorly responded front side of the pack for reading fortified food label.

Seventy two (71.30%) subjects responded that government makes it compulsory for the manufacturer to fortify some food groups, 17 (16.80%) were not sure; while 12 (11.90%) responded that government doesn't make it compulsory. **These differences were highly significant ( $\chi^2 = 65.84$ ,  $p < 0.01^{**}$ )**. Out of 101 male subjects' major participants responded that government makes it compulsory for the manufacturer to fortify some food products.

When male subjects were asked about their knowledge regarding which food products are fortified in India, 54 (53.50%) responded that combination of food products which includes Breakfast Cereals, Milk And Milk Products, Butter/ Oils, Salt and Water, 32 (31.70%) responded all of the products, 6 (5.90%) answered breakfast cereals, 5 (5.00%) were unsure and 4 (4.00%) said water. **These differences were highly significant ( $\chi^2 = 1.37$ ,  $p < 0.01^{**}$ )**. Majority of participants responded that combinations of food products are fortified.

On the question which vitamins/ minerals are used in fortification of food, 43 (42.6%) responded that combination of vitamins and minerals which majorly included Vitamin A, Vitamin D, Thiamine, Riboflavin, Niacin, Calcium, Iron and Omega 3- Fatty Acids, 42 (41.6%) opined all the mentioned products, 9 (8.9%) were unsure, 3 (3%) responded Vitamin E, 3 (3%) opined Iodine and 1 (1%) opined Dietary Fibre. **These differences were highly significant ( $\chi^2 = 1.19$ ,  $p < 0.001^{**}$ )**. Majority of participants responded that combination of nutrients which included Vitamin A, Vitamin D, Thiamine, Riboflavin, Niacin, Calcium, Iron and Omega 3- Fatty Acids.

When enquired about salt fortification, 53 (52.50%) responded that salt is fortified with Iodine, 20 (19.80%) opined Iron, 17 (16.80%) opined all of the mentioned nutrients, 7 (6.90%) opined they don't know and 4 (4.00%) responded Calcium. **These differences were highly significant ( $\chi^2 = 75.38$ ,  $p < 0.01^{**}$ )**. Out of 101 male subjects majority of participant's responded iodine should be added to salt along with other mineral.

#### **Attitude of Males towards Food fortification:-**

After considering knowledge of subjects, the study focused on other aspects of attitude and behaviour of the participants towards fortified foods.

**Table 2:-** provides data of male subject's attitude towards food fortification in which they were asked about their consumption of fortified food, reasons for consuming it, affordability of fortified foods, suggestions regarding any other food groups to be fortified, fortified food details on label, reading the labels and overall acceptability of fortified foods.

**Table 2:-** Attitude of males towards Food Fortification

<b>Fortified Foods consumed</b>	<b>Frequency (f)</b>	<b>Percent (%)</b>	<b>Chi-Square</b>	<b>P- Value</b>
<i>Yes</i>	<b>99</b>	<b>98.00</b>	93.15	0.00**
No	0	0.00		
I'm unsure	2	2.00		
<b>If, Yes which fortified food groups</b>				
Bread	0	0.00	61.56	0.00**
Breakfast Cereals	6	5.90		
Biscuits	0	0.00		
Milk & Milk Products	0	0.00		
Fruit Juices	0	0.00		
Butter/ Oils	0	0.00		
Salt	0	0.00		
Water	0	0.00		
All of them	26	25.70		
I'm unsure	0	0.00		
<i>Combination of Food product</i>	<b>69</b>	<b>68.30</b>		
<b>Reasons for consuming Fortified Food Product</b>				
<i>Healthy</i>	<b>36</b>	<b>35.60</b>	65.99	0.00**
To prevent Micronutrient Deficiency	21	20.80		
Improve Immunity	5	5.00		
Increase Strength	4	4.00		
Any Other reasons	0	0.00		
I'm unsure	3	3.00		
Mixed response	32	31.70		
<b>Fortified Foods improved Health Condition</b>				
<i>Yes</i>	31	30.70	7.50	0.02*
No	24	23.80		
<i>Made no difference</i>	<b>46</b>	<b>45.50</b>		
<b>Fortified Foods Affordable</b>				
<i>Yes</i>	<b>80</b>	<b>79.20</b>	92.93	0.00**
No	21	20.80		
<b>Suggestion over other foods Fortification</b>				
Rice flakes/ Puffed Rice	3	3.00	2.34	< 0.00**
Rolled Oats	1	1.00		
Ready to eat mixes/ Soups	2	2.00		
Cheese/ Paneer	1	1.00		
Sugar/ Jaggery	1	1.00		
Jams/ Marmalades/ Jellies	0	0.00		
Tea/ Coffee	1	1.00		
All of them	41	40.60		
I'm unsure	6	5.90		
<i>Combination of Food product</i>	<b>45</b>	<b>44.60</b>		
<b>Source of information about fortified food products</b>				
Read on the pack	27	26.70	21.72	< 0.001**
TV/ Magazine/ Newspaper/ Internet	16	15.80		
Read it in health article	7	6.90		
Heard from family/ friend	17	16.80		
Others (Specify)	0	0.00		
<i>Mixed Response</i>	<b>34</b>	<b>33.70</b>		
<b>Food label read before buying Fortified product</b>				
<i>Yes</i>	<b>62</b>	<b>61.40</b>	5.23	< 0.02*
No	39	38.60		

<b><u>Taste of Fortified Food changed</u></b>				
Yes	15	14.90	21.46	< 0.00**
No	33	32.70		
<b>Made no difference</b>	<b>53</b>	<b>52.50</b>		
<b><u>Texture of Fortified Food changed</u></b>				
Yes	16	15.80	20.45	0.00**
No	32	31.70		
<b>Made no difference</b>	<b>53</b>	<b>52.50</b>		
<b><u>Appearance of Fortified Food changed</u></b>				
Yes	13	12.90	21.68	0.00**
No	38	37.60		
<b>Made no difference</b>	<b>50</b>	<b>49.50</b>		
<b><u>Overall acceptability of Fortified food affected consumption</u></b>				
Yes	17	16.80	25.74	0.00**
No	27	26.70		
<b>Made no difference</b>	<b>57</b>	<b>56.40</b>		

\*p value <0.05 was considered to be significant

\*\*p value <0.001 was considered to be highly significant

When asked about consumption of fortified foods out of 101 male subjects, 99 (98%) answered yes and 2 (2%) were unsure. **These differences were highly significant ( $\chi^2 = 93.15$ ,  $p < 0.01^{**}$ ).**

When questioned about which fortified food is consumed 69 (68.3%) opined combination of fortified food groups including milk & milk products, butter/oils, salt and water, 26 (25.7%) opined all of the mentioned products and 6 (5.9%) responded breakfast cereals. **These differences were highly significant ( $\chi^2 = 61.57$ ,  $p < 0.01^{**}$ ).**

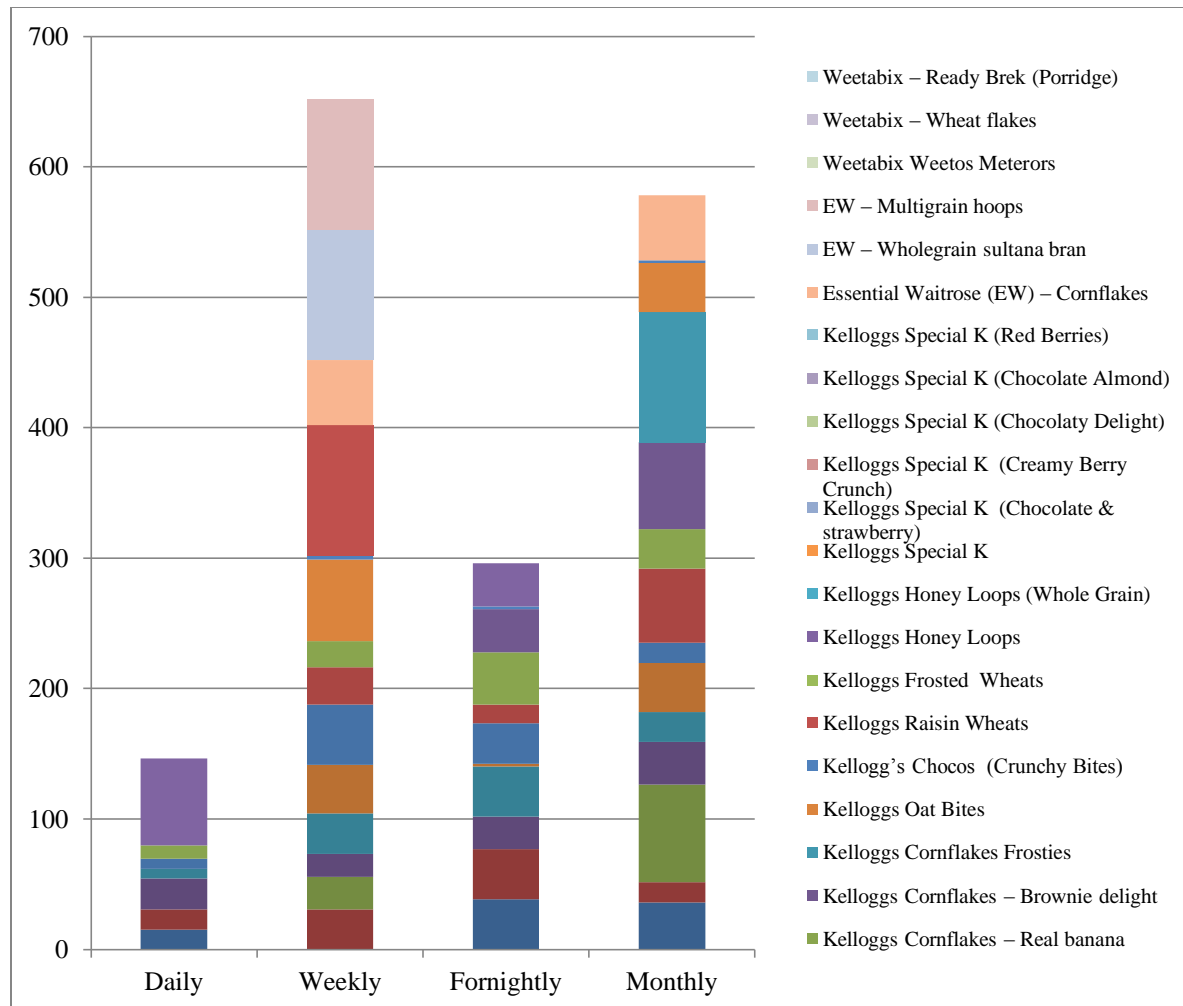
Regarding the reasons for consuming fortified food products, 36 (35.6%) responded that the products are healthy, 32 (31.7%) opined all of the mentioned options, 21 (20.85%) opined to prevent micronutrient deficiency, 5 (5%) opined to improve immunity, 4 (4%) opined to increase strength, and 3 (3%) were unsure. **These differences were highly significant ( $\chi^2 = 65.99$ ,  $p < 0.01^{**}$ ).** Majority of subjects responded that fortified foods are healthy.

When questioned has fortified food improved health condition 46 (45.5%) responded that it made no difference, 31 (30.7%) responded yes and 24 (23.8%) responded no. **These differences were significant ( $\chi^2 = 7.50$ ,  $p < 0.02^*$ ).** Eighty (79.2%) subjects responded that fortified foods are affordable. Majority of subjects gained awareness of the fortified foods through Friends, Family members, TV, Magazines, Newspaper, Internet etc. Majority of the respondents read food labels before buying the product.

Most of the subjects opined that the Taste, Texture, Appearance and Overall acceptability of fortified foods did not differ from the unfortified foods.

#### **Consumption of Fortified foods:-**

On the basis of market survey conducted, a list of total 102 fortified food products was prepared and the frequency of consumption of these foods was collected.



**Figure 1:-** Food Frequency consumption of breakfast cereals

From the data collected **figure 1** provides an overview on frequency of consumption of 29 fortified breakfast cereals. Three products reported highest consumption under fortnightly category such as Kellogg’s All Bran Wheat flakes 10 (38.50%) followed by Kellogg’s Cornflakes Real Honey 5 (38.50%) and Kellogg’s Cornflakes Real Banana 4 (40.00%). Kellogg’s Honey Loop was the only product with the highest frequency reported under daily consumption category. Kellogg’s Cornflakes Real Strawberry 3 (37.50%) and Essential Waitrose (EW) Cornflakes 1 (50.00%) showed highest frequency weekly and fortnightly. Out of 101 male subjects, most of them consumed fortified breakfast cereals on monthly and weekly basis.

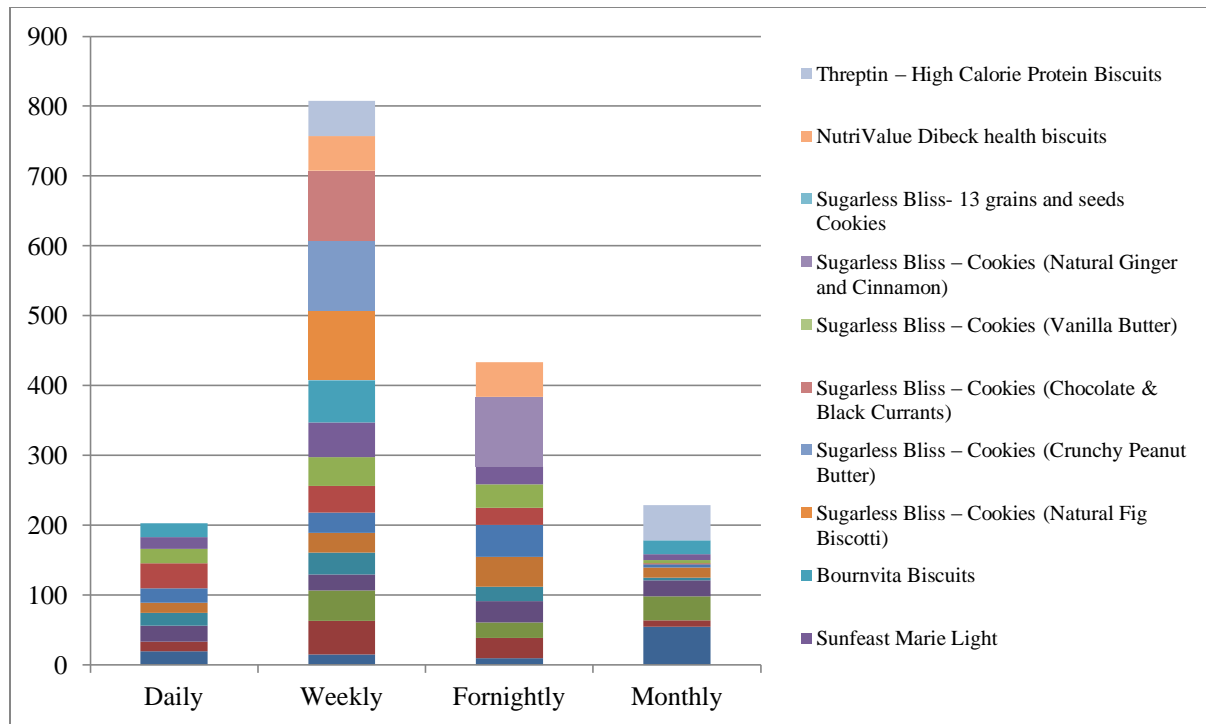


Figure 2:- Food frequency consumption of bread and biscuits

Figure 2 shows that McVities Wholewheat Mane 4 (30.80%), Britannia Tiger Kreemz Biscuit (Strawberry) 6 (42.90%), Britannia Milk Bikis Biscuits 11 (45.80%) and Sugarless Bliss – Cookies (Natural Ginger and Cinnamon) 1 (100.00%) were consumed fortnightly. Pilsbury Atta with Multi Grains 11 (55.00%) was only product with highest frequency reported under monthly category. Majority of male subjects consumed fortified bread and biscuits on a weekly basis.

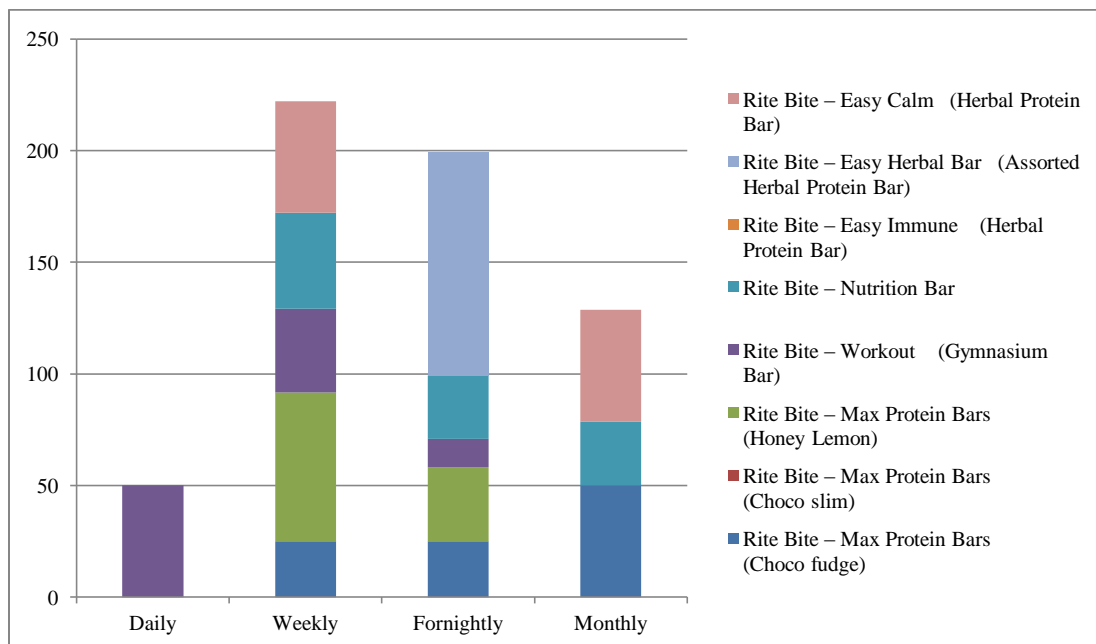
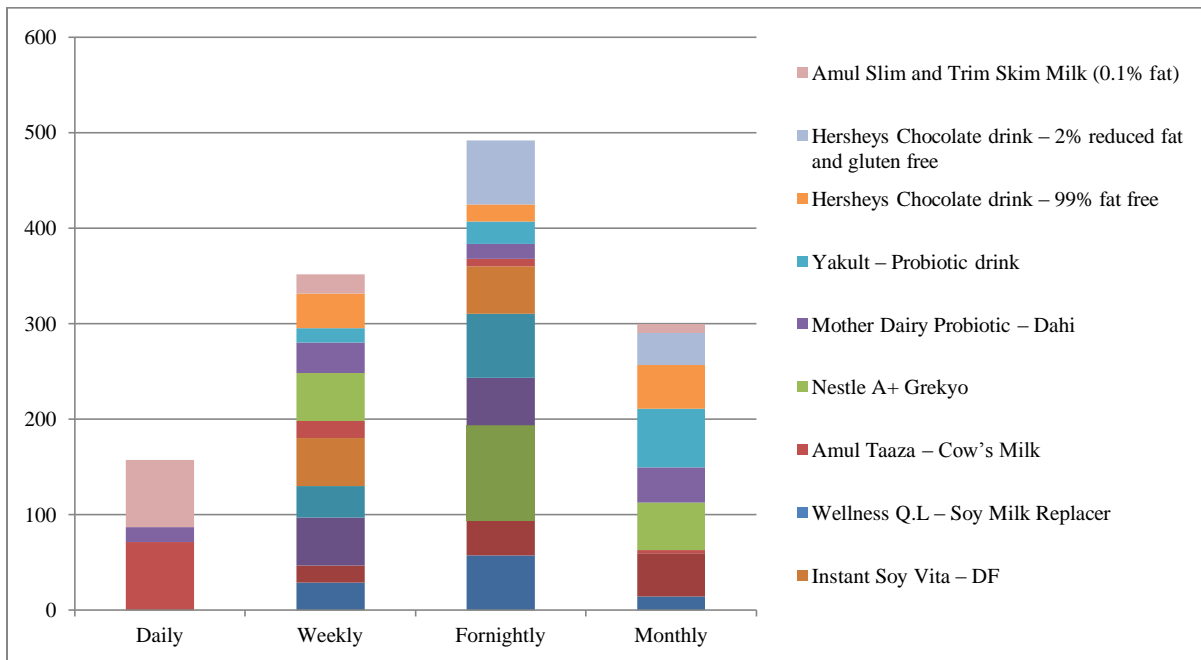


Figure 3:- Food frequency consumption of snack bars

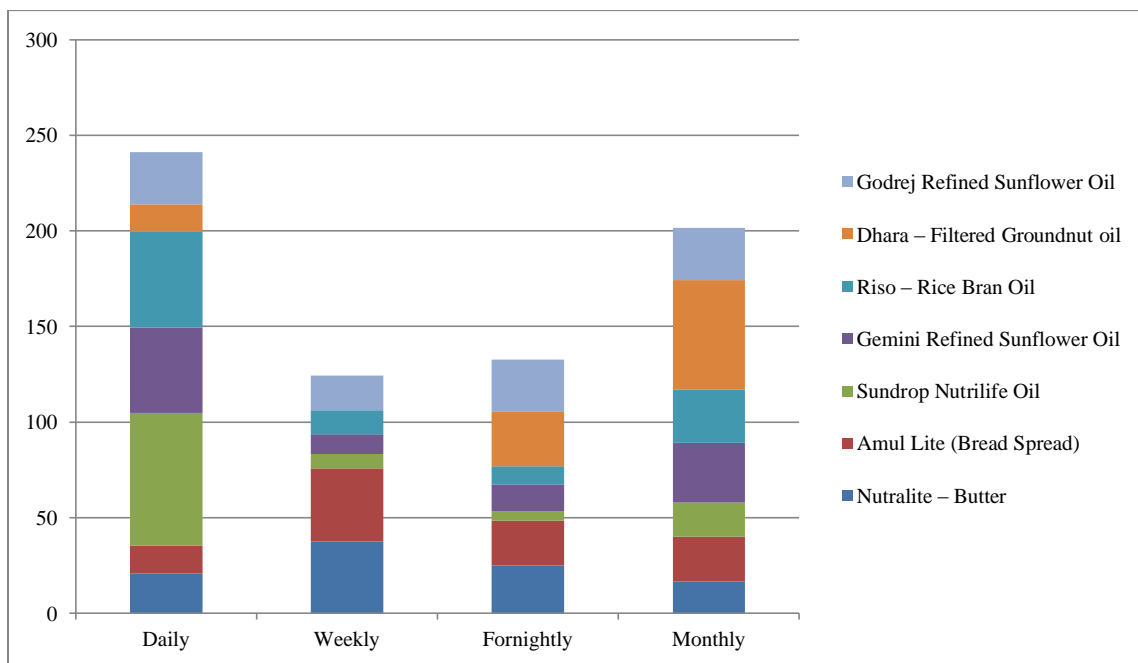


**Figure 3** shows that out of total 8 fortified products of snack bars, highest frequency was reported under weekly consumption for 2 products, among them were Rite bite – Max Protein Bars (Honey Lemon) 2 (66.70%) and Rite Bite – Nutrition Bar 3 (42.90%). Majority of subjects consumed fortified snack bars on a weekly basis.



**Figure 4:-** Food frequency consumption of soy milk, milk & milk products

**Figure 4** shows that majority of 101 males, reported fortnightly consumption of fortified soy products while monthly consumption of fortified milk products.



**Figure 5:-** Food frequency consumption of fats/ oils.

**Figure 5** shows that majority of male subjects consumed oil on a daily basis.

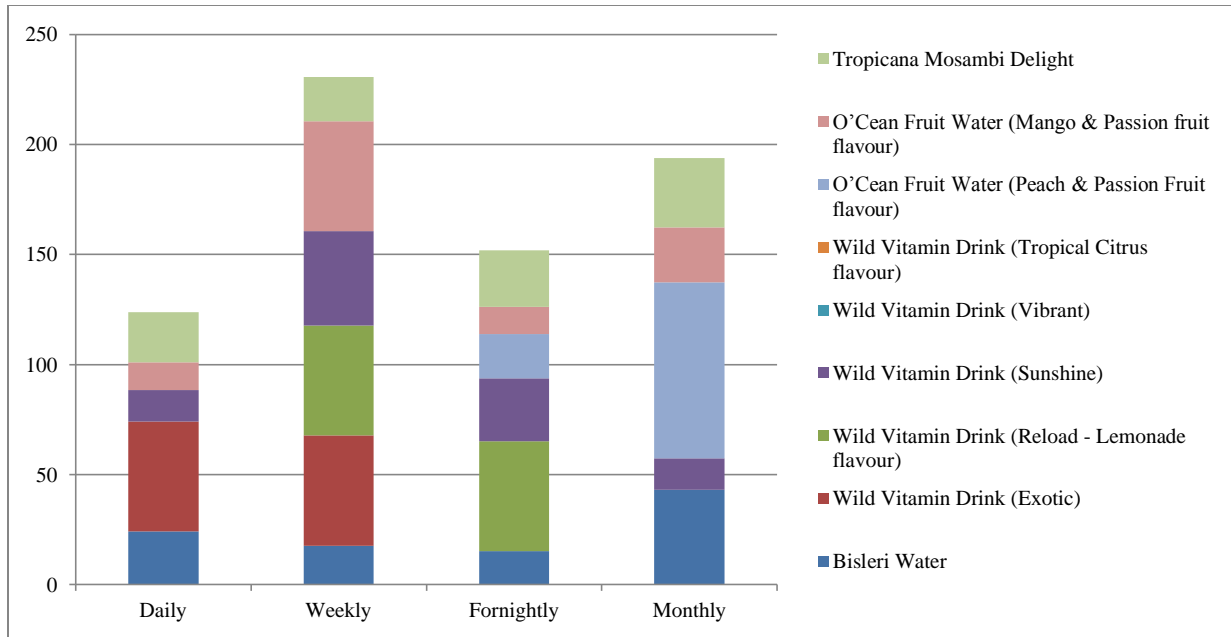


Figure 6:- Food frequency consumption of beverages

Figure 6 shows that majority of male subjects consumed fortified beverages on a monthly basis.

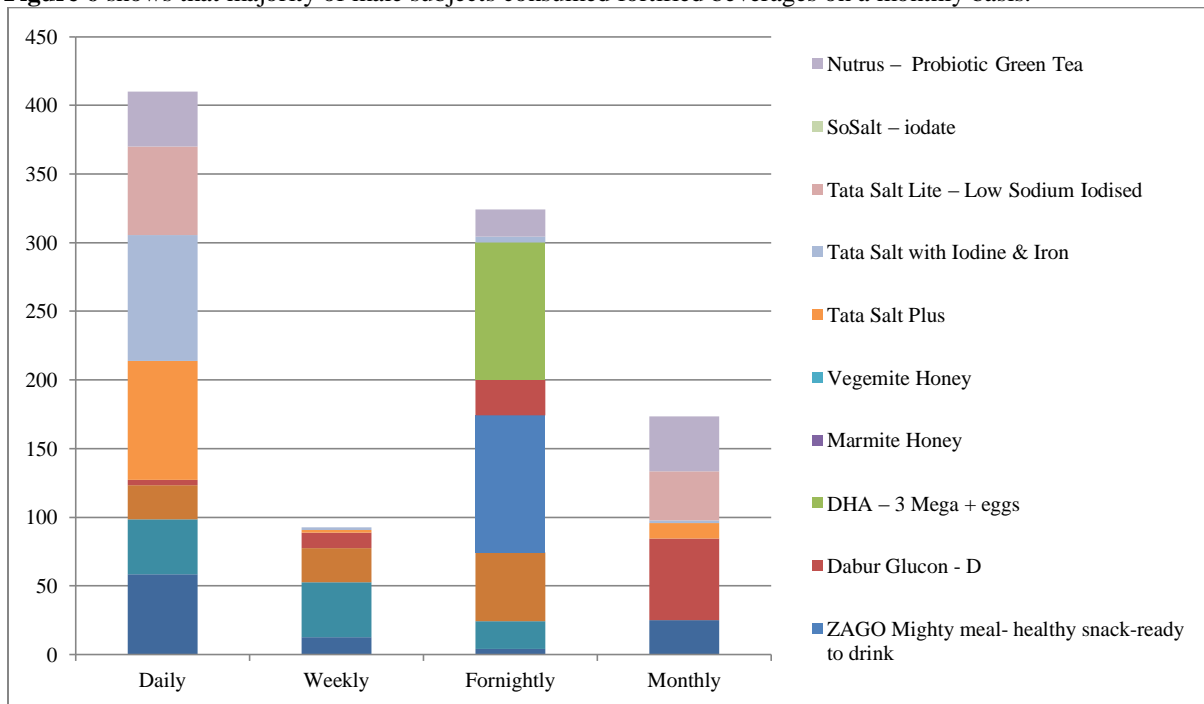


Figure 7:- Food frequency consumption of miscellaneous items

Figure 7 shows that majority of male subjects consumed fortified miscellaneous products which includes over the counter (OTC) supplements, fortified eggs, honey and salt on daily basis.

Study conducted states that in omega 3-FA enriched eggs total saturated fatty acid decreased slightly and omega 3-FA's (PUFA) increased, positively shifting the PUFA: SFA ratio. ALA, EPA and DHA were increased in all omega 3 eggs and omega 6: omega 3 ratio for flaxseed and fish oil feed group were exhibited low, whereas commercial eggs showed higher omega 6: omega 3 ratio respectively. Potassium, Vitamin A, D, E, Vitamin B6, Folate and

Vitamin B12 were slight increased in omega 3 eggs compared to commercially sold eggs. To contribute toward better health choice of the consumer consumption of omega 3 enriched eggs from the hens fed flaxseed or fish oil source would give a balanced diet which comprises of all three omega 3-FA i.e., ALA, EPA and DHA (11).

### **Conclusion:-**

The awareness of fortified foods was high in majority of male subjects in Mumbai city. They gained the awareness through family members, peers, internet and media. Consumption pattern of the fortified foods was also good and the main reason cited was health benefits of these foods. There is an increasing trend in the consumption of fortified foods in the modern societies.

### **References:-**

1. Anjali, V. (2015). Food fortification: a complementary strategy for improving micronutrient malnutrition (MNM) status. *Food Science Research Journal*, 6(2), 381-389.
2. Black, R. E. (2001). Micronutrients in pregnancy. *British Journal of Nutrition*, 85(S2), S193-S197.
3. Das, J. K., Salam, R. A., Kumar, R., & Bhutta, Z. A. (2013). Micronutrient fortification of food and its impact on woman and child health: a systematic review. *Systematic reviews*, 2(1), 67.
4. Ottaway, P. B. (Ed.). (2008). *Food fortification and supplementation: Technological, safety and regulatory aspects*. Elsevier.
5. Allen, L. H., De Benoist, B., Dary, O., Hurrell, R., & World Health Organization. (2006). *Guidelines on food fortification with micronutrients*.
6. Mary, S. (2010). The opportunity of flour fortification: building on the evidence to move forward. *Food and nutrition bulletin*, 31(1\_suppl1), S3-S6.
7. Beaton, G. H., Martorell, R., Aronson, K. J., Edmonston, B., McCabe, G., Ross, A. C., & Harvey, B. (1993). Effectiveness of vitamin A supplementation in the control of young child morbidity and mortality in developing countries.
8. Anderson, F. (1999). Nutrition and bone health, with particular reference to calcium and vitamin D. *Journal of human nutrition and dietetics*, 12(5), 469-470.
9. Gibso, S. A. (1999). Iron intake and iron status of preschool children: associations with breakfast cereals, vitamin C and meat. *Public Health Nutrition*, 2(4), 521-528.
10. Kyamuhangire, W., Lubowa, A., Kaaya, A., Kikafunda, J., Harvey, P. W., Rambeloso, Z., ... & Allen, L. H. (2013). The importance of using food and nutrient intake data to identify appropriate vehicles and estimate potential benefits of food fortification in Uganda. *Food and nutrition bulletin*, 34(2), 131-142.
11. Khan, S. A., Khan, A., Khan, S. A., Beg, M. A., Ali, A., & Damanhour, G. (2015). Comparative study of fatty-acid composition of table eggs from the Jeddah food market and effect of value addition in omega-3 bio-fortified eggs. *Saudi Journal of Biological Sciences*