
Results
and
Discussions

Chapter 5

RESULTS AND DISCUSSIONS

The broad objective of the present study was to create awareness among the participated subjects regarding Fortified Foods using the Diffusion of Innovation Model. This chapter presents the results of the study under the following heads.

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PHASE-I

5.1 Situational Analysis

5.1.1 General Information

5.1.1.1 Sociodemographic Characteristics of the Study Population

The sociodemographic characteristics of the subjects are presented in table 5.1.1. The gender profile of the study population revealed that 76% were females and 24% were males. Most of the respondents were among the age group of 41-50 years (47.7%), having an honors degree (57.6%) followed by High School (15.2) and Intermediate (11.5). The data on occupation shows that majority of the respondents were either unemployed or belonged to the Profession category. The majority of the households belonged to Upper Middle Class (48.3), followed by Lower Middle Class (39.5).

Table 5.1.1 Sociodemographic Characteristics of the Study Population

Indicators	No. of Subjects	Percent
GENDER		
a. Male	90	24
b. Female	**285**	76
AGE GROUP (in Years)		
a. 20-30	**--**	--
b. 31-40	103	27.5
c. 41-50	179	47.7
d. 51-60	93	24.8
EDUCATION		
a. Graduate	37	9.9
b. Honors	**216**	57.6
c. Intermediate	43	11.5
d. High School	57	15.2
e. Middle School	16	4.3
f. Primary School	6	1.6
PROFESSION		
a. Profession	**125**	33.3
b. Semi Profession	23	6.1
c. Clerical	36	9.6
d. Skilled	34	9.1
e. Unskilled	24	6.4
f. Unemployed	**133**	35.5
MONTHLY INCOME OF THE FAMILY (in Rupees)		
a. INR 199862	-	-
b. INR 99931-199,861	32	8.5

c. INR 74755- 99930	73	19.5
d. INR 49,962-74,755	159	42.4
e. INR 29,973-49,961	111	29.6
TYPE OF FAMILY		
a. Nuclear Family	283	75.5
b. Joint Family	92	24.5
SOCIOECONOMIC GROUP		
a. Upper	7	1.9
b. Upper middle	181	48.3
c. Lower middle	148	39.5
d. Upper Lower	39	10.4

5.1.1.2 Classification of the Subjects based on Nutrition Background

Information regarding the number of subjects who belonged to nutrition and non-nutrition background is depicted in table 5.1.2. The results revealed that only 33% of the respondents were from a nutrition background, while the rest 66% of the subjects were from a non-nutrition background.

Table 5.1.2 Classification of the Subjects on the basis of Nutrition Background

Nutrition Background	No. of subjects	Percent
a. Non- Nutrition Background	250	66.6
b. Nutrition Background	125	33.3
Total	375	100

5.1.1 Awareness of the subjects regarding various parameters of Fortified Foods

Various questions were asked from the subjects regarding their awareness of food Fortification, viz source of their awareness, and identification of the +***F*** logo

5.1.1.3 **Awareness of Food Fortification**

Out of 375 Subjects, 33% self-reported that they knew about the term ‘Fortified Foods’ while the majority of the subjects 66.7% did not hear about Fortified Foods at all (Fig 5.1.1).

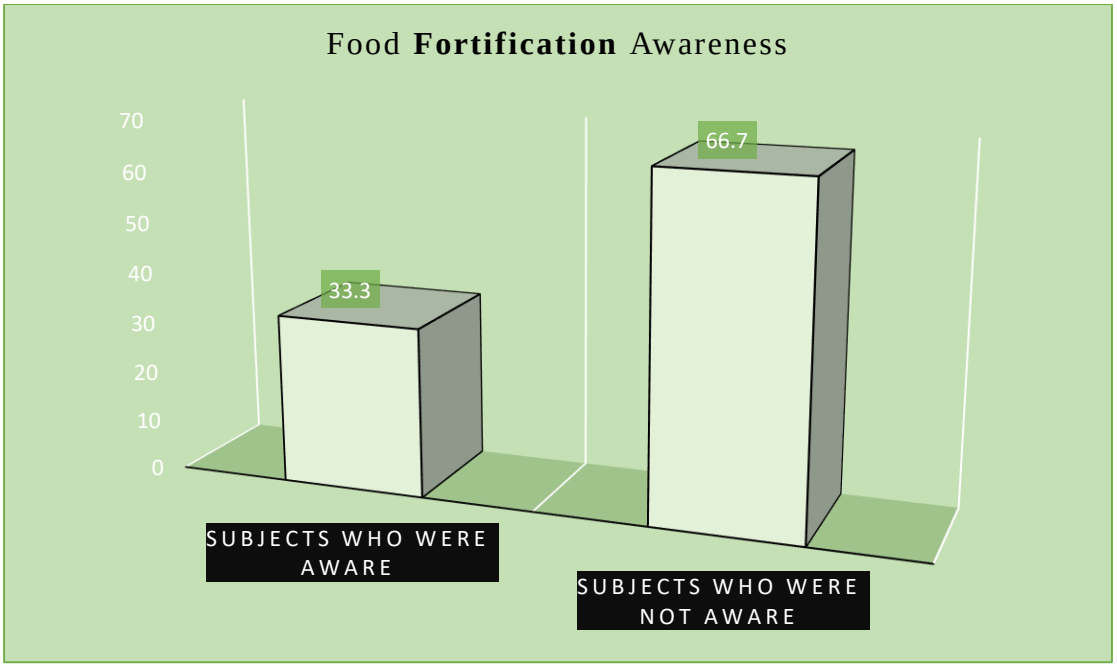

Fig 5. 1.1: No. of Subjects' who were aware and not aware of Food Fortification

5.1.1.4 Source of information regarding Food Fortification

The Source of information regarding Fortified Foods was elicited only from those subjects who reported they were aware of Fortified Foods (n=125). The majority of the subjects (45.2%) reported broadcast media (television, radio, internet, etc) as the major source of information from where they learned about Fortified Foods, followed by print media, internet, and outdoor media by 38.7%, 8.9%, and 7.3% respectively (Fig 5.1.2).

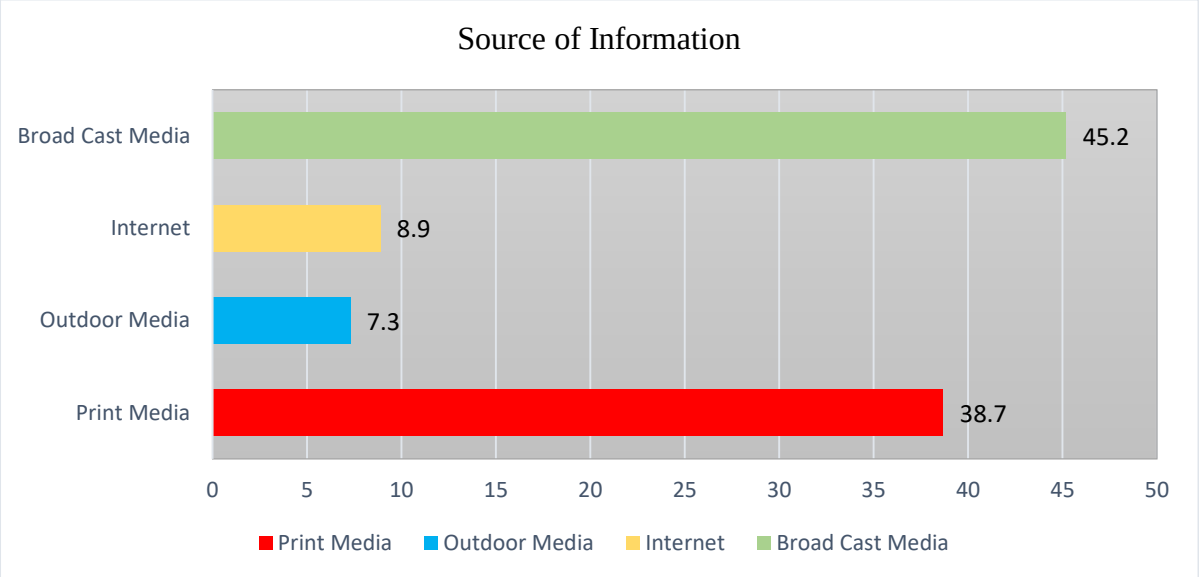

Fig 5.1.2: Percent subjects reporting the source of information for Fortified Foods (N=125)

5.1.1.5 **Verification of subject's awareness of Food Fortification**

Verification was undertaken amongst the subjects who self-reported having awareness of Food Fortification. They were asked to give the correct definition of Fortified Foods. Multiple options were given to the subjects, like foods rich in micronutrients, foods low in sugar and salt, etc. Only 28 subjects gave correct responses to the definition. The verification helped us in identifying the correct number of respondents who knew about Fortified Foods (Table 5.1.3)

Table 5.1.3 Number of Percent subjects identifying attributes of Fortified Foods accurately

	No. of subjects	Percent
Inaccurate Identification	270	72
Accurate Identification	105	28

5.1.2.4 Awareness of Fortification Logo

Subjects were asked about the correct food Fortification logo. Three images were shown to them in the questionnaire (Appended in appendix II) and were asked to mark the correct logo used for Food Fortification in India. As depicted in table 5.1.4, twenty percent (20%) identified the correct +F logo for the identification of Fortification in staple packed foods in India.

Table 5.1.4 Number of Percent subjects reporting correct identification of logo

	No. of Subjects	Percent
Inaccurate Identification	303	80
Accurate Identification	72	20

5.1.2.5 Awareness of Fortified staples in India

As depicted in Fig 5.1.3 majority of the subjects were aware of wheat flour Fortification (33.2%) and rice Fortification (33.3%), followed by milk (25%) and double Fortified salt (22%), only a few subjects were aware of oil Fortification (2.3%).

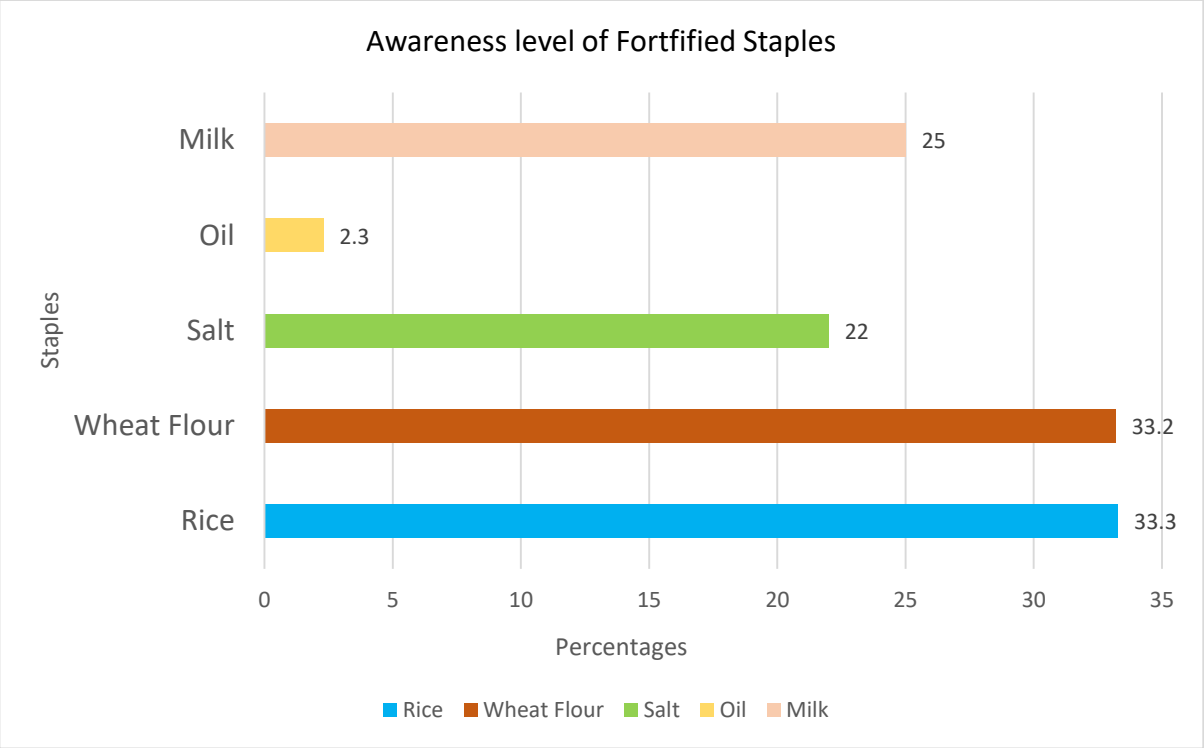

Fig 5. 1.3: Percent subjects reporting about awareness of staples that are being Fortified in India

5.1.3 Attitude towards Fortified Foods

Food Fortification definition was introduced to all the 375 subjects and thereafter questions on various aspects of their attitude towards Fortified Foods were asked.

Table 5.1.5 Number of Participant's indicating their Attitude towards Food Fortification (N=375)

Attitude Indicators	**No. of Subjects**	**Percent Subject**
A. Consumption of Ff Should Be For Everyone		
I) Agree (Positive Response)	7	2
II) Disagree (Negative Response)	368	98
B. Ffs Are Harmful		
I) Agree (Negative Response)	187	49.9
II) Disagree (Positive Response)	188	50.1
C. Willingness To Pay More For Ffs		
I) Agree (Positive Response)	251	66.9

II) Disagree (Negative Response)	124	33.1
D. Ffs Are Healthy		
I) Agree (Positive Response)	284	75
II) Disagree (Negative Response)	91	24
E. It Might Alter Taste And Smell		
I) Agree (Negative Response)	271	72.3
II) Disagree (Positive Response)	104	27.7
F. Readiness To Shift To Other Brands		
I) Agree (Positive Response)	247	66
II) Disagree (Negative Response)	128	33

As indicated in table 5.1.4, only 2% of subjects felt that the consumption of Fortified Foods should be for everyone while the majority (98%) felt, that its use is limited to a certain age group. The attitude regarding safe consumption of Fortified Food was uniform (50%) for correct and incorrect responses. Subjects were asked whether they were willing to pay more for Fortified Foods. Most subjects (66.9%) said 'yes,' while the rest 33.1 % were not willing to pay more for Fortified Foods. Further, subjects were questioned regarding the benefits of consuming Fortified Foods, where the majority (75%) felt Fortified Foods are safe. Regarding the change in taste and smell due to Fortification, 72% of subjects felt that Fortification will change the taste and smell of food. Sixty-six percent of the subjects agreed to shift to other brands after choosing Fortified Foods while 33% were reluctant for changing their preferences.

5.1.4 Purchasing Practices of Fortified Foods

5.1.4.1 Purchase Preferences for the grocery items

The purchasing preferences for grocery items are presented in table 5.1.6. The options provided to the subjects were a combination of organized and unorganized retail shops. The majority of the respondents preferred 'Traditional Stores' also known as 'Kirana stores' in India (32.3) for the purchase of grocery items, followed by, malls (27.7) and a combination of malls and traditional stores (20.5) depending on the convenience of the subjects.

Table 5.1.6 Purchasing preferences of the subjects for grocery items from organized/unorganized retail shops

Organized/Unorganized Retail Shops	Frequency	Percent
a. Malls	104	27.7
b. Traditional Stores	121	32.3
c. Online Application	16	4.3
d. Online and Traditional Stores	12	3.2
e. All the Options	45	12.0
f. Malls and Traditional Stores	77	20.5

5.1.4.2 Purchase practices for Fortified Foods (Foods with +F logo)

Subjects were categorized based on intentional and unintentional buying of Fortified Foods. Intentional buyers were those who knew about Fortified Foods and were practicing its purchase for the benefit of their health, while the unintentional were those who were not aware of Fortified Foods but were purchasing. According to table 5.1.7, the majority of the subjects (57.1%) were not buying Fortified Foods. Further, it was observed that 60% of the subjects were practicing un-intentional buying of Fortified Foods.

Table 5.1.7 Percent Subjects who were Purchasing Fortified Foods at the Baseline

Purchase Indicators	No. of Subjects N= 375	Percent
I) Purchasing	60	16
II) Not Purchasing	315	84
Intentional/Unintentional Purchase of FFs		
I) Intentional Buying	24	40
II) Unintentional Buying	36	60

5.1.4.2 Purchase practices of Fortified staples by the subjects at the baseline

As seen in Fig. 5.1.4 purchase of Fortified Foods for different staples varied from 7% to 15%. None of the subjects purchased Fortified milk. The purchase of Fortified rice and oil was being

practiced by 6% and 15% of the subjects respectively as reported, followed by wheat flour (13.6%) and salt (7.7%).

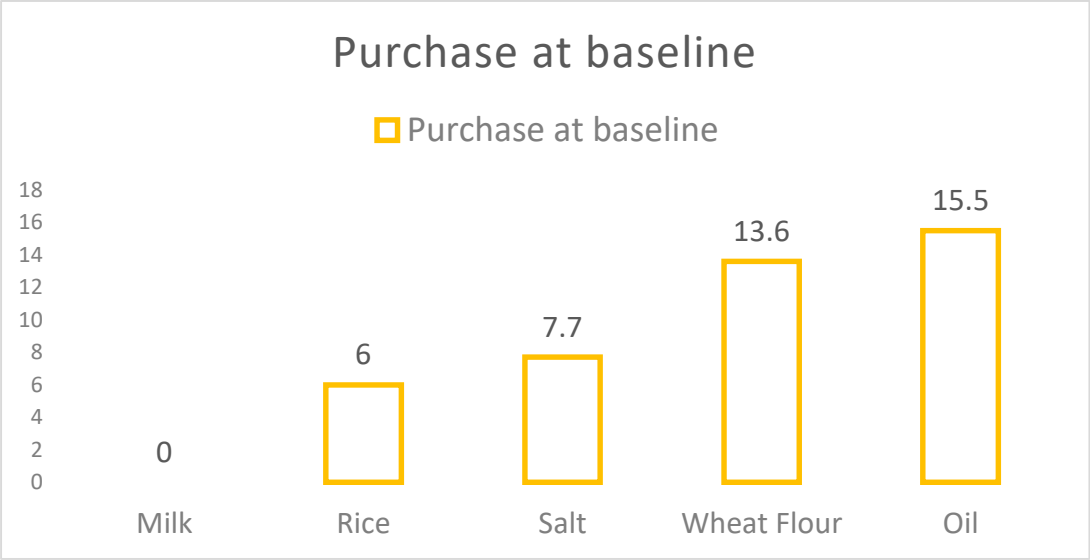

Fig 5.1.4: Percent subjects purchasing Fortified Staples at Baseline

5.1.4.2 Consumption of Multivitamin Tablets

As seen in Table 5.1.8, subjects were asked about their practices regarding the consumption of multivitamin tablets, 14.7% of the subjects self-reported consuming the tablets regularly, while the majority of the subjects were not consuming the tablets.

Table 5.1.8 Percent Subjects who were consuming Multivitamin Tablets

Multivitamin Tablets		Frequency N= 375	Percent
I)	**Consuming Multivitamin**	55	14.7
II)	**Not Consuming Multivitamin**	320	85.3

5.1.4.3 Yearly storage of staples by the study population

Subjects were questioned whether they stored any of the staples (Wheat Kernels, Oil, and Rice) for a year or purchased in bulk. Out of 375 subjects, 59% reported that they practiced yearly storage. The subjects further shared the list to mark which staple they stored for a year. The results are depicted in Fig 5.1.5

The majority (33%) of the subjects were storing Wheat Kernels for a year. It is a Traditional practice in Gujarat to make wheat flour at home using Traditional Chakkis. Rice was being stored by 16% of the subjects, while the storage of oil (2%) was practiced by a minority group.

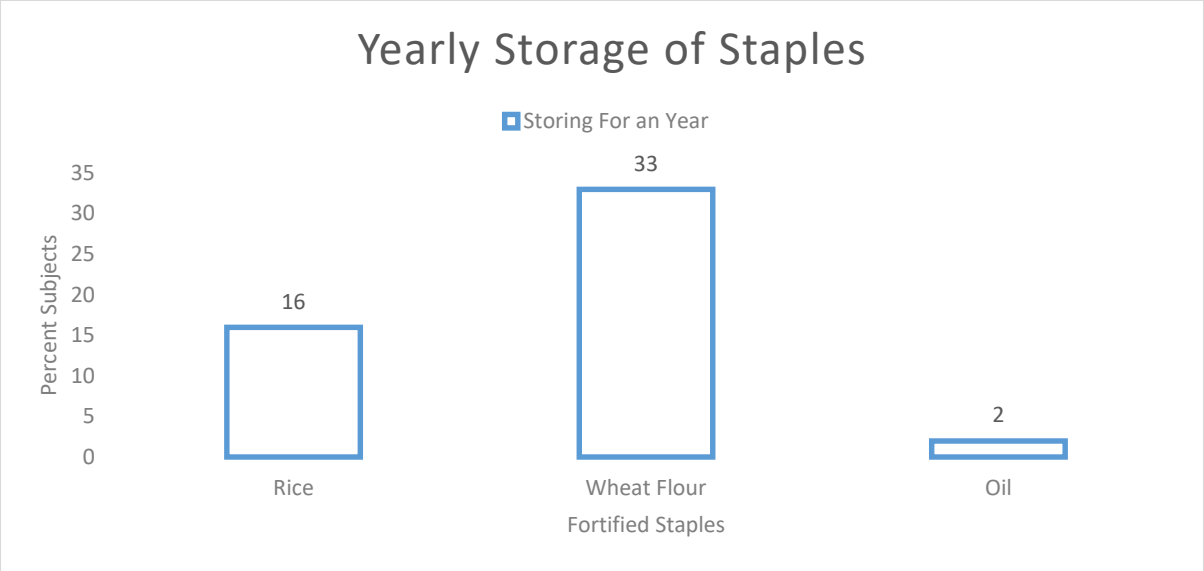

Fig 5.1.5: Percent subjects storing staples for a year

5.1.5 Association between Awareness and Purchase Practices of Fortified Foods amongst the subjects

The data was analyzed to study the association between subjects who could identify Food Fortification accurately and who were also practicing it. According to Fig 5.1.6, nearly 40% of the subjects were aware of Fortified Foods and were also practicing its purchase, whereas 31.8% of the subjects knew about Food Fortification but were not purchasing. Using the Chi-Square test, efforts were made to look at the association between two parameters. The results showed that there was no significant association between recognition of Fortified Foods and purchase practices of Fortified Foods with ($P < 0.219$), which means both variables were independent of each other.

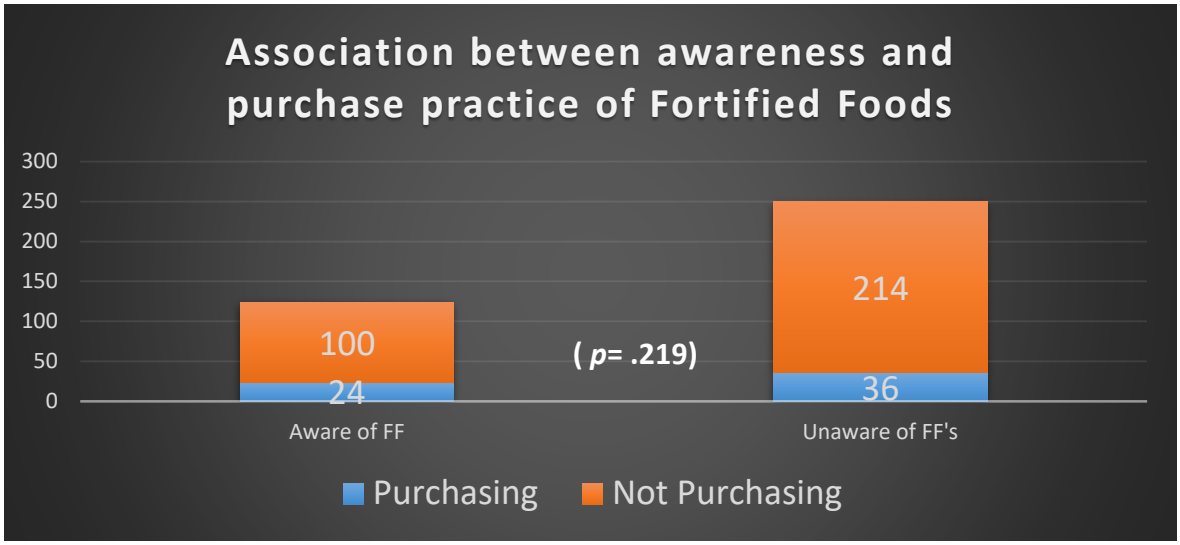

Fig 5.1.6 Association between awareness and purchase practices of Fortified Foods

5.1.6 Awareness regarding health benefits, sources, and deficiency signs for micronutrients

It was important to determine the existing awareness of micronutrients of the subjects for various parameters, to positively affect the purchase of Fortified Foods through e-intervention.

5.1.6.1 Awareness of Vitamin A

Referring to Fig 5.1.7, it was reported that the majority of the subject's awareness regarding Vitamin A was correct for the health benefits (65%) and signs of deficiency (77.3), however, the awareness of food sources for vitamin A was limited.

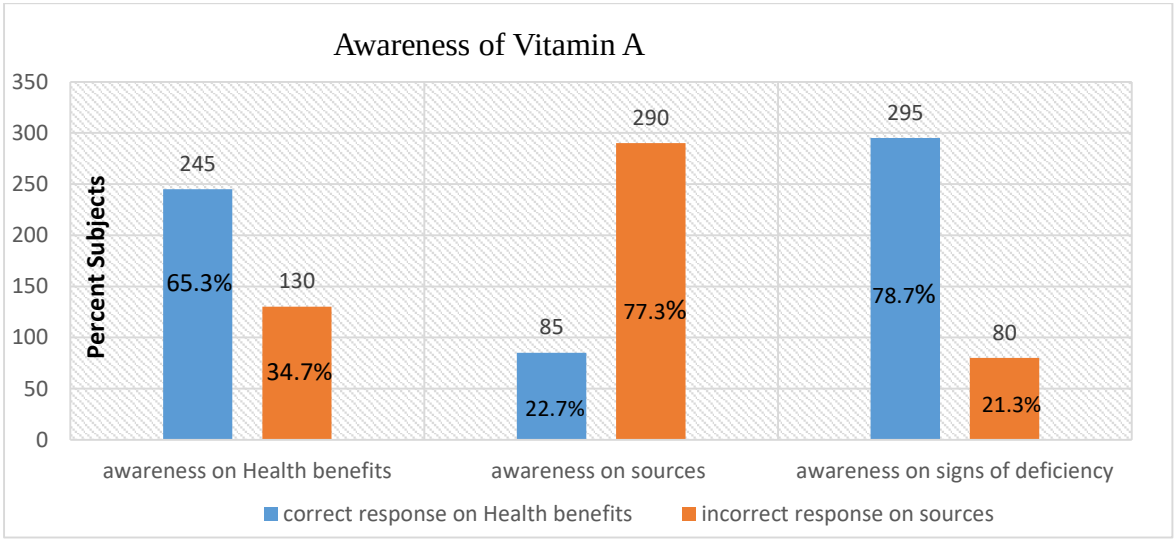

Fig 5.1.7 Responses of the subjects for Vitamin A Health Benefits, Sources, and Signs of Deficiency

5.1.6.2 Awareness of Vitamin D

Awareness of Vitamin D health benefits, sources, and signs of deficiency were identified correctly by, 67%, 60%, and 72% of subjects respectively (Fig 5.1.8).

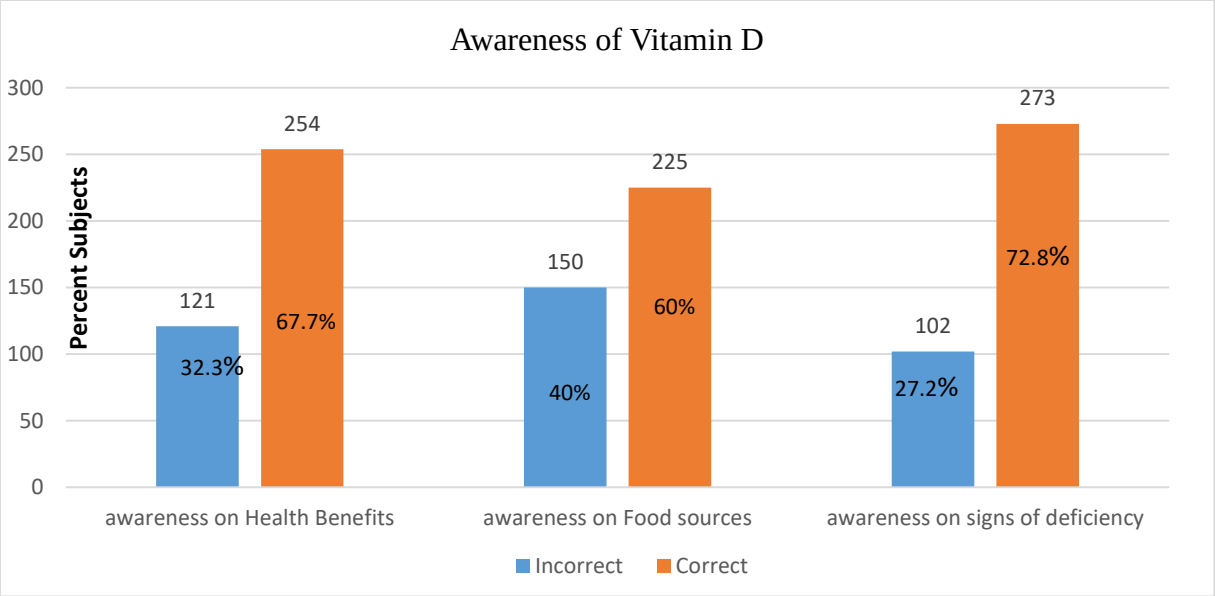

Fig 5.1.8 Responses of the subjects for Vitamin D Health Benefits, Sources, and Signs of Deficiency

5.1.6.2 Awareness of Vitamin B12

Awareness of Vitamin B12 health benefits was identified correctly by the majority of the subjects (73.6%), sources by 50%, and signs of the deficiency by 57.6% of the subjects (Fig 5.1.9).

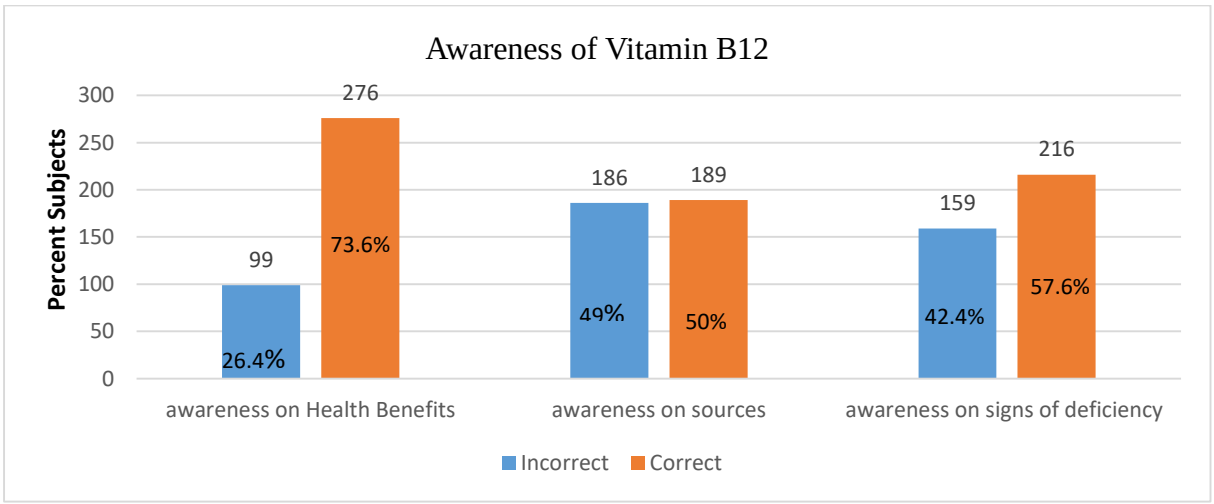

Fig 5.1.9 Responses of the subjects for Vitamin B12 Health Benefits, Sources, and Signs of Deficiency

5.1.6.3 Awareness of Iron

Awareness regarding the health benefits of food sources and signs of deficiency of Iron was identified correctly by the majority of the subjects (77.9%), sources and signs of the deficiency by 78% and 61% of the subjects, respectively.

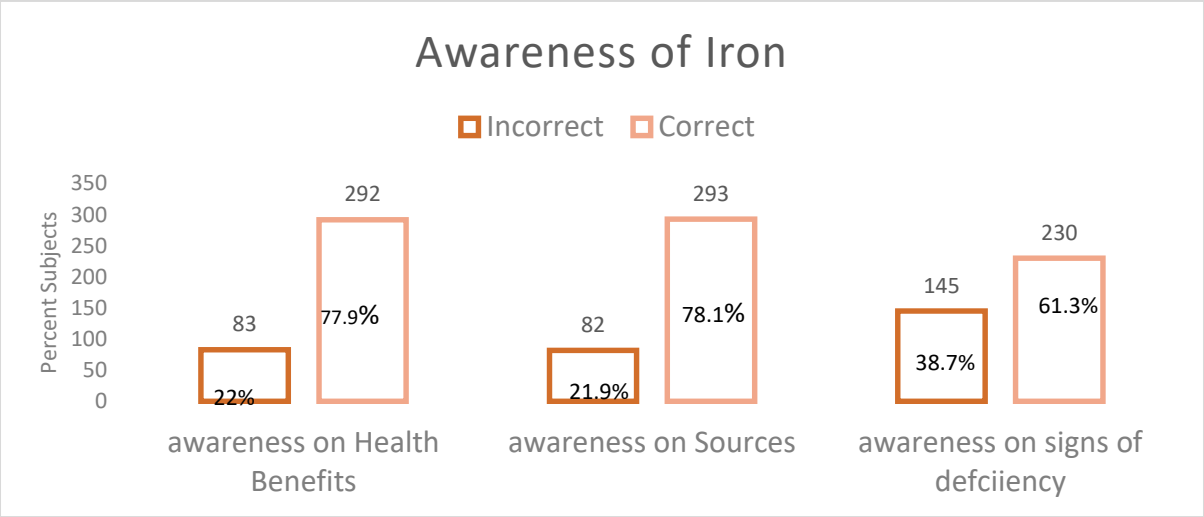

Fig 5.1.10 Responses of the subjects for Iron Health Benefits, Sources, and Signs of Deficiency

5.1.6.4 Awareness of Iodine

Awareness of Iodine health benefits was identified correctly by only a few of the subjects (5.3%), whereas awareness regarding sources was known to (43.2%) and signs of deficiency to (57.6%) of the subjects.

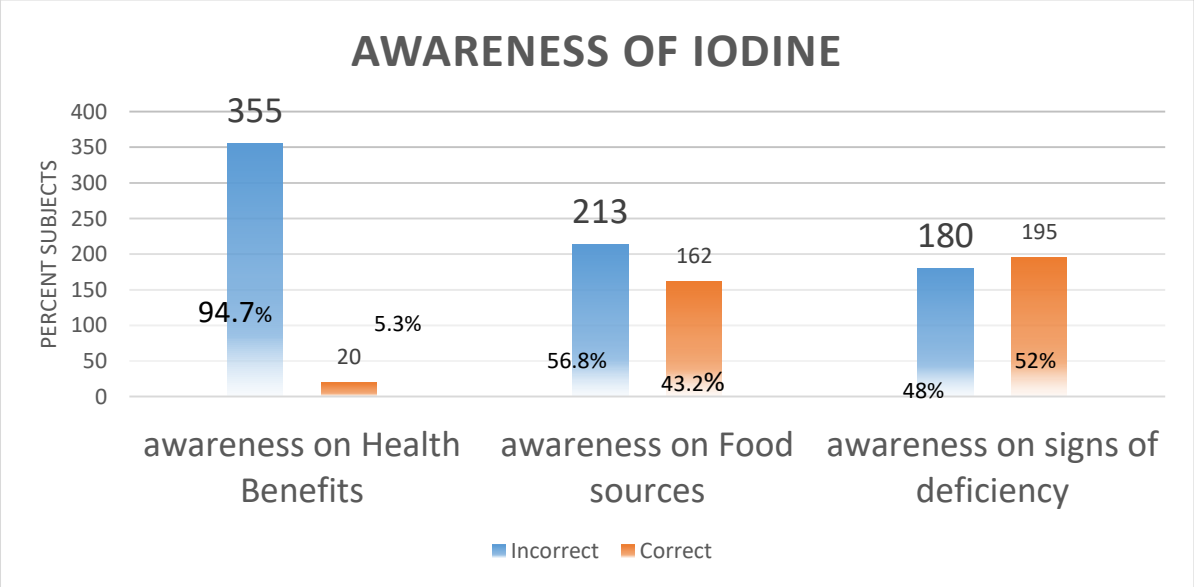

Fig 5.1.11 Responses of the subjects for Iodine Health Benefits, Sources, and Signs of Deficiency

5.1.7 Association between Awareness of various Micronutrients with Educational levels

Information regarding five micronutrient awareness, health benefits, and signs of deficiency was collected, and further its association with the subjects' educational levels was studied**.**

As seen in Table 5.1.9, a significant association was observed between awareness regarding signs of deficiency of Vitamin D, Health benefits of Vitamin B12, and Iodine, and with educational levels of the study subjects. Subjects having the highest degree of education had better awareness of the micronutrients. However, the degree of association was weak as per Cramers' V test. However, no such association was observed between the degree of education and awareness scores of vitamin A and Iron.

Table 5.1.9 Association between Awareness of Fortificants with Education levels of the subjects

Educational Levels		*Chi-Square/Fischer's test* Value	*p*-Value
Vitamin A	a. Health Benefits ***(Chi-Square)***	6.246	0.182 (NS)
	b. Food sources ***(Fischer's Exact Test)***	4.280	0.367 (NS)
	c. Signs of Deficiency ***(Fisher's Exact Test)***	4.225	0.372 (NS)
Vitamin D	a. Health Benefits	6.341	0.175 (NS)
	b. Food sources	1.190	0.884 (NS)
	c. Signs of Deficiency	13.983	**0.007 (Significant) Cramer's V= .193 Weak degree of association**
Vitamin B12	a. Health Benefits	17.469	**.002 (Significant) Cramer's V .216 Weak degree of association**
	b. Food sources	8.852[a]	0.064 (NS)
	c. Signs of Deficiency	0.926[a]	0. 094 (NS)
Iron	a. Health Benefits **(Fischer's Exact test)**	-3.539	0. 470 (NS)
	b. Food sources **(Fischer's Exact test)**	1.283	0.869 (NS)
	c. Signs of Deficiency	1.763[a]	0.783 (NS)

Iodine	a. Health Benefits (Fischer's Exact test)	8.570	**0.045(Significant) Cramer's V Value=.0154 P Value=.065 Weak degree of association**
	b. Food sources	7.026[a]	0.134 (NS)
	c. Signs of Deficiency	0.876	0.930 (NS)

NS= Non-Significant

5.1.8 Association of various Micronutrients awareness and Occupation of the study subjects

Information regarding five micronutrient awareness, health benefits, and signs of deficiency was collected, and further its association with the subject's occupation levels was studied. Efforts were made to study whether the subjects belonging to the highest category in the hierarchy (Professional Kuppuswamy Scale) had better awareness than their counterparts (Table 5.1.10).

Table 5.1.10 Association between Awareness of Fortificants with Occupation Levels of the subjects

Occupation Levels and Awareness of Fortificants		*Chi-Square* Value	*p*-Value
Vitamin A	a. Health Benefits	16.386	**0.005 (Significant) Cramer's V = 0.006 (Weak Degree of Association)**
	b. Food sources	6.905	0.367 (NS)
	c. Signs of Deficiency	2.034	0.851 (NS)
Vitamin D	a. Health Benefits	3.926	0.565 (NS)
	b. Food sources	3.965	0.559 (NS)
	c. Signs of Deficiency	2.237	0.815 (NS)
Vitamin B12	a. Health Benefits	5.695	0.339 (NS)
	b. Food sources	8.674	0.123 (NS)
	c. Signs of Deficiency	4.584	0.469 (NS)

Iron	a. Health Benefits	7.069	0.215 (NS)
	b. Food Sources	1.637	0.897 (NS)
	c. Signs of Deficiency	1.415	0.925(NS)
Iodine	a. Health Benefits	4.932	0.356 (NS)
	b. Food sources	1.913	0.864 (NS)
	c. Signs of Deficiency	1.596	0.902 (NS)

NS= Non-Significant

A significant association between awareness regarding the health benefits of Vitamin A and the occupational levels of the subjects was observed (P<0.05). It was observed those who belonged to the highest hierarchy in the occupational level had better awareness of the health benefits of Vitamin A. Using Cramer's V test weak association was observed between the two variables.

5.1.9 Association between Subjects having Educational qualifications s in the field of Nutrition with their Awareness of various micronutrients

Efforts were made to study whether the subjects belonging to the nutrition background had better awareness than their counterparts (Table 5.1.11).

Table 5.1.11Association between awareness of micronutrients and with nutrition background of the subjects

Nutritional and Non-Nutrition Background and Awareness of Fortificants		*Chi-Square* Value	*p*-Value
Vitamin A	a. Health Benefits	16.386	**0.005 (Significant) Cramer's V = 0.006 (Weak Degree of Association)**
	b. Food sources	6.905	0.367 (NS)
	c. Signs of Deficiency	2.034	0.851 (NS)
Vitamin D	a. Health Benefits	3.926	0.565S)
	b. Food sources	3.965	0.559S)
	c. Signs of Deficiency	2.237	0.815 (NS)

Vitamin B12	a. Health Benefits	5.695	0.339S)
	b. Food sources	8.674	0.123S)
	c. Signs of Deficiency	4.584	0.469 (NS)
Iron	a. Health Benefits	7.069	0.215 (NS)
	b. Food Sources	1.637	0.897 (NS)
	c. Signs of Deficiency	1.415	0.926(NS)
Iodine	a. Health Benefits	4.932	0.356 (NS)
	b. Food sources	1.913	0.864 (NS)
	c. Signs of Deficiency	1.596	0.902 (NS)

NS= Non-Significant

Only Vitamin A health benefits were significantly associated with the nutrition background of the subjects ($P<0.005$), however, no such association was observed for the other micronutrients.

Result Highlights

PHASE I

- At baseline, 33% of the subjects reported that they have heard the term' Fortified Foods'
- Major source of information was the Broadcast media – Television, Radio, internet etc for 45% of the subjects
- Only 28% of subjects could identify the correct definition of Fortified Foods
- Awareness of +F logo was amongst the 20% of the subjects
- Awareness regarding Fortified staples was limited amongst the study subjects. Wheat flour Fortification for 33.2%, rice Fortification for 33.3%, followed by milk 25% and double Fortified salt (22%). Only a few of the subjects were aware of oil Fortification (2.3%)
- Only 2% of the subjects believed Fortification should be for everyone, irrespective of age and gender
- The Unintentional purchase practice for one or few of the staples was being followed by 60% of the subjects

Phase II- Interventional Phase on Food Fortification

5.2.1 Effect of the e-intervention on subjects' awareness, attitude, and purchase Practices regarding Fortified Foods

At the baseline 375 subjects were enrolled in the study, however, there was a dropout of nearly 26 subjects. The final sample size on which the impact of the e-intervention was studied was 349 subjects.

5.2.1.1 Impact of e-intervention on subject's awareness of Fortified Foods

Impact of e- intervention regarding awareness parameters of the Fortified Foods showed a significant increase for the awareness of Fortified Foods by definition, awareness regarding logo and target group who can consume it. Using McNemar's test, a significant level was calculated at P<0.001 for all the parameters.

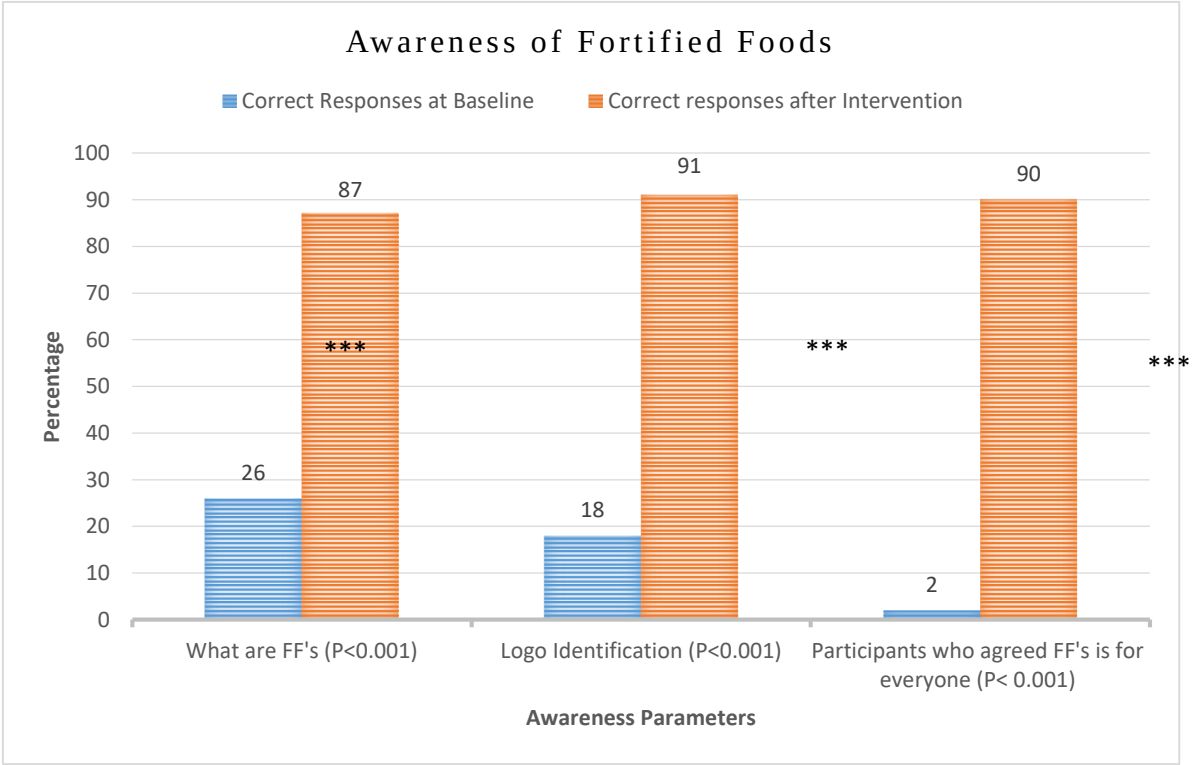

Fig 5.2.1: Increase in Awareness of Fortified Foods

Table 5.2.1 shows the percent improvement post e-intervention in the awareness parameters of Fortified Foods amongst the subjects. There was an improvement of 17- 24% in the total awareness parameters of Food Fortification.

Table 5.2.1 Percent shift in awareness parameters of the subjects for Fortified Foods

I. Awareness Parameters	Impact of E-intervention	Percentages
a. FF Awareness	Pre Interventions	6%
	Post Intervention	23%
	% increase	**17%**
b. Awareness of +F logo	Pre- Interventions	4.8%
	Post Intervention	24%
	% increase	**19.2%**
c. Awareness of FF target group (It's for everyone)	Pre- Interventions	0%
	Post Intervention	24%
	% increase	**24%**

5.2.1.2 Impact of e- intervention on awareness of staples that are being Fortified in India under FSSAI regulations 2018

Awareness of staples that are being Fortified under FSSAI 2018 regulations in India are rice, wheat flour, oil, salt, and milk. The yellow shaded part is the number of respondents who responded incorrectly before the e-intervention but gained awareness after the e-intervention. One hundred and sixty-one subjects could identify rice as one of the staples being Fortified in India, followed by 157, 252, 183, and 185 for wheat flour, oil, salt, and milk respectively.

Using McNemar's test it was determined that there was a statistically significant increase in the proportion of awareness of all the Fortified staples, post-e-intervention, $p < 0.001$.

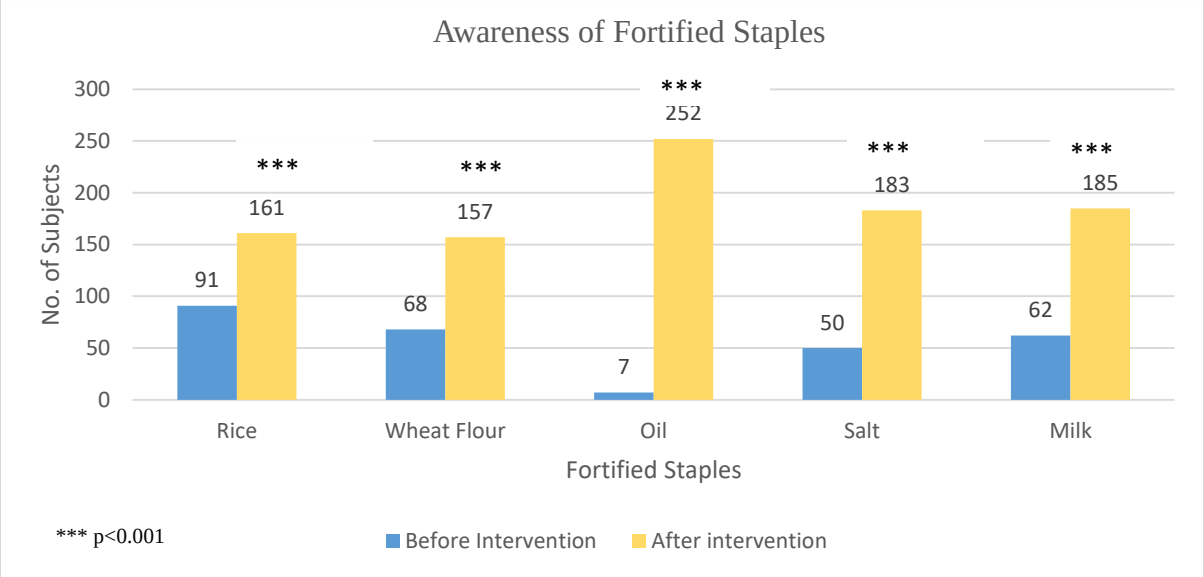

Fig 5.2.2: Impact of E-intervention on Awareness of Fortified Staples amongst the Subjects (N=349)

Table 5.2.2 Percent shift in awareness parameters of the subjects for Fortified Foods

II. Awareness of FF staples		
a. Rice	Pre- Interventions	24%
	Post Intervention	42%
	% increase	**18%**
b. Wheat Flour	Pre- Interventions	18%
	Post Intervention	41%
	% increase	**23%**
c. Oil	Pre- Interventions	1%
	Post Intervention	67%
	% increase	**66%**
d. Salt	Pre- Interventions	13%
	Post Intervention	48.8%
	% increase	**35%**
e. Milk	Pre- Interventions	16%
	Post Intervention	49%
	% increase	**33%**

The percent increase in the awareness of Fortified staples was studied. The awareness regarding Fortified Foods, post-e-intervention improved from 18% to 66%. A maximum increase in awareness was observed for oil (66%) followed by salt (35%) and milk (33%).

5.2.1.3 Impact of e-intervention on subject's attitude toward Fortified Foods

The researcher shared brief information about what are Fortified Foods and why it is being done, to know about the baseline attitude of the subjects after knowing the crucial details about Fortified Foods.

Various questions related to the attitude towards Fortified Foods were asked to the subjects during the post-assessment stage to know the change in their attitude after e-intervention. Highly significant improvement was observed in the various attitude parameters, post-e-intervention ($P<0.05$) Fig.5.2.3.

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Attitude regarding the safety of consuming Fortified Foods improved for 140 subjects, willingness to pay more for Fortified Foods was improved for 92 subjects, while 80 subjects agreed that the Fortified Foods will be beneficial for their health. Nearly 221 subjects accepted the fact that there will not be any change of taste in the Fortified Foods and 91subjects agreed that shifting to other brands for choosing Fortified Foods, will be beneficial for their health.

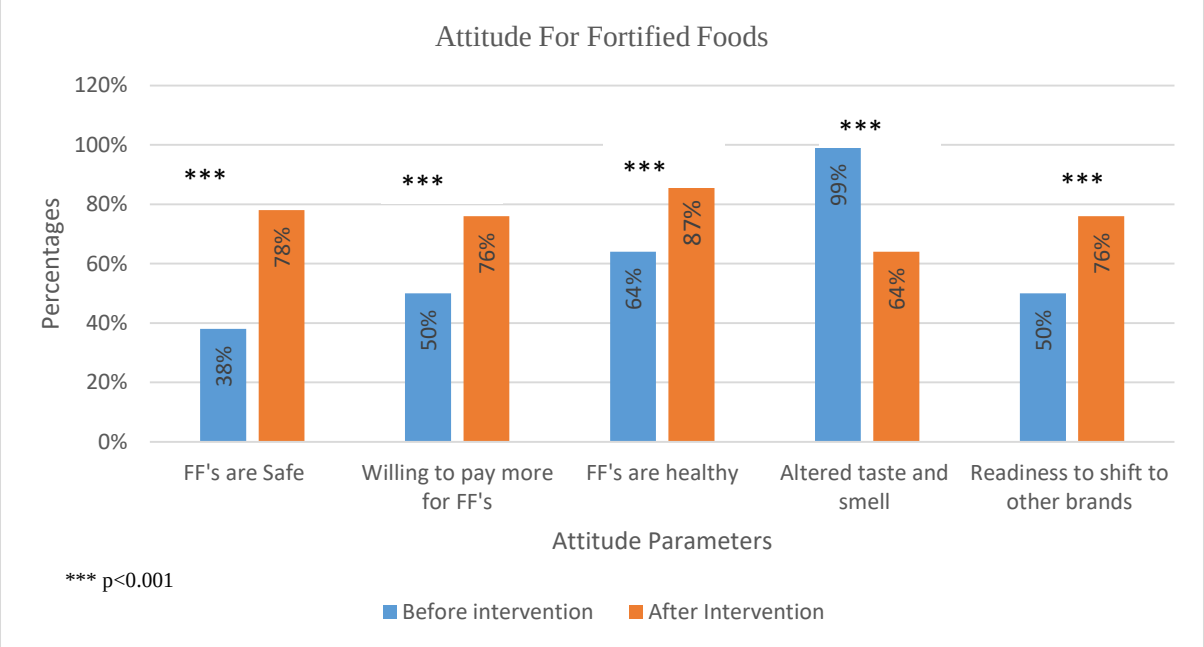


Fig 5.2.3 Impact of e-Intervention on Attitude of the subjects toward Fortified Foods

McNemar's test determined that there was a statistically significant improvement in the proportion of attitude about Fortified Food, post-e-intervention, p <0.001.

Table 5.2.3 shows a percent shift in the attitude parameters of Fortified Foods amongst the subjects

Table 5.2.3 Percent shift in the attitude of the subjects' toward Fortified Foods

I. Attitude Parameters	Impact of E-intervention	Percentages
a. FFs are safe	Pre- Interventions	38%
	Post Intervention	78%
	% increase	**40%**
b. Willingness to pay more	Pre- Interventions	50%
	Post Intervention	76%
	% increase	**26%**
c. FFs are healthy	Pre- Interventions	64%
	Post Intervention	87%
	% increase	**23%**
d. Change in Taste and Smell of FFs	Pre- Interventions	99%
	Post Intervention	64%
	% decrease	**35%**
e. Readiness to shift to other brands	Pre- Interventions	50%
	Post Intervention	76%
	% increase	**26%**

Maximum improvement was seen in the attitude towards the safety of Fortified Foods (40%), followed by their attitudes about taste and smell (35%) and 26% of the subjects were willing to shift to other brands that are Fortified. Also, 26% of the subjects were willing to pay more for Fortified Foods and 23% considered it to be healthy.

5.2.1.4 Impact of e-intervention concerning the purchase practices regarding Fortified Foods

The purchase practices for five staples were observed and there was a significant increase in the purchase practices (refer to Fig 5.2.4). Thirty-seven subjects started the purchase Fortified rice after the e-intervention, while 69 subjects started the purchase of Fortified wheat flour, 87 subjects Fortified salt, 95 subjects started the purchase of Fortified milk,

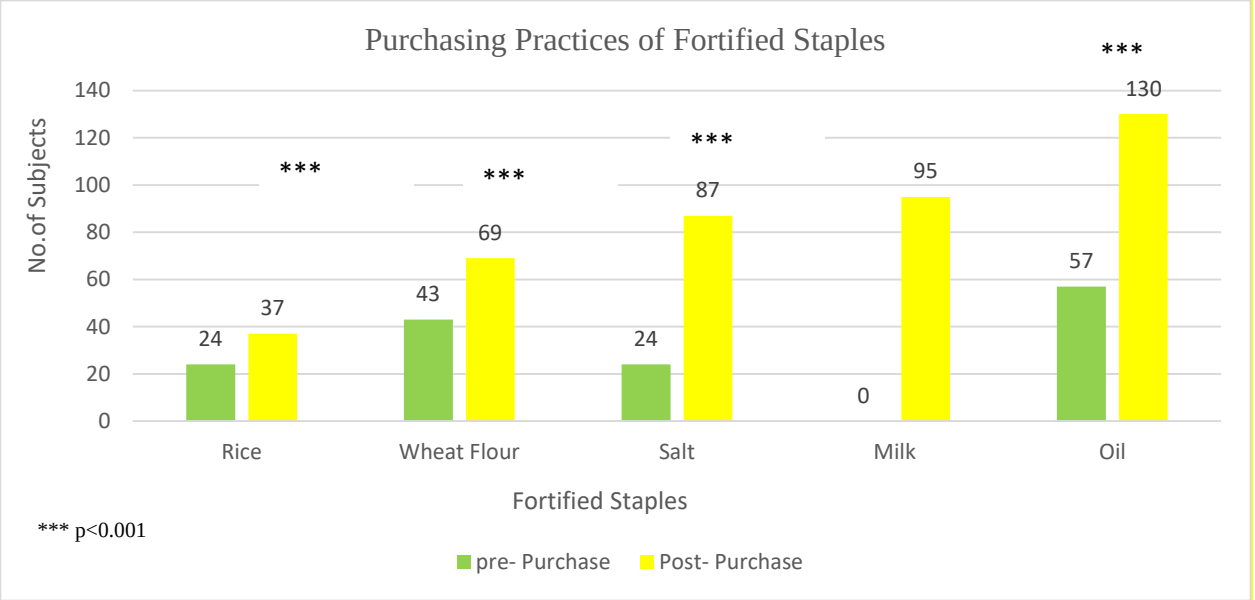


Fig 5.2.4: Impact of e-intervention on Purchase Practices for the five staples

Table 5.2.4 provides information regarding the shift in purchase practices after the intervention. The maximum impact of e-intervention was observed for milk (25%), followed by the purchase of salt (17%), while there was very little impact studied for wheat flour (7%) and rice (3%). Using McNemar's test, it was determined that there was a statistically significant difference in the proportion of purchase practices of Fortified rice, wheat flour, salt, milk, and oil, pre-and post-e-intervention, with $p < 0.001$.

Improvement in the purchase practices was minimal due to factors affecting the purchase such as availability in an open market as per the preferences of the subjects. A maximum percent increase was observed for Fortified milk which increased by 25%.

Table 5.2.4 Percent shift in the Purchase Practices of the subjects for Fortified Foods

I. **Purchase Practices**	**Impact of e-intervention**	**Percentages**
a. Purchase of Rice	Pre- Interventions	7%
	Post Intervention	10%
	% increase	**3%**
b. Purchase of Wheat Flour	Pre- Interventions	11%
	Post Intervention	18%
	% increase	**7%**
c. Purchase of Salt	Pre- Interventions	6.4%
	23.2%	87%
	% increase	**17%**
d. Purchase of Milk	Pre- Interventions	0
	Post Intervention	25%
	% increase	**25%**
e. Purchase of Oil	Pre- Interventions	15%
	Post Intervention	34%
	% increase	**19%**

5.2.1.5 Bottlenecks reported by the subjects for procuring Fortified Foods

Subjects were asked about the reasons that were impeding their purchase of Fortified Foods. The majority (38%) of subjects reported unavailability of Fortified Foods in the nearest store, followed by a preference for buying local/ unpacked staples such as rice and wheat kernels (34%) (Table 5.2.5).

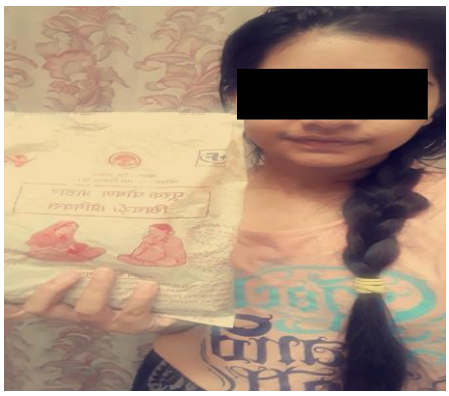
Table 5.2.5 Bottlenecks regarding Purchase of Fortified Foods by the subjects (N=326)

Reasons	**No. of subjects (N=326)**	**Percent**
Unavailability in the nearest store	144	38.4
It's Expensive	2	0.5
Prefer buying loose products	129	34.4
The preferred brand is not Fortified	51	13.6

5.2.1.6 Impact of e-intervention on purchase practices during the '*Sunday Selfie Contest*'

A total of 17 participants shared their pictures during the selfie contest while others shared pictures of the products brought them. Some of the selfies are shown below.

a. Selfie with Fortified Activa Oil



b. Selfie Contest with Fortified Anganwadi Product

d. Selfie with Fortified Dhara oil

c. Selfie with Fortified Gulab

e. Selfie with Fortified Gulab oil

f. Selfie with Fortified Gulab

Plate 5.2.1 (a-f) Subjects displaying purchase of Fortified Foods during the Sunday selfie Contest

5.2.2 Mid-level evaluation of e-intervention

The study period was on of one month, i.e. 30 days, subjects were shared one small questionnaire in the middle of the e-intervention (second Sunday- 14 days after the e-intervention started) to know whether they initiated buying Fortified Foods and to know their views about the messages being shared.

5.2.2.1 Attitude regarding the purchase of Fortified Foods

The mid-e-intervention assessment form was shared with the subjects, however, it was optional. Out of 239 subjects, 93% changed their attitude within fifteen days time frame for buying Fortified Foods. Out of 224 subjects, 74% reported that they already started the purchase of Fortified Foods. The subjects were further asked about which staple they have started buying. Purchase of Fortified wheat flour (41%) and salt (37%) was practiced by the majority of the subjects (Table 5.2.6).

Table 5.2.6 Change in attitude regarding the purchase of Fortified Foods during the mid-evaluation

Indicators	**No. of Subjects N= 239**	**Percent**
a. Will not purchase	15	6.3
b. Will purchase/Started Purchase	401	93.7
Staples	**Fortified Staples**	
a. Rice	8	4.4
b. Wheat Flour	75	41.7
c. Milk	-	-
d. Salt	68	37.8
e. Oil	29	16.1

5.2.2.2 e-intervention Feedback Responses

Subjects were asked whether the messages shared with them using WhatsApp are insightful for their health or not. Results revealed that the messages were insightful as reported by 98% of the subjects (N=239)

Table 5.2.7: Percent of subjects who felt messages were insightful

Feedback Responses	No. of Subjects	Percent
a. Messages were not insightful	4	1.7
b. Messages were insightful	235	98.3

5.2.3 Effect of e-intervention after 7 months of Washout Period

5.2.3.1 Purchase Practices for Fortified Foods after Washout Period

Google questionnaire was administered after 7 months of the e-intervention period for assessing the sustainability of purchasing practices for Fortified Foods and subjects' awareness of the Fortified Food logo (Primary outcomes of the study).

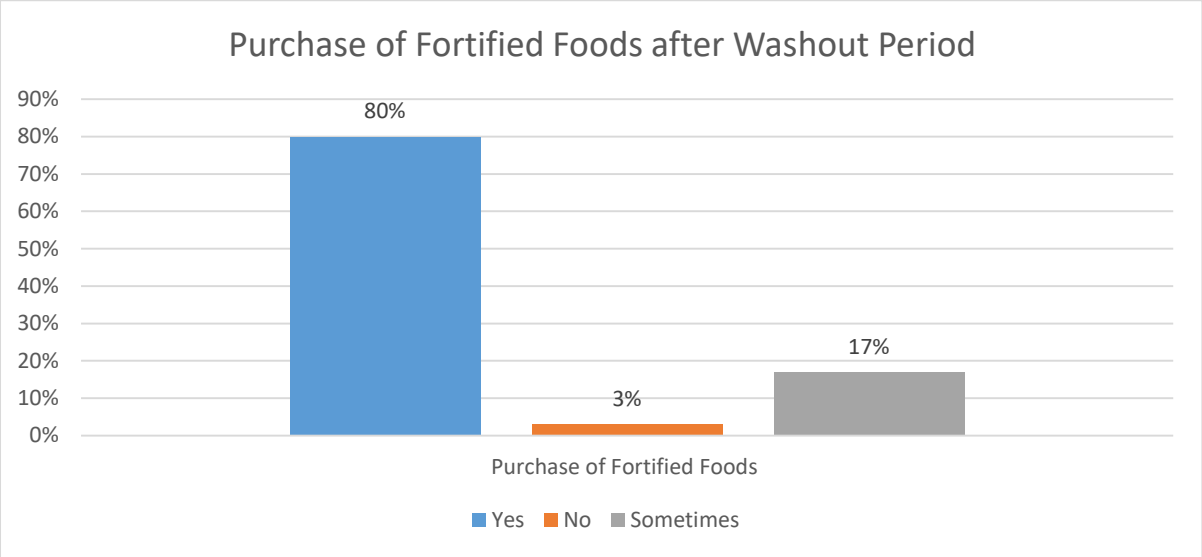


Fig 5.2.5: Purchase of Fortified Foods after 7 months of Washout

Washout Form was undertaken by 244 subjects, of which 80% (n=195) were still consuming Fortified Foods after 7 months of washout, while 17% (n= 42) were purchasing sometimes and 3% (n=7) marked 'No' as their response.

Subjects who marked 'Yes' as their response for purchase of Fortified Foods were further questioned about the staple. The majority of the subjects (70%) were purchasing oil, followed by 53% for Double Fortified Salt, Milk (40%), Wheat Flour (20%), and Rice (13%).

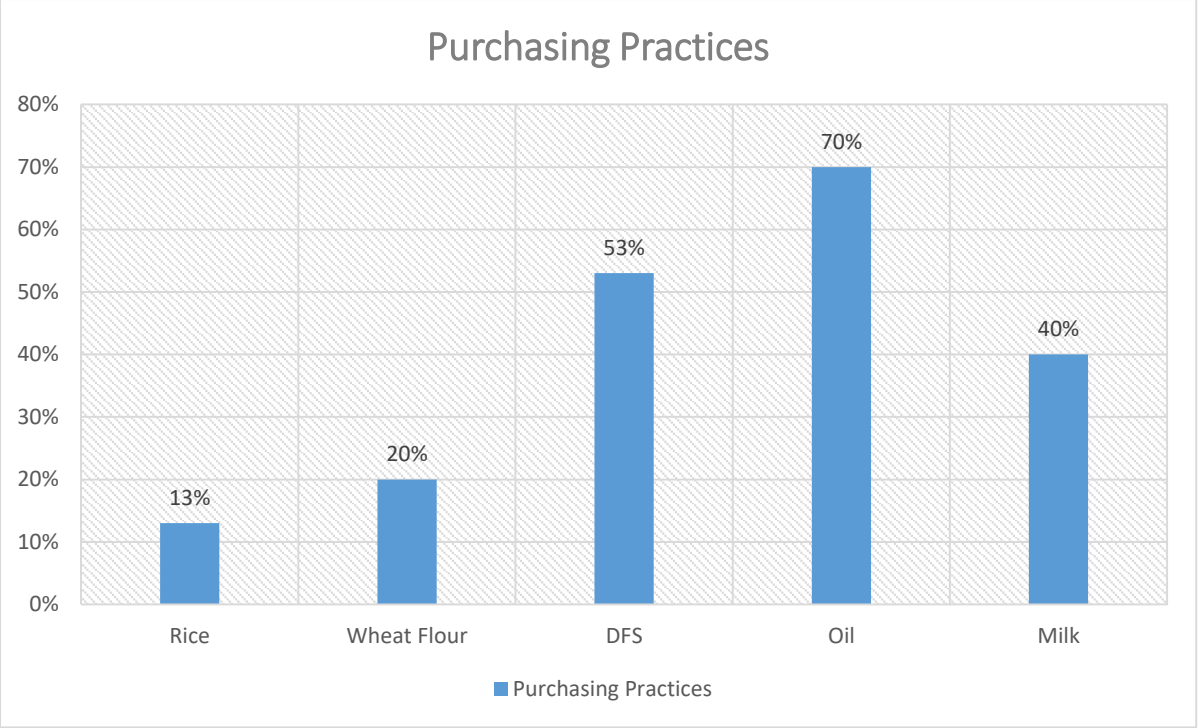


Fig 5.2.6: Purchase Practices of Fortified Staples after 7 months of Washout

5.2.3.2 Identification of correct logo for Fortified Foods

All the respondents (100%) who undertook google form post 7 months of washout period, marked the correct logo for Fortified Foods as their response.

5.2.4 Statistical Association between Pre and Post data of awareness, attitude, and purchase practices for Fortified Foods

Using Wilcoxon signed ranks, for the three parameters (Awareness, Attitude, and Purchase) it can be seen that the positive ranks were more i.e. improvement from pre to post-. There was a significant improvement for all the parameters (P<0.001) (table 5.2.8).

Table 5.2.8 Ranks chart for awareness, Attitude, and Practice

		N	Mean Rank	Sum of Ranks
Post – Pre Awareness	Negative Ranks	4[a]	28.00	112.00
	Positive Ranks	95[b]	50.93	4838.00
	Ties	9[c]		
	Total	108		
Wilcoxon Signed Ranks Test	Z	-8.480[b]		
	Sig. (2-tailed)	<.001		
Post – Pre Attitude	Negative Ranks	80[a]	136.30	10904.00

	Positive Ranks	236[b]	166.03	39182.00
	Ties	33[c]		
	Total	349		
Wilcoxon Signed Ranks Test	Z	-8.731[b]		
	Sig. (2-tailed)	<.001		
Post - Pre-purchase	Negative Ranks	6[a]	66.25	397.50
	Positive Ranks	232[b]	120.88	28043.50
	Ties	116[c]		
	Total	354		
Wilcoxon Signed Ranks Test	Z	-13.203[b]		
	Asymp. Sig. (2-tailed)	<.001		

a. =Post < Pre, b. Post> Pre, c, post= Pre

Diffusion of Innovation Model

The study followed the Diffusion of Innovation Model (DIM) as one of the strategies. According to this model, subjects were categorized according to Innovators, Early adopters, late adopters, and Laggards depending on when they started the purchase of Fortified staples from the time of e-intervention. The model helped in recording the time taken for an innovation to be adopted by the people.

5.2.4 Analysis of Subject's Purchasing Practices using Diffusion of Innovation Model

Using the Diffusion of Innovation Model, Purchase practices were categorized based on adopters, depending upon the rate of adoption which was adopted by the enrolled subjects. The results revealed that 12.4% of the subjects were categorized as Innovators, 24.3% as early adopters, 26.2% as the early majority, 8.2% as the late majority, and 24.7% as laggards. Table 3 clearly describes the week of adoption and the category of the subjects following the diffusion of innovation model (table 5.2.9).

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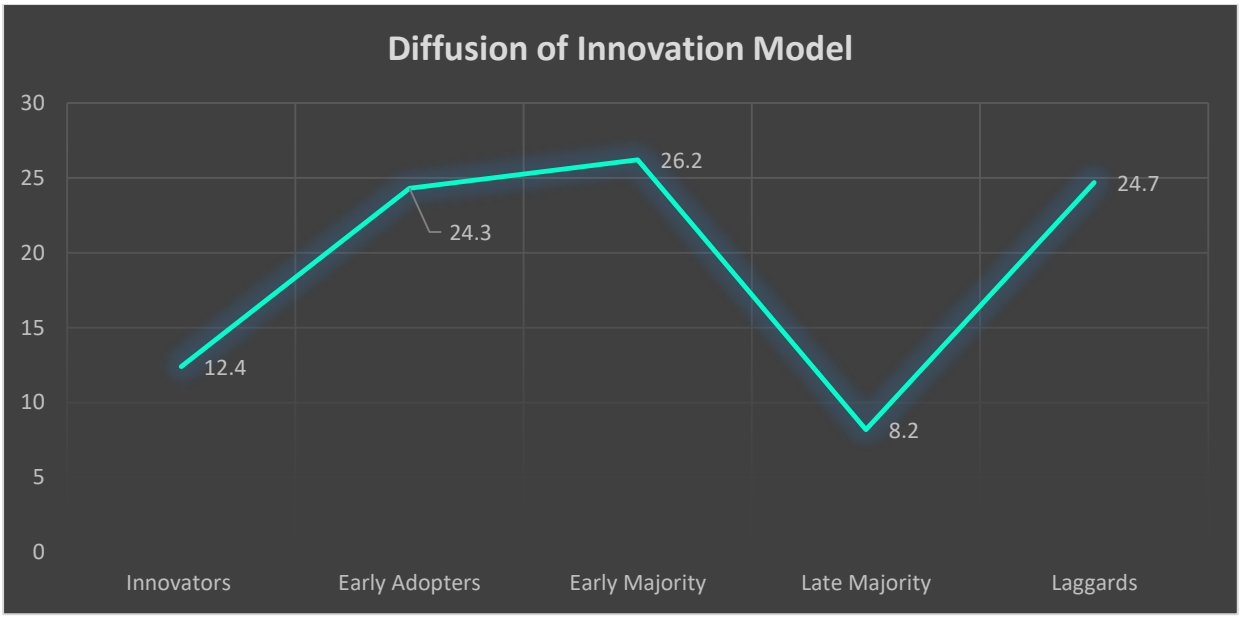

Fig 5.2.7: Purchase practices concerning the DIM Model

Table 5.2.9 Categorization of subjects based on the Diffusion of Innovation Model

Week of Adoption	**No. of Subjects**	**Percent**	**DIM (%)**	**Statistical Analysis**
1st week - Innovators	27	12.4	2%	**Mean = 1.89** **Median= 2nd week** **Std. Dev= 1.601**
2nd week-Early Adopters	53	24.3	14%	
3rd -4th Week Early Majority	57	26.2	34%	
5th week – Late Majority	18	8.2	34%	
>5th Week -Laggards	54	24.7	16%	

Result Highlights

PHASE II

- Food Fortification awareness for definition, logo and the target group increased by 17- 24%
- The awareness regarding Fortified Foods, post e-intervention improved from 18% to 66%. Maximum increase in the awareness was observed for oil (66%) followed by salt (35%) and milk (33%).
- Highly significant improvement was observed in the various attitude parameters, post e-intervention ($P<0.05$)
- Statistically Significant difference in the proportion of purchase practices of Fortified rice, wheat flour, salt, milk and oil, was observed post e-intervention with $P<0.001$
- All the respondents (100%) who undertook google form post 7 months of washout period, marked correct logo for Fortified Foods as their response
- The results revealed that 12.4% of the subjects were categorized as Innovators, 24.3% as early adopters, 26.2% as early majority, 8.2% as late majority and 24.7% as laggards when assessed using Diffusion of Innovation Theory.

5.3 Phase III- Market survey for Fortified Foods Availability

A market survey for available Fortified Foods was conducted in the Vadodara city of Gujarat. Different markets like online retail platforms, hypermarkets, and traditional *Kirana* stores were selected for the wide coverage. Currently, there are 157 Fortified brands available in India of which 80 brands are for Fortified edible oils, 55 for milk, 12 for wheat flour, 2 for rice, and 8 for double Fortified salt (FSSAI, 2019).

The rationale for conducting the market survey was to record the number of brands that were Fortifying the five staples (rice, wheat flour, salt, oil, and milk) and are available in Vadodara city which may help the manufacturer to design the strategies for further promotion and availability in the city.

5.3.1 Market survey for Fortified Foods availability on online retail platforms

	Amazon	Big Basket	Jio Mart	Grofers
Rice	-Dr. Rice Granova Naturals India Pvt ltd (Unavailable) Lohitha Nutri Rice	-	-	-
Wheat Flour	P Mark Chakki Atta	• Superior MpChakki Wheat Atta (Fortified with iron) • Superior Chakki Wheat Aata • BB Royal Multigrain 100% MP Sharbati	-	-
DFS	Tata Salt Plus -	-	-	-
Oil	Refined sunflower oil DharaKachi Ghani oil Dhara Rice bran oil Sundropsuperlite advanced sunflower oil Anjali cold-pressed Gingelly /sesame oil Sun drop heart oil Patanjali Fortified Mustard Oil	• Fortified Mustard Oil Patanjali • Active Corn Oil • Cotton Seed Oil Tirupati • Ankur Cotton Seed Oil • Tirupati Cotton Seed Oil • Groundnut Oil Ankur • Oil Hear Sundrop • Sundrop Heart Oil vegetable • Tirupati Active Corn oil • Cotton Seed Oil, • Gulab Double Filtered Groundnut Oil • Superlite Advanced Oil • Sunflower Sundrop • Gulab Refined Sunflower Oil • Sunflower Bucket Gulab	• Ankur Double Filtered Groundnut Oil • Gulab Double Filtered Groundnut Oil • Groundnut Health refined cottonseed oil • Sundropsuperlite advanced sunflower oil • Tirupati refined cottonseed oil	• Gulab Cottonseed oil • Gulab groundnut oil • Tirupati Cotton Seed Oil • Sundropsuperlite advanced sunflower oil • Tirupati Rice bran oil

		• SundropNutrilite Oil Blend		
Milk	Nestle Nido Fortified Milk Anchor Fortified Full cream milk Nezline Fortified milk powder			• Britannia Milk • Grofers Fortified Milk • Nestle Milk

It was observed that the Fortified Wheat Flour was available only on Big Basket in its brand name, however, the oil brands that were available varied from 7 to 17 types of oils on online retail platforms. There was one brand of Double Fortified salt and two brands of Fortified rice on any of the platforms. Fortified milk was available in three brands on Grofer's online retail platform.

5.3.2 Market survey for Fortified Food availability in Hypermarkets of Vadodara

As seen in Table 5.3.2 shows the availability of Fortified Foods in the hypermarkets of Vadodara. The hypermarkets in Vadodara that were selected were Big Bazaar, Spencer's, D-Mart, Bansal mall, Spencer's, and Patanjali. It was observed that nearly 7 to 10 Fortified oil was available in the hypermarkets of Vadodara. The availability of Fortified milk was available in Spencer's and Big Bazaar. There was no availability of Fortified wheat flour. Availability of one brand for Fortified rice and Double Fortified salt each in the hypermarket.

Table 5.3.2 Market survey for Fortified Food availability in Hypermarkets of Vadodara

	Spencer's	**Bansal Mall**	**D-Mart**	**Big- Bazaar**	**Patanjali**
Rice	-	-	-	Dawat Sehat Mogra	-
Wheat Flour	-	-	-	-	-
DFS		-	TATA Salt Lite	TATA Salt Lite	-
Oil	AnkurKapasiya oil SundropSuperlite Advanced oil Sundrop Heart Oil Sundrop Low absorb Superlite Advanced	Fortune SunLite refined sunflower oil Tirupati active refined corn oil plus Akur Groundnut Oil	Raani Gold Filtered Groundnut Oil Korndrop Refined Corn Oil Gulab Cottonseed oil Gulab groundnut oil Gulab sunflower oil	Gulab Cottonseed oil Gulab groundnut oil Gulab sunflower oil Tirupati refined sunflower oil	Patanjali sunflower oil PatanjaliSarso oil Patanjali Rice bran oil

	Tirupati Kapasiya Oil		Tirupati refined sunflower oil SundropSuperlite Advanced Fortune SunLite refined sunflower oil	SundropSuperlite Advanced	
MILK	Maahi Milk			Maahi milk Britannia Milk Nestle milk	-

5.3.3 Market survey for Fortified Food availability in Traditional Kirana (Grocery) stores of Vadodara

Two Kirana Stores were selected at random from the four zones of Vadodara North, East, West, and South.

	Mahalaxmi Alkapuri (WEST)	**Apexa Alkapuri (WEST)**	**Taaza New Sama (NORTH)**	**Aggarwal Store Karelibaugh (NORTH)**	**Shree Ram Provision Store NyayMandir (EAST)**	**Shri Krishna Provisional Store Gotri (EAST)**	**South Super Market Tarsali (SOUTH)**	**Ganesh Super Store (SOUTH)**
Rice	-	-	-	-	-	-	Dawat Sehat Mogra	
Wheat Flour	-	-	-	-	-	Golden Harvest	-	
DFS	-	Tata Salt Lite	-	-	-	Tata Salt Lite	-	TATA Salt Lite
Oil	AnkurKapasiya oil SundropSuperliteAdvanced oil Sundrop Heart Oil Sundrop low absorb Superlite Advanced TirupatiKapasiya Oil	Fortune Sun-Lite refined sunflower oil Tirupati active refined corn oil plus	Raani Gold Filtered Groundnut Oil Korndrop Refined Corn Oil Gulab Cottonseed oil Gulab groundnut oil	Gulab Cottonseed oil Gulab groundnut oil Gulab sunflower oil Tirupati refined sunflower oil	Fortune Sun Lite refined sunflower oil Tirupati active refined	Gulab Cottonseed oil Gulab groundnut oil Gulab sunflower oil Tirupati refined sunflower oil	Fortune Sun Lite refined sunflower oil Sundropsuperlite Advanced oil Tirupati refined sunflower oil	AnkurKapasiya oil Sundropsuperlite Advanced oil Sundrop Heart Oil Tirupati active refined

		Akur Groundnut Oil	Gulab sunflower oil Tirupati refined sunflower oil Sundropsuperlite Advanced	Sundropsuperlite Advanced		Sundropsuperlite Advanced	Gulab Cottonseed oil Gulab groundnut oil Gulab sunflower oil	Gulab groundnut oil

The Fortified oil was widely available at the Traditional store (Kirana). However, the availability of other Fortified staples like Wheat flour, DFS, Milk, and Rice was not available or was limited to one brand.

5.3.4 Market survey for the retail shops where Fortified milk is available in Vadodara (Maahi Milk)

1. Jalaram Bangle, SobhanabenJadavOppAnand Nagar bus stop Akshta Society near Hanuman Temple Karelibaugh

2. Amar Medical Store- A, 3-4 Tilak Park society Opposite Sangam Society Nr. Kavita nursing home. Harni Road

3. Patel Store Karelibaughopposite Ambica School, Jay Santoshi Nagar -2

4. Maahi Milk Parlour Balaji Exotica, TP 13, Chaani Vadodara

5. Gael MAA Essentials-Maahi Milk Parlour
   G-8 Siddheshwar Happy Homes b/h Cygnus school Harni- Motnath road oppMadhuvan Elegance, Vadodara, Gujarat- 390022

6. Maahi milk parlor 653/16 Vaikunth 1 shopping center, Waghodia Road, Jakat Naka, Vadodara, Gujarat, 390019

7. Balaji Firm, Manjalpur Vadodara shop no. 8, Gujarat 390011

Market Survey was conducted on 15th July 2021

5.4 Phase- IV Development of IEC Material

A Booklet on ***'Let's Know about Food Fortification'*** was developed to create awareness about Food Fortification amongst the general population for the following components"-

A. Benefits, signs of deficiency, and food sources for various micronutrients being used as Fortificants
B. Need for Fortified Foods and their benefits
C. Identification of Fortified Foods through its logo
D. List of stores and brands where Fortified staples are available

DISCUSSIONS

One of the strategies with the broadest impact on micronutrient deficiency is the Fortification of Food due to its cost effectiveness, sustainability, and viability, however, there is a lack of extensive data on advocacy strategies adopted by the government or agencies of food producers. (Bromage et al., 2019)

In the present study, knowledge, attitude, and practice for Fortified Foods were studied at the baseline, following which an e- intervention session was organized for the enhancement of knowledge and practice of the subjects on Food Fortification. The e- intervention was WhatsApp based, wherein messages were shared with the participants for one month using Graphics, Videos, and Voice recordings as a tool for a shift in knowledge and change in practices.

A study was conducted by Battalwar and Syed, 2017 conducted a study to assess awareness, attitude, and consumption patterns for Fortified Foods. The study was conducted on 100 females from Mumbai in the age group of 18-60 years and it was found that 43% of subjects knew the definition of Fortified Foods, ($p< 0.01$), and 52% of subjects knew that salt iodization is mandatory in India. The results revealed that 76% of subjects were practicing the consumption of Fortified Foods while others gave mixed responses. On enquiring about the reason for consumption, 28% of subjects marked "Healthy'' as an option. (Battalwar and Syed., 2017)

The results were similar and close to Battalwar, In the present study out of 375 Subjects, 33% self-reported that they knew about the term 'Fortified Foods' while the majority of the subjects 67% did not hear about Fortified Foods at all. However, post-intervention, awareness of Fortified Foods has been recorded at 66%, post-intervention which statistically stating is highly significant compared to the recordings of baseline with $p <0.001$. Subjects were asked about the correct definition of Fortified Foods, 28% of subjects who self-reported they are aware of Fortified Foods were able to identify the correct definition while the rest gave mixed incorrect responses.

Another study on Food Fortification awareness in Tanzania by (Kasankala et al., 2018). The study undertook the capacity building for Fortified Foods and their importance. The study was conducted on 200 Mothers and children from four health facilities in Tanzania. The results

reported that 29% of the respondents heard the term Fortified Foods while the majority (71%) had no idea about it. The knowledge of Fortified Food was low amongst all the participants. The researcher also studied the knowledge of various micronutrients amongst the participants, 64% of the participants were aware of the term 'micronutrients', on prompting further only 7.9% of mothers were able to define micronutrients correctly. The study undertook sessions on capacity building, however, participants were not able to define it correctly, in post-education sessions due to ignorance of the participants, as reported by the researcher. On questioning about the type of foods getting Fortified in Tanzania, only 9% of the participants could identify maize, 4% for wheat flour, and salt, while 2% mentioned edible oil and margarine, however majority (68%) could not respond for the sources of food.

The results were similar to the present study in terms of low awareness of Fortified Foods and Micronutrients amongst the study population at baseline. The present study focused on micronutrients knowledge from Vitamin A, Vitamin D, Vitamin B12, Iron and Iodine for the importance, health benefits, and source of knowledge.

A study was conducted in Bangladesh in Tangail Sadar Upazila to assess the knowledge of people residing in residential areas for Vitamin A Fortified staples. The study selected 400 subjects randomly and collected the data through face-to-face interviews. The study concluded that the knowledge and the consumption of Vitamin A oil and Rice were poor. Only 15% had awareness about vitamin A Fortified oil while 3.5% knew rice was Fortified with Vitamin A. Majority of the subjects (62%) were not consuming the Fortified staples (Begum et al., 2021).

In Australia, a community-based knowledge assessment was carried out amongst 1000 Australians aged 18 and above, selected from the Australian Directory. The study was cross-sectional in design using telephone interviewing through computer assisted. The study reported a response rate of 76%. The knowledge was present amongst the 13% of the subjects, however, the knowledge regarding the staples that were voluntarily Fortified was limited. Nearly 9% of the respondents reported that they would avoid foods with Fortification due to the uncertainty of the benefits which was majorly reported by 50% of the respondents (Molster et al., 2007). The results of the study are similar for the knowledge however, inconsistent for the barriers reported, since the present study observed availability as one of the major barrier for not being able to buy Fortified Foods, since the change in perception reported after successful e-intervention. The benefits of Fortified Foods were well known to subjects after the intervention strategy.

A study conducted amongst 25,297 households in Zimbabwe with under 5 years children, revealed that 12% of the households had knowledge about Fortified Foods and practiced the consumption. The study captured that the households headed by females were less likely to adopt the Fortified Foods as compared to households headed by males with a 5% of significant level. The association was studied between the households having good education background and their consumption of Fortified Foods, however, the present study recorded no such difference which might be due to the availability and limited advocacy regarding Food Fortification or due to self-selection bias in the adoption of limited available products (Kairiza et al., 2020).

A cross-sectional intervention-based study in Australia amongst 139 pregnant and 75 non-pregnant women was conducted. The study was conducted before Fortification was initiated in the country and after. The study recorded poor knowledge of both pre and post-food Fortification wherein 66% of the women were not aware of the adequacy of iodine in their diet while only 5% of women were able to identify bread as the source of iodine Fortification in Australia. Only 21% of the respondents were able to identify mental retardation as one of the causes of iodine deficiency, post-intervention, the change in practice for iodine Fortified salt was observed in 11% of the women while others reported a rise in the intake of seafood as the alternate of iodine source. The Mean dietary intake was recorded using Food Frequency Questionnaire which increased significantly post Fortification (Charlton et al., 2012).

Awareness amongst the Chinese and Mongolian communities was recorded by (Bromage et al., 2019), among men and women of age > 18 years. The knowledge amongst Mongolians was between 19-30% for the rural and urban communities while it was 48% amongst the residents of China. Fourteen to 38% of the respondents were reluctant about the Fortification. The acceptance regarding Fortified drinks with Vitamin D was more amongst Mongolians (90%) than in Harbin (52%), The influence regarding the change in practice was more amongst Mongolian 44% than their counterparts were only 19%. The study recorded no significance amongst the socio-demographic characteristics and lifestyle characteristics pertaining especially to practice.

Majority of the studies discussed in the chapter are similar with the present research, where the findings on the awareness level was low irrespective of the country, intervention geography, sample size and target population. However, the level of awareness on Fortified Food has found significantly improved through one-month of *e*-intervention.

On asking about the affordability, 64 subjects responded that it's affordable ($P<0.01$). The source of knowledge for Fortified Foods was through TV, magazines, and food labels for 42 subjects ($p<0.01$). Forty percent of subjects believed that Fortification changes the taste of Fortified Foods while 38% believed its taste, and appearance to be changed.

The source of knowledge was broadcast media (45%), print media (38.7%), Internet (9%), and Outdoor media (7.3%). In another study, conducted in Tanzania, the main source of knowledge was health workers for 41% of the participants, followed by village leaders (21.3%), radio (6.3%), seminars (5.5%), and television (5.5%), schools, friends, etc. A similar study conducted in Pakistan for knowledge, attitude, and practice of Fortified Foods, also reported that the major source of information in Pakistan was health workers (Aliya, Mahmood, et al, 2014).

(Battalwar and Syed, 2017) reported the highest frequencies for Fortified products that were being consumed by the subjects, 86% of subjects reported consuming Tata salt plus on daily basis, Tata salt with Iodine and Iron by 66%, followed by Dabur glucon (39%) and others like Marmite honey, Mother's Horlicks, etc.

The present study focused on the consumption of staples that are being Fortified in India, 6% reported consumption of Fortified rice, 7.7% salt, 13.6% for Wheat Flour, and 15.5% for Oil.

A similar study was conducted by Motadi, Mbhatsani, and Shilote in South Africa, NkowaNkowa Township on 360 women of childbearing age. The study comprised participants who were between the age group of 20 and 29 years (42.8%), majority of participants (66.7%) had tertiary education. Fifty-Four percent of subjects were able to identify staple foods that are being Fortified in South Africa, 57% were able to identify the correct definition of Fortified Food, 72% were able to identify the sources of Fortified Foods, 72% of participants knew that the target population for Fortified Foods in South Africa is for children in the age group of 6 months and above (Motadi et al., 2016).

In the present study, only 2% of the subjects said Fortified Food is for everyone at the baseline since in India staples that are being consumed by all the age groups are being Fortified.

The present study showed improved results after undertaking e- intervention sessions for one month through WhatsApp, and it was observed that awareness of Fortification improved by 50- 80% for different questions on awareness, and the awareness regarding staples improved from 18% to 66% post e- intervention. Maximum improvement was seen in the attitude towards

the safety of Fortified Foods (40%), followed by their attitudes about taste and smell (35%) and 26% of the subjects were willing to shift to other brands that are Fortified. Also, 26% of the subjects were willing to pay more for Fortified Foods and 23% considered it to be healthy.

McNemar's test determined that there was a statistically significant improvement in the proportion of attitude about Fortified Food, post-e-intervention, p <0.001.

For Purchasing Practices, the maximum impact of e-intervention was observed for milk (25%), followed by the purchase of salt (17%), while there was very little impact studied for wheat flour (7%) and rice (3%).

Using McNemar's test, it was determined that there was a statistically significant difference in the proportion of purchase practices of Fortified rice, wheat flour, salt, milk, and oil, pre-and post-e-intervention, with p <0.001.

The present study also looked at the bottlenecks that the subjects are experiencing while purchasing Fortified Foods, the majority (38%) of subjects reported unavailability of Fortified Foods in the nearest store, followed by preference towards buying local/ unpacked staples such as rice and wheat kernels (34%).

A study conducted in Australia on Consumer Awareness, Attitudes and Behaviours to Fortified Foods reported that the participants were skeptical regarding mandatory Fortification of foods due to concern for increased prices of the products because few of the big companies were Fortifying their brands voluntarily, thus making it more expensive considering it to be healthy. Another concern of the participants was regarding the naturally occurring nutrients that the ones induced through technology. The study reported low awareness of folate amongst the participants, regarding its health benefits and its sources, only women who had experienced pregnancy in the past reported good knowledge of folate. One of the limitations of the referred study is that it has not given definite percentages (Rowland and Dugbaza, 2010).

The study conducted in China assessed awareness and attitude toward the Industrial Food Fortification in Mongolia and Harbin districts. The survey collected the data from men and women during the year 2014-2017 aged more than 18 years. Less than half a percentage of people were aware of food Fortification, the survey questioned the participants about its acceptance and recorded that 50% of the participants from Mongolia and 18% of participants from Harbin favored food Fortification on learning the purpose of it (Bromage et al., 2019).

A Cross-sectional study was conducted in 13 different countries for assessing Fortification awareness using a structured questionnaire. The survey assessed the information of 1435 respondents. The awareness was limited to 28% of the respondents, the major source of knowledge being the radio for 27% of the respondents. The subjects could mark the correct response for the risk relating to deficiency of micronutrients (76%) The study assessed the association with the occupation of the participants with $P<0.001$, household size, education level, and age. The study also noted that respondents lying in the above age bracket had better knowledge of nutrients than their younger counterparts. The knowledge regarding different micronutrients was limited in the study (Linda et al., 2020).

The attitude amongst the people of 76 people in the United Kingdom the Fortified Foods showed 67% of the responses in favor of the Fortified Foods while it was opposed by 20% while the remaining were unsure regarding their attitude. The subjects who were willing to use Fortified Foods were amongst the younger generation. The willingness to pay extra for the Fortification was reported by 40% of the respondents while 13% were not eager to pay extra, while others were skeptical (Dixon and Shackley, 2003).

The knowledge about Food Fortification will directly reflect in the attitude and the practices of the people, however since the low price is the main criterion affecting the buying practice of the individuals, especially belonging to the low or middle category in the socioeconomic status. A study conducted in Delhi amongst 930 consumers who were selected randomly using the interview recorded the willingness and behavioral intentions of the people for Fortified Foods. Amongst the surveyed population 4.65 was taken as an average tend to buy Fortified products when they are cheaper, other factors affecting the purchase were fear of additives, and side effects, which were the major cause of concern amongst the selected population (Satyapriya et al., 2021).

It has been observed that the knowledge of specific health benefits for the Fortificants or Fortified Foods will significantly increase the willingness to purchase Fortified Foods since it will expose the benefits of the functional foods, amongst consumers.

(Dolgopolova and Teuber., 2018) concluded that specification on nutrition and health claims receives high valuations than any other claims

The increased micronutrient deficiency has given food Fortification a way to combat the situation, as it is one of the cost-effective and viable approaches (Premkumar and Garg., 2020). The advantage of the strategy is to provide micronutrients without altering the dietary practices of the

population. The vehicles for Fortification are chosen based on staple foods that are consumed frequently and in large quantities (Das et al., 2013).

Few researchers have collected the data from the different communities regarding the consumer's awareness, perception, and practice of Fortified Foods which created the need for intervention-based studies.

A study conducted amongst 150 urban women in Delhi, reported good (48%) awareness of the Fortified Foods logo, where 69.8% agreed to the consumption of Fortified Foods as essential. (Premkumar and Garg., 2020) An interventional study conducted by (Sirohi et al., 2015), amongst 400 subjects, recorded awareness of Fortification as 12% at the baseline which increased to 72% after the intervention. A study conducted in Kenya on 1435 subjects found that only 28% of the respondents had awareness of Fortified Foods (Linda et al., 2020). Findings of the present study have recorded awareness at baseline at 26% which increased to 88% after the e- intervention.

A study conducted in NkowaNkowa Township, Africa, to determine the awareness of women on Fortification reported that 57% of the participants were able to define food Fortification correctly, and 72% of the participants were aware of the foods that are being Fortified, the staple that is being Fortified in South Africa is maize, which was reported by 70% of the participants. The target group for which Fortification is essentially being done are the children (<6 years of age) answered correctly by 72% of the participants (Motadi et al., 2016). The possible reason for better awareness amongst the Africans was the mandatory use of the Fortification logo on bread, flour, and maize, however, in India, the +F logo for identification of Fortified Foods was created in 2016 after the development of the food Fortification resource center (Teaotia and Singhal., 2020).

The subjects in the present study were willing to pay more for Fortified Foods by 50% at the baseline, which increased to 76% after the e-intervention. The results of Garg and Kumar 2020 also observed similar findings ($P<0.01$). On questioning about the difficulties for purchase Fortified Foods, only 0.5% of the subjects marked price as one of the reasons for not buying Fortified Foods, while unavailability (38%) and preference for buying unpacked staples (38%) were the other reasons which jeopardized the purchase of Fortified staples amongst the participants.

A report by Dalberg estimated that 40-60% of the Fortified Food production in India is not reaching the general population. Thus, it becomes important to create supply and demand for Fortified Foods simultaneously (Bhatnagar and Kanoria., 2020).

The results of the study have shown a significant difference in the awareness, perception, and purchase of Fortified Foods for all the five staples post-intervention, which provides enough evidence that the proposed strategy for creating awareness and promoting the purchase of Fortified Foods amongst the selected participants was highly effective.

A cross-sectional study conducted among school going kids in Benghazi city, amongst 200 students, observed a significant reduction in the consumption of chocolate ($p<0.01$), chips ($p<0.01$), bread, and other fast foods, post nutrition intervention (Sachithananthan et al., 2012), however due to pandemic e-education sessions using WhatsApp as the education platform proved to be highly effective in terms of improving the awareness, perception and purchase practices.

In an educational intervention study, carried out amongst 400 subjects, the improvement in awareness of soybean oil increased to 62% from 10%, and awareness about various Fortified Food products also enhanced to 83% from 40% (Sirohi et al., 2015). Multiple studies have undertaken advocacy strategies for improvement in the awareness, perception, and practices of the subjects, however, the results of the intervention can vary depending upon the outcome variables, characteristics of the subjects, and the tool used for advocacy strategies (Contento., 2007).

A study was conducted in Iran on the knowledge of micronutrients amongst the 14136 subjects using a cluster sampling method. The knowledge of food sources of calcium was 11.6-64.7%, zinc (12.8%-16.7%), and iron (50.9- 46%) in rural and urban Iranian provinces, respectively. Since nutrition knowledge is one of the biggest factors in influencing the diet and dietary habits amongst the people, it looks appropriate to come up with interventions focusing on enhanced knowledge and awareness (Heshmat et al., 2016). The present study also recorded the knowledge regarding Food sources, signs of deficiency, and functions of different micronutrients being used as Fortificants in India. In the current study knowledge and food sources of Iodine were known to few of the subjects as compared to the knowledge of other micronutrients which ranged from 60-75% for the three indicators of knowledge.

Attempts were made to create awareness about Food Fortification in the general population through the last phase of our research which was the development of IEC boo, whereas in the Intervention phase an audio-visual animated movie, developed Government and FSSAI videos on Food Fortification featuring Sakshi Tiwari and Virat Kohli and the audio messages promoting Fortified Foods in the content of the message were shared with the participants. Moreover, additional animated videos were created for addressing the additional messages through

information- education -communication (IEC). Multimedia-based communication has got better retention possibilities compared to other methods.

The advent of technology and the internet has gained momentum in recent times in India, thus it is considered an appropriate strategy for changing health-related behaviors since the majority of the population relies upon the internet for information related to health or any other topic. Social media has great potential over other print media since it can reach the masses with ease and doesn't require time for printing and distribution which could otherwise delay the timing of the messages. A study developed a Smart health awareness framework. The study included 701 individuals and recorded their acceptance of the messages disseminated through media. The response rate recorded was 55%. Sixty-nine percent of the people use Social Media whereas 305 hardly or never use social media, indicating the potential to reach messages to the people amongst the majority (Alsisi et al., 2020).

Social media can be clubbed with other techniques to reinforce the messages already disseminated through social or mass media networks. One of the biggest advantages of the technique is it creates change in the behavior of the people who were not even exposed to the messages directly but were influenced by the people who were exposed or shared the messages with. The social network of the people gets educated with word of mouth or the practices that have been accepted by their fellow networks. This can influence the behavior directly or indirectly, however, attention has to be given to the designing of messages which should be short, interesting, and clear in terms of what change one is expecting in the behavior of the people after the exposure. The likelihood of success will increase when mass media or social media interventions will be used with other mulita intervention techniques (Wakefield et al., 2010).

Worldwide 4 billion users are using social media which is projected to increase by 7% every year, for the delivery of public health-oriented messages like tobacco, smoking, physical activity, and vaccination. Studies have reported better health outcomes when exposed to web-based interventions. A systematic review of 71 studies on the use of social media for behavior change techniques amongst participants >18 years revealed that the use of Facebook with tailored messages on health education amongst 31 studies with a better rate of adoption, however, the use of Facebook in the studies doesn't dismiss the effectiveness and the popularity of other social media platforms (Simeon et al., 2020) (Jones et al., 2012) (Korda and Itani., 2013).

In one of the blogs published by the World Bank, the use of social media as the next step for communication channels has been appreciated due to the wide use of social media usage amongst

people irrespective of age, geography, and socioeconomic characteristics. The use of Social media for creating awareness during the Covid pandemic for taking up the vaccines and maintaining the social distancing has proven to be effective since the online seeking behaviors have been exponentially rising. The use of e- intervention techniques offers a window of opportunity for recording the evaluation and addressing the doubts of the people and providing a platform with interaction where doubts can be instantly answered (Sanchez-Paramo and Legovini., 2021).

The present study is closely related to the evidence since the rise in knowledge and practice has been observed amongst the participants through the use of e- intervention strategy. The strategy adopted in the study can be scaled up in partnership with government or private agencies wherein the larger section of the people in different geographical settings can be reached out with tailored language specificity, enhancing the capacity and behavior change in the people and promoting the use of Fortified Foods.

Besides, the impact of the intervention, the present study has followed the Diffusion of Innovation theory (DOI). DOI is often used for spreading awareness about the innovation through communication channels over a period of time to the target population. The pattern that has been proposed by the researcher is the sigmoid pattern which is commonly reported (S- Shaped, however, the S- shape is often observed when the influence of opinion leaders or the fellow community members is passed on to the next group of people in the community over a period of time. The key components of DOI are the innovation, the adopters reflecting the earliness in the adoption of technology compared to their counterparts, the social pressure of leaders, adoption process, to track the adopter's categories (Dearing and Singhal., 2020).

According to Rogers's model, the four components that can persuade a person to the adoption of innovation are relative advantages, compatibility, complexity, and trial ability, which were considered while sharing the messages on WhatsApp during an intervention. Messages regarding the advantages of Food Fortification, safe use while cooking and consumption, and the availability of Fortified Foods in the markets for promoting trialability were ensured. The DIM model has been applied in agricultural, public health, social marketing, and educational-based interventions (Dearing., 2009).

A study using the Diffusion of Innovation Model was conducted to understand the factors affecting the acceptance of e-health interventions in Australia. The study was longitudinal, with 29 months of observational pattern that was recorded for the diffusion of a new idea. The study revealed an increase in the adoption of e- appointment services by 1.5% in 3 months and by 4%

by the end of the study. The Factors observed for the low adoption rates were insufficient communication, lack of value of *e*- communication, preferences towards oral communications, and low level of internet literacy levels. During the study though 300 people out of 7189 were visiting the website for the electronic appointments, however, only 6% adopted it for continuous use till the end of the research (Zhang et al., 2015).

Roger has proposed the attitude of the individuals in a social structure will affect the rate of adoption of the innovations. Multiple studies have been using the DOI model for studying the adoption of new healthcare technologies. Chew et al., conducted a study using DOI for internet health care services. amongst physicians wherein, the response rate was 63 %. The majority of the respondents were able to identify the benefits of the Internet and agreed to use it as an information access platform. Helitzer, in his study, used DOI for studying the adoption of telehealth programs in the social systems (Helitzer et al., 2003) (Chew et al., 2004).

The success of DIM can vary with the type of technology and innovation that is being promoted to the target audience. However, the graph observed in the present study was similar to the bell-shaped graph that was proposed by Roger in his model.