



# SCOPING OF FORTIFIED AND NUTRITIOUS FOOD PRODUCTS FOR THE TARGETED HOUSEHOLDS AND STRENGTHENING THE DISTRIBUTION NETWORK TO THE LAST MILE

*JANO Food Fortification Study*

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## EXECUTIVE SUMMARY

### Introduction

A large population around the world suffer from micronutrient deficiency, especially pregnant and lactating women, children, and adolescent girls. Micronutrient deficiencies can have severe effects on health. One of the health consequences of micronutrient deficiency is anemia, which is caused by iron deficiency; zinc deficiency is also high among pre-school children. Food fortification has received worldwide recognition for its potential to address the issue of micronutrient deficiency. In Bangladesh, to fight malnutrition, the project- Joint Action for Nutrition Outcome (JANO) began its journey in 2018. The overall objective of JANO is to, “Contribute to ending malnutrition of children under five years of age, together with addressing the nutritional needs of Pregnant and Lactating Women (PLW) and adolescent girls”.

### Method

A mixed methods approach was used, combining qualitative and quantitative approaches to understand consumers' knowledge, attitude, perception, and practices, related to fortified foods, including the willingness to pay for fortified products. Quantitative and qualitative data collection was conducted between August and September 2021 simultaneously but independent of one another. Quantitative data collection employed a cross-sectional survey. The sampling technique used a multi-stage cluster design. From the JANO program area, seven upazilas from two districts of Rangpur and Nilphamari were selected, from which 14 villages were selected using the probability proportional to the size (PPS) of the village population. Participants comprised women who had delivered within the last three years and were randomly selected (N=507) from the village for the survey. Data was cleaned in Excel spreadsheet and analyzed using STATA 17. Participants for the in-depth interviews (IDI), Key Informant Interviews (KII) and Market Observation were selected through purposive sampling method. To gain broad insight into perceptions and experiences surrounding fortified foods, the research team conducted KIIs with 16 fortified food suppliers including public and private sector; 23 IDIs with pregnant and lactating women and their husbands; 14 IDIs with married and unmarried adolescent girls; and 15 IDIs with in-laws, CSG members and health workers. Interviews were conducted to explore the respondents' perceptions regarding the advantages and disadvantages of fortified food products, acceptability and affordability, and challenges in reaching the last-mile population. Apart from these, we also used

a semi-structured checklist to conduct 42 market observations interviewing the shopkeepers around the selected study area.

## Findings

Knowledge about fortified foods including edible oil and zinc rice was low among the respondents, but they were very knowledgeable of iodized salts. Only 41% of respondents had heard about food fortification and among them 52% did not know the process of food fortification. Respondents had clear understanding of the difference of nutrition dense food and processed foods. Interestingly, they had more knowledge about the nutrition available naturally in foods such as vitamin A (70%), protein (60%) and carbohydrates (49%). Respondents were aware of nutritional benefits from natural sources of food such as spinach, carrots, and milk. Participants who knew about food fortifications also understood the benefits of consuming fortified food for adolescents, pregnant women, and children. However, few of the participants felt that they were already getting nutrition from natural sources and did not feel the necessity of getting it from fortified foods.

Incremental costs were a barrier for participants to use fortified foods. Those who used fortified oil spent an average of 133 BDT per week to buy it. On the contrary, those who used non-fortified oil spent only 63 BDT per week. Participants spent an average of 18 BDT per week for iodized salt. Despite the increased cost, respondents were willing to pay for fortified food considering its beneficial health effects. In addition to the regular household expense, respondents were willing to spend 107 BDT per week for fortified oil and 15 BDT for iodized salt per week.

Less than half of respondents (48.9%) were using fortified foods other than iodized salt. Almost all the respondents knowingly consumed iodized salt and knew that packaged salts are iodized. This can be contributed to the campaigns carried out by the government for educating people about iodine deficiency and the availability of iodized salts everywhere in the country. Mass media, relatives/neighbors, and the suppliers are the major source of information in areas where community health workers and community mobilization program are not playing a major role in raising awareness about the importance of fortified food. On the other hand, fortified oils were used but many of the respondents were not using them for its benefit of being fortified. Instead, fortified oils were mostly bought because they were thought to be clean. Some of the respondents

from lower socioeconomic background had the perception that non-packet salt is grainy and coarse and is required less in quantity than packaged salt. On the other hand, middle- and higher-income group who use iodized salt perceived that the non-packet salt is dirty and adulterated.

A large portion of the respondents use non-fortified oil for cooking. Few respondents had the perception that nothing is added to fortified oils to enrich it, and that it is the same as oils sold openly. It has also been found through qualitative data collection that oils available in the rural areas get adulterated by mixing palm oil to soybean oil during summer season and during winter these oils are removed from the market as it solidifies. This not only creates a artificial crisis in the market for bottled oils but also increase the price of oils in the winter season for all bottled oils. This creates mistrust among consumers, and creates a barrier for some as the price rises. Many respondents reported knowing about the benefits of fortified oil but could not afford them due the high price. There is also an incremental cost for the families when it comes to affording fortified foods.

The survey also identified challenges at the retailer level in the supply chain of fortified food. Most retailers are mainly bulk oil sellers. Retailers said selling bulk oil is profitable and can be easily collected with little capital. On the other hand, selling bottled oil requires more capital which demotivates them to sell fortified oil. Retailers also reported lower profits for bottled oil, so local retailers are less interested in selling bottled oil and they influence customers to buy bulk oil. The study also found a number of behavioral factors affecting consumers' consumption of fortified foods. Affordability was reported by most of the participants as one of the prime barriers in consuming fortified foods. In addition to this, availability, the decision of the household head, knowledge about adulteration, formal education, motivation of relatives are also important factors that influence their fortified food intake. In respect to reaching out to the last mile for distributing fortified food, this study found the Food Friendly Program within the local government setting. The Food Friendly Program serves as an important safety net for the poor people of Rangpur and Nilphamari. Low-income people also had the opportunity to buy essential food products during the COVID-19 pandemic. Now these programs have become an important platform to reach out to people living at the union level. This supply chain from GoB is important because the prices of the fortified foods are lower than the price in the market.



This study also explored respondent's exposure to the channels of nutrition related information. It found that all the respondents used different kinds of media. Almost half (49%) of the respondents watched television and 70% reported to watch television almost every day. Sixty-four percent of the respondents owned cell phones and 33% owned smartphones. Eighty percent of the cell phone users could read SMS in their phones and 47% could read both English and Bengali.

### **Conclusion and Recommendation**

This study explored attitudes, preferences, knowledge, and practices related to fortified food products and fortified product supply chain actors. This assessment has also identified reasons for influencing consumers' decisions to purchase fortified and non-fortified foods. Although the target population comprises pregnant and lactating women and adolescents, husbands and household heads should also be informed of the micronutrient deficiencies and ways to address it. Though there are some established food distribution channels that can be used to deliver fortified food, some additional behavior change programs need to be introduced. This study suggests-

- ❖ Community-based SBCC intervention is needed to increase awareness and involve individuals, families, and communities to promote the use of fortified food.
- ❖ Consumer motivation activities at market level should be done by local government agencies through the orientation of retailers.
- ❖ Inspire mothers and husbands at the family level by the existing community mobilization team (e.g., Community Support Group) to sensitize and promote the use of fortified foods.
- ❖ Establish a system for continuous monitoring at the market level by market committees to address the artificial crisis.
- ❖ Relevant government departments ensuring the food safety should monitor the issue of food adulteration.
- ❖ Government should develop or modify policies to involve TCBS in the supply chain to distribute subsidized fortified food in the rural areas.
- ❖ Private investors/distributors should consider making the fortified food (e.g., soybean oil, iodized salt) available in affordable sizes with subsidized prices to reach the last mile as a corporate social responsibility.

## CHAPTER 1: INTRODUCTION

Globally, more than two billion people, including women and children, do not get the micronutrients they need to survive and thrive. The impacts of micronutrient deficiencies are devastating for individuals, families, and the entire nation. Poor diet and limited access to nutritious foods are the key reasons someone may lack crucial micronutrients for human development, such as iron, folic acid, vitamin A, and iodine [1]. Micronutrient malnutrition (MNM) is widespread in industrialized nations, but even more so in the world's developing regions. 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. Micronutrient malnutrition has many adverse effects on human health, not all of which are clinically evident. Even moderate levels of deficiency (which can be detected by biochemical or clinical measurements) can have serious detrimental effects on human function [2]. Micronutrient deficiencies are prevalent in Bangladesh across all wealth quintiles.

However, pregnant women and children are most vulnerable. Anemia is one of the biggest public health concerns in the country, where over 50% of young children (under 5-years-old) and 11% of school-aged children and over 50% the women of reproductive age suffer from anemia [3]. This high burden of deficiency has a far-reaching economic impact; 8% of the gross domestic product of Bangladesh is estimated to be lost due to anemia alone. Moreover, the 2011–12 National Micronutrient Survey found that the national prevalence of zinc deficiency was approximately 45% among preschool-age children. Many factors have been reported to contribute to micronutrient deficiencies, including diets with low nutrient quality and diversity, low household purchasing power, inadequate access to drinking water and sanitation facilities, inadequate knowledge of nutritional practices and inequality [4].

To address the micronutrient deficiency the method of fortification<sup>1</sup> is widely recognized as being one of the most cost-effective strategies to increase the regular consumption of micronutrients in a population [5]. Food fortification adds nutrients and non-nutrient bioactive components to edible products (food, food constituents and supplements). Food fortification can be used to correct or

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<sup>1</sup> Industrial or large-scale food fortification (LSFF) is the **addition of micronutrients** during processing to commonly consumed foods such as salt, flours, oil, sugar and condiments.

prevent widespread nutrient intake shortfalls and associated with deficiencies to balance the total nutrient profile of a diet to restore nutrients lost in processing or to appeal to consumers looking to supplement their diet. Food fortification can be considered a public health strategy to enhance nutrient intake [6]. In Bangladesh, to fight malnutrition, a five-year project named Joint Action for Nutrition Outcome (JANO) began its journey in 2018. The overall objective of JANO is, “Contribute to ending malnutrition of children under five years of age, together with addressing the nutritional needs of Pregnant and Lactating Women (PLW) and adolescent girls” [7]. With its strategic objective, JANO had four expected results (ER) as follows:

ER1: Women and adolescent girls in communities, through Community Support Groups, are empowered to demand and utilize both nutrition-sensitive and nutrition-specific services.

ER2: Coordinated and resourced sub-national and local government structures recognize, respond to, and are accountable to the demand of poor and marginalized communities.

ER3: Production and access to high -value nutritious commodities and services are increased.

ER4: Information and communication technology (ICT) platform is established at the local level to connect relevant govt. departments and increase awareness of community people on nutrition interventions.

JANO aimed at providing support with strengthening access to and availability of fortified and nutritious food items for targeted households, especially for women, adolescents, and children. Consequently, this intervention expects to improve the affordability and intake of nutritious products to meet the nutritional needs of pregnant and lactating women, adolescents, and children. The study's overall objective was to understand the consumers (JANO participants) knowledge, attitudes, and perceptions about fortified products.

#### **SPECIFIC OBJECTIVES OF THE STUDY**

The following are the specific objectives-

- 1) To understand the perceived benefits and disadvantages of fortified food (FF) consumption
- 2) To capture the perceived incremental cost of fortified foods vs. non-fortified foods
- 3) To identify the incremental cost families would be willing to spend to obtain benefits from FF
- 4) To understand the perceptions about FF sellers

5) To identify the constraints and opportunities from suppliers' perspective (both public and private) for last-mile reach/distribution of fortified and nutritious food products.

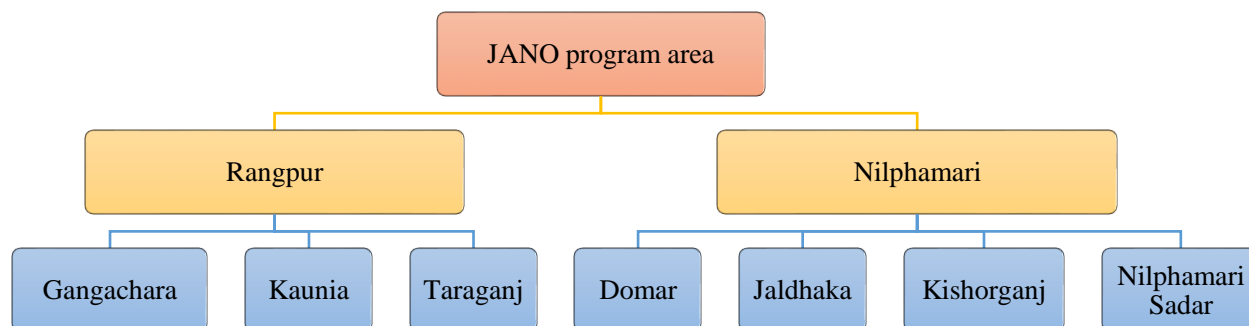
## CHAPTER 2: METHODOLOGY

### STUDY DESIGN

This study employed a cross-sectional design, utilizing a mixed-methods approach to collect both qualitative and quantitative data. A short survey was conducted to assess the knowledge, attitudes, and practices (KAP), including the willingness to pay for fortified products among pregnant and lactating women in remote rural settings. At the same time, qualitative data collection approaches such as in-depth interviews (IDI), and Key Informant interviews (KII) were used to explore perceptions regarding the advantages and disadvantages of fortified food products, acceptability and affordability, preferred channels for distribution of fortified food products, existing barriers to access the distribution channels, availability of public and private distribution channels and their challenges in reaching the last-mile population. Respondents included pregnant and lactating women (PLW), married and unmarried adolescent girls, and public-private suppliers.

### STUDY AREA

The data was collected from seven Upazilas of Rangpur and Nilphamari districts. Out of seven Upazilas, three were from Rangpur and four from Nilphamari districts.



**Figure 1: Study area selection**

## DATA COLLECTION

A team of experienced investigators from icddr,b oversaw overall coordination of the study. The team developed the data collection tools after desk review and in consultation with the CARE Bangladesh team. The data collection tools were then pre-tested. Based on the results of the pre-tests, the tools were modified and further contextualized before finalization. Guidelines were developed and finalized for qualitative and quantitative data collection procedures in consultation with the CARE Bangladesh team.

A team of efficient and experienced data collectors was recruited and trained on the specific data collection tools for this study. The training module for data collectors included interviewing techniques and specific instructions for each of the data collection questionnaires and checklists. Research Investigators, the Project Research Physician and the Senior Research Officer monitored the qualitative and quantitative data collection team very closely at field sites and communicated with study investigators on a regular basis. Standardization procedures were done before and during the study to ensure similarity in measurement techniques among staff members, and standard study protocols were established for all data collection procedures. Guidelines used for the collection of information were translated into the local languages appropriate to the communities.



## **SAMPLING STRATEGY AND SAMPLE SIZE**

### **Quantitative**

A two-stage cluster sampling method was used to carry out the study. In the first stage, one union was randomly selected from each selected upazila. Then, two mouzas/villages were randomly selected from the selected unions. Probability Proportional to Size (PPS) sampling was applied for mouza/village selection. Considering the prevalence of fortified food intake by women of reproductive age, around 500 women were needed to conduct the survey. We used Hays and Bennet statistical method with enough statistical power to calculate the sample size. To estimate the sample size we considered 95% confidence level, 80% statistical power, 1.25 design effect and 5% non-response rate. Finally, we were able to interview with 507 women, including the adolescents.

### **Qualitative**

Study participants were selected using the purposive sampling method and the sample size was determined in the field based on data saturation. A qualitative sampling frame was developed taking into account factors such as age, gender, and location-specific recommendations. Within the sampling frame, age group (e.g., age of the pregnant and lactating mother), sex (male and female), profession, duration of the job, education, etc. were included. Additionally, a snowball sampling technique was used to find the relevant respondents. Participants of the study included pregnant and lactating women (PLW), PLW's husband and in-laws, health workers, and members of the Community Support Group (CSG). We also interviewed public and private suppliers and producers of fortified food items. Apart from this, we also included shopkeepers, dealers, and retailers as key informants for the market observation. We selected six market actors from each upazila (sub-district) totaling 42 actors across sub-districts. In each selected upazila, we identified the closest market to the community and randomly chose six shopkeepers who sold fortified food items for the interview. For public-private suppliers and producers' interviews, we selected actors in the GoB's Food Friendly Program based on their availability for the interview. We selected Upazila Food Controller (UCF), Food Officer, TCB dealer, VGF dealer and other private dealers and retailers of private companies deal with fortified foods.

**TABLE-1: DATA COLLECTION FROM DIFFERENT SOURCES**

Method	Participant	Rangpur	Nilphamari	Male	Female	Total
KII	Public Producer and Supplier of fortified food	2	5	7	0	07
	Private Producer and Supplier of fortified food	4	5	9	0	09
IDI	Husband, pregnant and lactating woman	09	14	6	17	23
IDI	Married and unmarried adolescent girls	06	08	0	14	14
IDI	In-laws, CSG members and health workers	06	09	2	13	15
Market observation	Interview with shopkeepers	18	24	42	0	42
Household Survey	Women	215	292	0	507	507

**DATA COLLECTION METHOD**

Data collection procedures were designed keeping Covid-19 pandemic in mind. To utilize time efficiently, we conducted some interviews with husbands and PLW over phone calls as the whole country was under lockdown. Later, after lockdown was lifted, we visited the study area to collect information which was not possible to collect over phone call. All the consent forms were translated into local languages. Verbal consent was obtained before the start of each phone call interview, and written consent was obtained during face-to-face interviews. For the participants who did not have any formal education we read out the consent form and they signed it. Furthermore, we ensure signature of the witness in the consent forms.

**Quantitative data collection**

To begin the quantitative survey, the midpoint of the study area was first determined in consultation with the community people. The data collectors then went to the midpoint and using the random walk method, spun a bottle to determine the direction to start searching for eligible participants. Interviewers visited every household on next-door basis according to the direction of bottle and eligible participants were identified and interviewed after obtaining their written consent. Data was collected in this procedure until the cluster's required sample size was met. During household visits, if any eligible respondents were reported to be absent, data collectors returned at least two more times to attempt to interview the participant.

Survey data was collected electronically using KoBoToolbox to collect data via TAB/mobile. KoBoToolbox is a free, open-source tool for mobile data collection, available to all. Data collection by KoBoToolbox is much more accurate and faster as data validation can occur in real-time as data is collected [8].

### **Qualitative data collection**

Desk reviews were carried out in order to understand the topic profoundly and inform development of data collection tools. Interview guides and guidelines were pre-tested before final data collection. A structured form was used at the end of each interview to collect socio-demographic data from the respondents. In-depth Interviews (IDI) and Key Informant Interviews (KII) were conducted to explore the perceptions regarding the advantages and disadvantages of fortified food products, acceptability and affordability, preferred channel for distribution of fortified food products, existing barriers to access the distribution channels, availability of public and private distribution channels and challenges in reaching the last-mile population.

For quality assurance, a team of efficient and experienced data collectors were recruited, trained, and standardized on specific data collection tools. The training module for data collectors included interviewing techniques and specific instructions for each of the interview guides, guidelines, forms, and checklists. Research Investigators, the Senior Research Officer, and Senior Research Assistant collected data and monitored the data collection team very closely at field sites and communicated with the Principal Investigator on a regular basis. Study investigators visited field sites to ensure the quality of data collection. Spot checks, re-interviews and cross-checks were done to ensure the quality of the data. Guidelines used for the collection of information were translated into the local languages appropriate to the communities.



## DATA ANALYSIS

### **Quantitative component:**

Quantitative analysis was conducted using the statistical software package STATA 17. Descriptive analyses were conducted to summarize the basic features of the study population. Means and frequencies were computed for continuous and categorical variables, respectively.

**Qualitative component:** Qualitative data was analyzed using the ‘Framework Approach’. The Framework approach provides researchers with a systematic structure to manage, analyze and identify themes, enabling the development and maintenance of a transparent audit trail. It is particularly useful with large volumes of text and is suitable for use with different qualitative approaches. The steps mentioned below were used to analyze the qualitative data.

Step one: An outline of the purpose and plan of data analysis was developed at the initial stage of data collection. At this stage, the researchers listened to the recorded interviews conducted in different sub-districts and districts to identify the discussed issues, new emergent issues, strengths and weaknesses of the interview techniques, and any missed opportunity for further exploration. This step is essential to improve the quality of future interviews and for starting the initial data analysis.

Step two: The recorded interviews (conducted in the native language, Bengali) were transcribed in their original form as soon as they were available, termed as “verbatim transcription”. In verbatim transcription, everything that is said and the way it is said is transcribed, without editing or changing the conversation. Field notes and interviewers’ observations were also incorporated into the transcriptions.

Step three: To identify gaps in the data that may need further clarification, transcribed data from interviews were compared to assess how similar issues are discussed by different types of interviewees. This helps improve further interviews in terms of deeper exploration.

Step four: Before looking at the raw data, a set of a priori codes based on the interview guidelines and study objectives were prepared. The data analysis team therefore assigned these a priori codes

to each transcription, which is the first step of coding and transcription. Next, relatively similar codes were aggregated to a narrower set of codes. Such condensing continued until concrete themes emerged for a final set of codes. Throughout these steps, the coders re-examined all interviews to ensure all raw codes from the previous steps are included into the next step of coding.

Step five: Emerging themes and sub-themes were identified, and common ideas and recurrent themes were highlighted. Key issues, concepts, and themes were identified based on actual data aligned with the objectives of the study.

Final Step: In the last step of data analysis, data were systematically indexed or coded, synthesized and interpreted with a view to provide explanations of the findings.

#### **POVERTY PROBABILITY INDEX (PPI) SCORING**

PPI is a simple and statistically sound poverty measurement tool that determines the likelihood of a household living below the poverty line by answering 10 questions about the household's characteristics and asset ownership. In our study, we used this method to measure the socio-economic status of study participants. We used Mark Schreiner's Simple Poverty Scorecard Assessment tool for Bangladesh to compute the PPI score [9]. A social enterprise specialized in Low-Income Financial Transformation (L-IFT) used the PPI score in a slightly modified manner. We used almost similar type of cut off point for wealth classification in this study [10].

## CHAPTER 3: BASIC CHARACTERISTICS OF STUDY PARTICIPANTS

### SECTION-3.1: BACKGROUND CHARACTERISTICS OF SURVEY RESPONDENT

**TABLE-2: CHARACTERISTICS OF SURVEY RESPONDENTS**

Traits	Rangpur n=215 (%)	Nilphamari n=292 (%)	Total N=507 (%)
<b>Age of the respondents</b>			
15-19 years	40 (18.6)	50 (17.1)	90 (17.8)
20-24 years	64 (29.8)	113 (38.7)	177 (34.9)
25-29 years	61 (28.4)	69 (23.6)	130 (25.6)
30 years and above	50 (23.3)	60 (20.6)	110 (21.7)
<b>Religion</b>			
Islam	214 (99.5)	247 (84.6)	461 (90.9)
Hindu	1 (0.5)	45 (15.4)	46 (9.1)
<b>Education of respondent</b>			
No education	9 (4.2)	14 (4.8)	23 (4.5)
Primary incomplete (Class 1-4)	27 (12.6)	38 (13.0)	65 (12.8)
Primary complete (class 5)	17 (7.9)	40 (13.7)	57 (11.2)
Secondary incomplete (class 6-9)	91 (42.3)	125 (42.8)	216 (42.6)
SSC and higher	71 (33.0)	75 (25.7)	146 (28.8)
<b>Respondent's occupation</b>			
Homemaker	208 (96.7)	279 (95.6)	487 (96.1)
student	2 (0.9)	1 (0.3)	3 (0.6)
Others	5 (2.3)	12 (4.1)	17 (3.4)
<b>Marital status</b>			
Married	215(100.0)	287 (98.3)	502 (99.0)
Separated	0(0.0)	5 (1.7)	5 (1.0)
<b>Education of husband</b>			
No education	45 (20.9)	51 (17.5)	96 (18.9)
Primary incomplete (Class 1-4)	31 (14.4)	45 (15.4)	76 (15.0)
Primary complete (class 5)	26 (12.1)	46 (15.8)	72 (14.2)
Secondary incomplete (class 6-9)	56 (26.1)	70 (23.9)	126 (24.9)
Class 10 and above	57 (26.5)	80 (27.4)	13 (27.0)
<b>Husband's occupation</b>			
Service holder (Both Govt. and Non-govt.)	8 (3.7)	8 (2.7)	16 (3.2)
Business and Handicraft	64 (29.8)	94 (32.2)	158 (31.2)
Transport worker (motorized/manual)	28 (13.0)	34 (11.6)	62 (12.2)
Day labour, Skilled labour	92 (42.8)	101 (34.6)	193 (38.1)
Agriculture/Farming/fisherman	22 (10.2)	49 (16.8)	71 (14.0)
Others	1 (0.5)	6 (2.1)	6 (1.4)
<b>Family members involved in income generation</b>			
One	159 (73.9)	206 (70.6)	365 (72.0)
Two	44 (20.5)	66 (22.6)	110 (21.7)
Three	10 (4.7)	16 (5.5)	26 (5.1)
Four	2 (0.9)	4 (1.3)	6 (1.2)
Mean	1.3	1.4	1.3
<b>Household monthly average income</b>			
<5000 BDT	7 (3.26)	7 (2.40)	14 (2.76)
5000-9,999 BDT	94 (43.72)	118 (40.41)	212 (41.81)
≥10,000 BDT	114 (53.02)	167 (57.19)	281 (55.42)

Most of the survey respondents (35%) were in between 20 to 24 years age category followed by 26% in 25-29 years and 22% in 30 years or more. In terms of the religion of the respondents, 91% respondents were Muslims and 9% were Hindus. In Rangpur, area only one respondent was Hindu. Educational qualification of the respondents in both area are similar. Most of the respondents were between class 6 to 9. Almost 96% respondents were homemakers. Ninety-nine percent respondents were currently married. Almost 19% respondent's husband did not have any formal education and 15% could not complete primary education. Most of husband's occupation were day labor/skilled labor (38%) followed by 31% were involved with business and handicraft. Mean numbers of family members involved in income generation was 1.3. Almost 55% household monthly average income were 10,000 BDT or more.

**TABLE-3: MARRIAGE AND REPRODUCTIVE INFORMATION OF SURVEY RESPONDENTS**

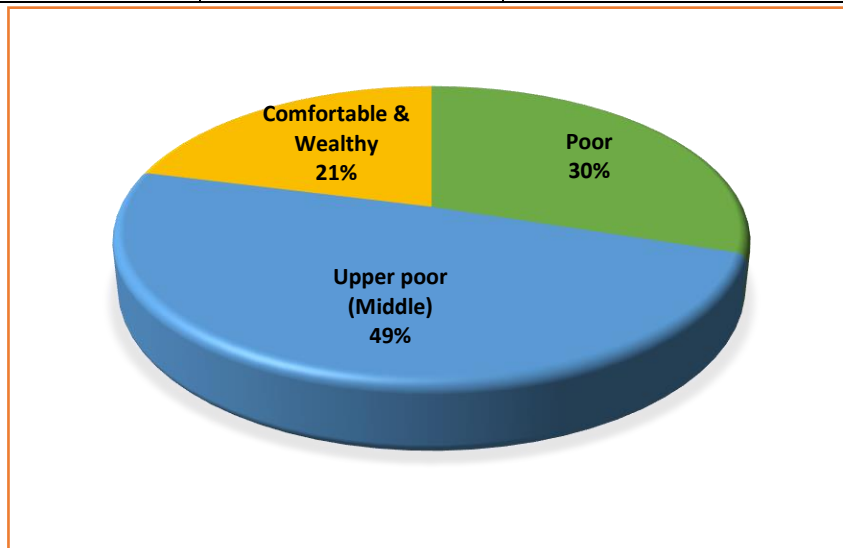
<b>Traits</b>	<b>Rangpur n=215 (%)</b>	<b>Nilphamari n=292 (%)</b>	<b>Total N=507 (%)</b>
<b>Age at first marriage (completed years)</b>			
<18 years	156 (72.6)	228 (78.1)	384 (75.8)
18-20 years	41 (19.1)	53 (18.1)	94 (18.5)
≥21 years	18 (8.3)	11 (3.8)	29 (5.7)
<b>Age during first delivery of baby</b>			
<18 years	101 (47.0)	136 (46.6)	237 (46.8)
18-20 years	79 (36.7)	122 (41.8)	201 (39.6)
≥21 years	35 (16.3)	34 (11.6)	69 (13.6)
<b>Pregnancy Status of the Respondent</b>			
Currently pregnant	27 (12.6)	41 (14.0)	68 (13.4)
Not pregnant	188 (87.4)	251 (86.0)	439 (86.6)

Marriage is the leading social and demographic indicator and demographic indicator of the exposure of women to the risk of pregnancy. Marriage in Bangladesh marks the point in a woman's life when childbearing becomes socially acceptable. Age at first marriage has a major effect on child bearing because the risk of pregnancy depends on the age at which women first marry. Women, who marry early, are more likely to have their first child at a young age, give birth to more children, and contribute to higher fertility. Majority of the survey respondents (76%) were married before 18 years of age and almost 47% respondents had given birth to their first child before 18 years. Around 13% respondents reported to be pregnant at the time of interview.

**TABLE-4: SOCIO-ECONOMIC STATUS OF SURVEY RESPONDENTS**

Wealth Index	Rangpur n=215 (%)	Nilphamari n=292 (%)
Poor	67(31.1)	84(28.8)
Upper poor (Middle)	104(48.4)	147(50.3)
Comfortable and Wealthy	44(20.5)	61(20.9)

Almost half of the respondents (50%) belongs to upper poor (Middle) group followed by 30% respondents are from poor group and 21% from comfortable & wealthy group.

**Figure 2: Socio-economic status of respondents**

### SECTION-3.2 BACKGROUND OF QUALITATIVE PARTICIPANTS

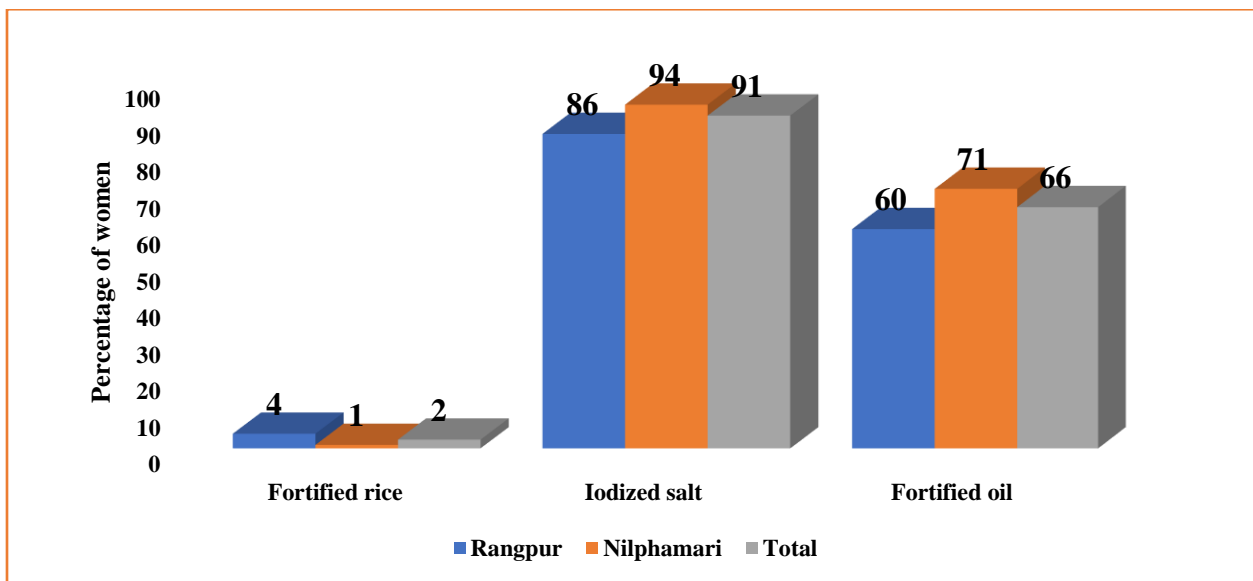
All the participants (PLW) were between 18 and 40 years of age. Almost all the participants (PLW) reported learning up to 10<sup>th</sup> grade while some of them could only sign. All the participants (PLW) had a monthly average family income of 6000-15000 BDT. All PLWs were housewives. Within the PLW, very few had pucca houses while most of them had semi-pucca houses in tin shades. We interviewed seven husbands and three of them were day laborers, one was a businessman and three were rickshaw pullers. Of the 14 married and unmarried adolescents, six are from low-income (BDT 6,000 per month) households, six more are from middle-income (BDT 8,000-1,0000 per month) and the other two are from the 12,000 BDT plus income group per month. The level of higher education in adolescence was grade 10 and the lowest grade was 6. We interviewed 5 in-laws and they are all women and from the mixed-income groups with low and high income in the local socio-economic context. Of the five CSG members interviewed, the highest education was at the higher secondary level and the lowest was at the secondary level. One of them had two years of experience in the CSG committee and the other four had more than two years. Most of the health workers had higher secondary degrees. Out of 42 shopkeepers, 6 were wholesalers and 34 were retailers. We also interviewed 9 private suppliers and 7 government producers.

## CHAPTER 4: KNOWLEDGE, ATTITUDE & PRACTICE

### SECTION-4.1: KNOWLEDGE

#### 4.1.1 IDENTIFYING FORTIFIED FOOD

From both qualitative and quantitative data, most respondents were found to be unfamiliar with the term ‘food fortification’ and did not understand that micronutrients can be added externally to enhance the nutritional value of a food item. The quantitative data, presented in table 6, shows that only 41% of the respondents heard the term ‘food fortification’, and the percentage was slightly higher in Rangpur than Nilphamari, about 46% and 38% respectively. About 34% of the respondents explained ‘food fortification’ as a process where micronutrients are added to foods, and 52% of them had no knowledge about the process of ‘food fortification’. Around 91% of respondents mentioned that iodized salt is available in their area, followed by 66% mentioning fortified oil (*figure 3*).



**Figure 3: Percentage of respondents who could identify fortified food items available in the area.**

A housewife and pregnant woman said,

*“I know a little about the salt, it is advised to eat iodized salt” -IDI 79, Kishoreganj, Nilphamari*

Only one respondent (housewife and pregnant women) recalled zinc rice as a fortified food,

*Oh yes! The madam in the courtyard meeting said something about fortified food...fortified rice, it has zinc in it. – IDI 38, Rangpur*

Few of them mentioned they may have heard of it but cannot remember and among those who said they did not know about fortified foods stated,

*“I cannot say about it, I haven't heard about fortified foods, I could've said something about it had I heard of it”- ID-79, Nilphamari*

Many of the respondents identified noodles, biscuits, dairy milk, cake, Horlicks and flour as fortified foods though such food items are not available as fortified food in the country. They considered any packaged food as qualityful, and few of them considered these packaged food (refined sugar, foods made with milk and egg, etc.) as fortified food.

The commonly available fortified food items in the rural areas, vitamin A fortified soybean oil, iodized salt, and zinc rice, were not recognized as fortified food by most consumers. Fortified food was in fact, found to be defined by the respondents as ‘packaged oil’ or ‘bottled oil’ for oil and salt as ‘packaged salt’.

One husband said,

*“I always like bottled oil for cooking. Because bottled oil is clean and pure. I buy whichever oil is available at the shop. But I do check that they are not giving palm oil. ” -IDI 05, Husband, Rangpur*

On the other hand, Zinc rice was not known to most of the respondents. Quantitative data also supports the unfamiliarity with zinc rice presented in *figure 3*.

On the contrary, a handful of the respondents believed that cooking oil sold in sealed bottles is the same as oil sold unsealed in the market, similar belief was found to hold for salt as well. One husband in the respondent group said,

*“I think the openly sold cooking oil and the bottle are the same in terms of vitamins. Companies refine the oil sold in the open and refill it in packets then they increase the price. So, people believe that it is a better oil. In fact, they are equal in all aspects”. IDI 17, Husband, Kishoreganj, Nilphamari.*

One of the non-iodized salt user lactating mothers said,

*“We have been using non-packet salt for many years. There is no difference between packet and non-packet salt.” IDI 15, Lactating Mother, Kishoreganj, Nilphamari*

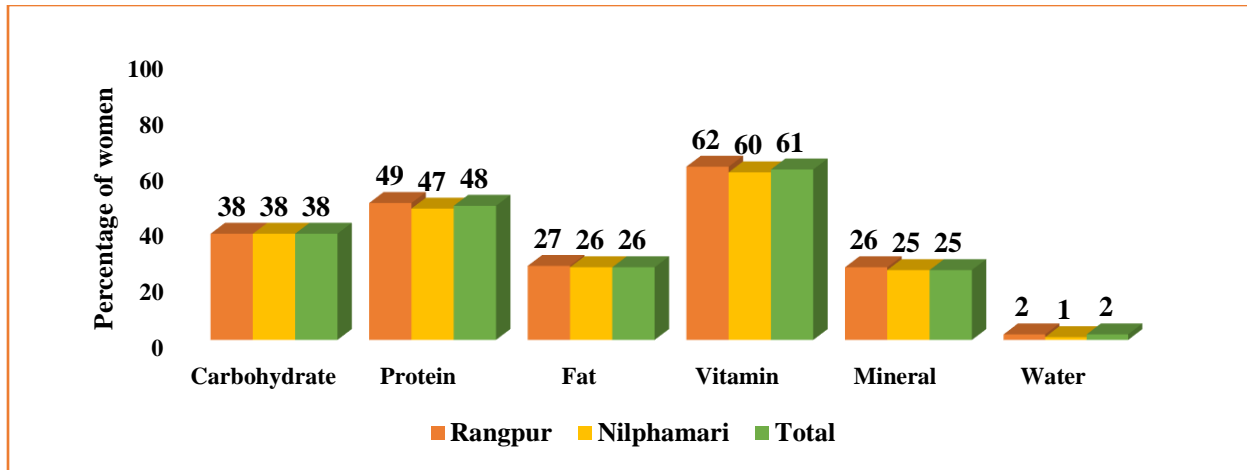
From the market observation, we found similar findings. About 86% of the sellers identified that most of the people did not know about the fortified foods.

#### **4.1.2 Identifying Nutritious Food**

Respondents recognize nutritious foods without much probing and can name nutritious foods available in their area. Eggs, spinach, colorful vegetables, fish, and milk are commonly mentioned by them. They also talked about fruits such as bananas, apples, papayas, and vegetables such as, green vegetables, basil leaves, red amaranth, water amaranth, and radish leaves as nutritious foods. They had the clear understanding of the differences between terms like “nutrition-dense” foods and “processed foods.” A respondent (pregnant woman) said,

*“[...] we are advised to eat nutritious foods like salt, oil, then egg, banana, milk, chicken gizzard, fish-meat, even I know these are nutritious food” -IDI 37, Pregnant Women, Domar Nilphamari*



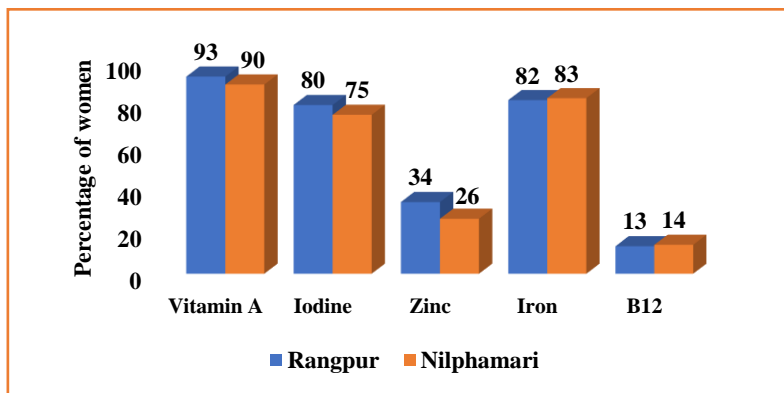


**Figure 4: Percentage of women who could mention major nutritive element present in food**

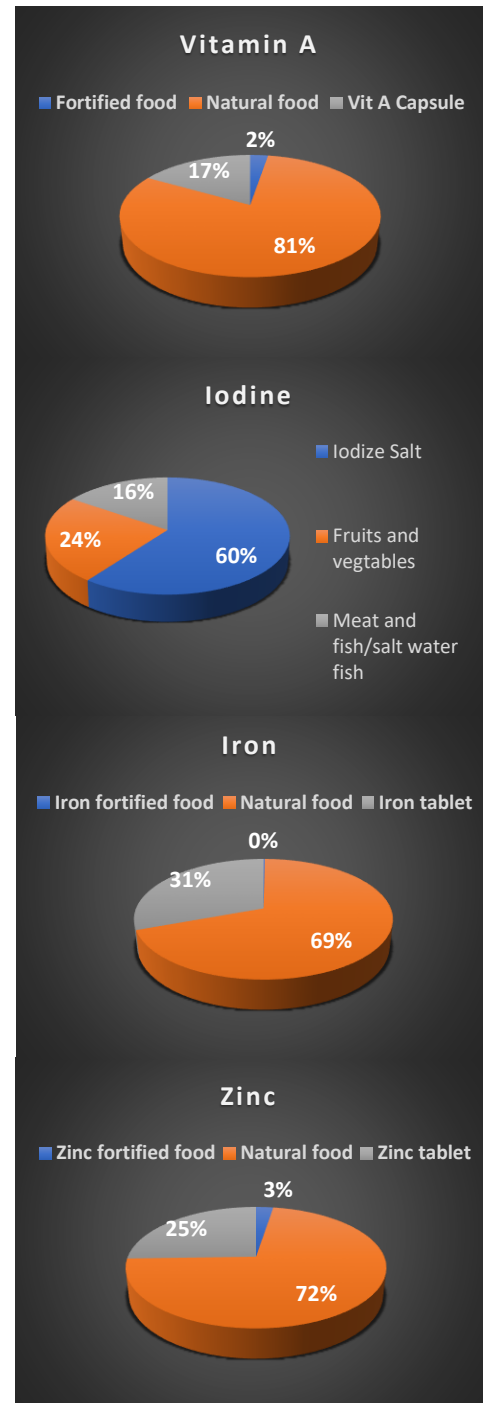
To have a better understanding of their knowledge on nutritious food, the quantitative survey had asked them what nutrients can be found in food, both areas had almost similar responses. Survey data presents that vitamin (61%), protein (48%), carbohydrate (38%), and fat (26%) were the frequently mentioned nutritive element by the respondents that are present in food (*figure 4*).

### 4.1.3 KNOWLEDGE ON MICRONUTRIENT DEFICIENCY & APPROACHES TO ADDRESS IT

From the qualitative interviews the micronutrient deficiency that was reported most by the participants were of iodine. Respondents were well aware that iodized salt is beneficial for their health and prevents goiter. Quantitative survey further explored their knowledge on micronutrient deficiency, presented in *figure 6*. Both the areas had almost similar level of knowledge on micronutrient deficiencies, vitamin A deficiency is widely known, followed by iron deficiency and iodine deficiency. Quantitative survey also explored the knowledge on the approaches that can be taken to address the specific micronutrient deficiency. For vitamin A, Zinc, and iron deficiency majority responded that natural food intake can overcome the deficiency while for iodine deficiency majority said that intake of iodized salt as an approach to address the deficiency (*figure 5*).



**Figure 6: Percentage of respondents who had heard about micronutrient deficiencies**



**Figure 5: Ways to address micronutrients deficiencies**

## **SECTION-4.2: ATTITUDE**

### **4.2.1 PERCEIVED BENEFIT FOR FORTIFIED FOOD**

From the quantitative data presented in *table 6*, almost all the respondents (99%) reported that fortified food was beneficial for mothers who breastfeed, adolescents, and children and 59% of the respondents explained that fortified food improved adolescents' overall health. Nearly 38% explained fortified foods help adolescent girls to grow to as a healthy woman. Seventy-one percent of respondents replied fortified food was beneficial for pregnant and lactating women to improve their overall health, whereas 62% mentioned about healthy pregnancy outcome. About 80% of the respondents replied that fortified food improved health status of the children whereas these percentages was similar in Rangpur than Nilphamari, 79% & 81%, respectively. However, 46% of them replied that food fortification reduced disease among child and 28% mentioned that fortified food increase IQ level. More than 40% of the respondents replied to Vitamin A, 69% replied iodine, about 19% of the respondents replied about iron were the main micronutrients used for making fortified food.

After the respondents were explained about the food fortification process, most of the respondents stated that consuming fortified food was beneficial for health. Most could not specify what the benefits were, but very few mentioned about boosting immunity, improving hemoglobin level, improving digestion, and improving brain development of children, preventing goiter and night blindness as the benefits of fortified food.

### **4.2.2 PERCEIVED DISADVANTAGES FOR FORTIFIED FOOD**

From the qualitative exploration, it was found there were no perceived disadvantages reported by the respondents. Only two had responded that fortified food cause health risks e.g. heart problem, as a result of adulterations and one reported that it caused indigestion.

Though many respondents think that fortified foods are not affordable (discussed in Chapter 5) they do not perceive it as a disadvantage of the fortified food itself.

### 4.2.3 PERCEPTION ABOUT FORTIFIED FOOD SELLERS (LACK OF TRUST)

Respondents were explained that companies add vitamin A in the cooking oil and iodine to the salt. Few said they do not believe that the fortified food products carry any extra food value due to the presence of artificial elements. They think fortified foods are not equal in terms of nutrition value in comparison to natural foods. Few respondents also stated that they do not believe the television advertisements shown on fortified foods.

Few respondents informed that the color of bottled soybean oil (non-popular brand) is dark and in winter it solidifies, and it happens because it is mixed with palm oil. This makes them think that fortified oil claimed by the companies are in fact adulterated oil.

One of the mothers (breastfeeding) said,

*“The companies advertise the product in a way that the product carries all the nutrition elements, and it is the best product. But I found the oil freezes when kept in the refrigerator.” -IDI 11, Lactating Mother, Nilphamari*

One mother mentioned,

*“The color of the oil was not clear. The color of the curry will not be good if I use that oil. I think they mix something with the oil. So, it is not pure.” IDI 06, Lactating Mother, Rangpur*

### 4.2.4 PERCEIVED INCREMENTAL COST AND WILLING TO PAY

Respondents who use fortified foods reported having to spend more which was becoming a burden to them. Those who used fortified oil spent an average of 133 BDT per week to buy it. On the contrary, those who used non-fortified oil spent only 52 BDT per week (*table 7*). For iodized salt, an average of 18 BDT was spent per week (*table 8*). Despite the increased cost, respondents were willing to spend on fortified food, considering its beneficial health effects. In addition to the regular household expense, respondents were willing to spend 107 BDT (*table 7*) per week for fortified oil and 15 BDT (*table 8*) for iodized salt per week. Though they have to spend more, they said they still buy fortified foods because it is beneficial health-wise. A respondent had said,

*“I am spending more, but still have to buy it for my own good...these are more expensive than the regular items. My monthly expenditure has increased” -IDI 39, Husband, Nilphamari*

## SECTION-4.3: PRACTICE

### 4.3.1 VITAMIN A FORTIFIED OIL

Qualitative interviews explored that many participants in both districts use non-bottle cooking oil. They think they have been using non-bottled oil for many years and do not have any health problems. So, they do not want to switch to bottled oil. The major issue they mentioned for not consuming bottled oil was the price; some stated that they get larger quantity at a lower price for open oil. They also do not believe that bottled oil is different from non-bottle one.

Many of them switched from oils sold openly to fortified cooking oils, thinking of the effects of poor health, including acidity, stomach problems, and even vomiting. Another major reason for switching was the cleanliness of the bottled oil. In addition, food cooked with adulterated oil is spoiled in a short time during storage. Some of households who had regular monthly income purchase bottle oil. This income group had a positive perception of the bottle oil. One of the breastfeeding women said,

*“The bottled oil tastes good when used. There is no adulteration in the oil and there is no dirt, so I like it. The oil looks transparent, and shiny.” -IDI 17, Lactating Mother, Nilphamari*

Another participant said,

*“Bottled oil looks clean or pure. There is no dirt. The oil looks beautiful and golden. The oil tastes good and I like to eat curry. But I don't know what nutrients are in the oil.” IDI 18, Mother, Nilphamari*

There were some consumers (mainly daily wage earners) of non-bottle cooking oil who had no regular monthly income, but they also had positive perception about bottled oil. They cannot consume bottled oil because they think they cannot afford it with their limited income. A lactating woman of a day laborer household said,

*“We know that the non-bottle cooking oil is adulterate and not good. It often freezes inside the bottle and causes hassle during cooking. But we have no other choice, we have to use it because we get it at a relatively low price.”-IDI 19, Lactating Mother, Nilphamari*

From the quantitative data, we see that 91% of the population had heard of vitamin A deficiency and about 74% had the knowledge that not taking vitamin A rich food can lead to vitamin A deficiency.

### 4.3.2 IODIZED SALT

Qualitative interviews found that most of the interviewed participant holds the perception that packet salt is fresh and there are no adulterations. Some participants know that the salt in the packet contains iodine which is good for health. A large number of the interviewed households use iodized salt. They differentiate between salt as non-packet salt is for cattle and packet salt is for human consumption.

One of the husbands of a pregnant woman said,

*“While the price of unpacked salt is lower than that of packet salt, non-packet salt looks dark. It seems that salt is mixed with dirt. This salt is harmful to health. We can’t clean or wash the salt so it can ruin the curry. So, I would never buy unpacked salt.” IDI 13, Husband, Rangpur.*

Some of the respondents from lower economic status have the perception that non-packet salt is thicker and requires less in the curry than packet salt. On the other hand, middle- and higher-income groups who use iodized salt perceived that the non-packet salt is dirty and adulterated. They also think the grains in packet salt is finer; hence, a small amount is needed for cooking.

Few of the pregnant and lactating women who used iodized salt and fortified soybean oil have reported to be consuming it for a long time in their paternal house and many of them ensured use of iodized salt at their in-law’s house because of their previous experience. On the contrary, despite knowing the benefits of iodized salt and soybean oil they still consumed bulk salt and open oil as they are habituated to it. It was also reported by many participants that packaged iodized salts were opened and sold in small quantities to several customers as all customers cannot afford to buy one whole packet of salt.

From the market observation (presented in *table-15*), about 92% of the grocery shops were found to have fortified oils and iodized salt; whereas only 26% of grocery shops have fortified dairy products (*Shakti Doi*). We did not find fortified/zinc rice in any grocery shops. Majority of the grocery shops (41%) were selling 51-100 liters fortified oil in a month followed by 28% were selling more than 100 liters. Similarly, more than half of the shops (51%) were selling 51-100 kg iodized salt followed by 28% selling more than 100 kg iodized salt in a month. Hence, it shows availability of fortified oil and iodized salt in the local area were found to be sufficient.

Quantitative data from the household survey (presented in *figure 7*) further explored that, about 49% people consume fortified oil and 65% consume iodized salt. On the contrary, only 1% of population consumed zinc-fortified rice.

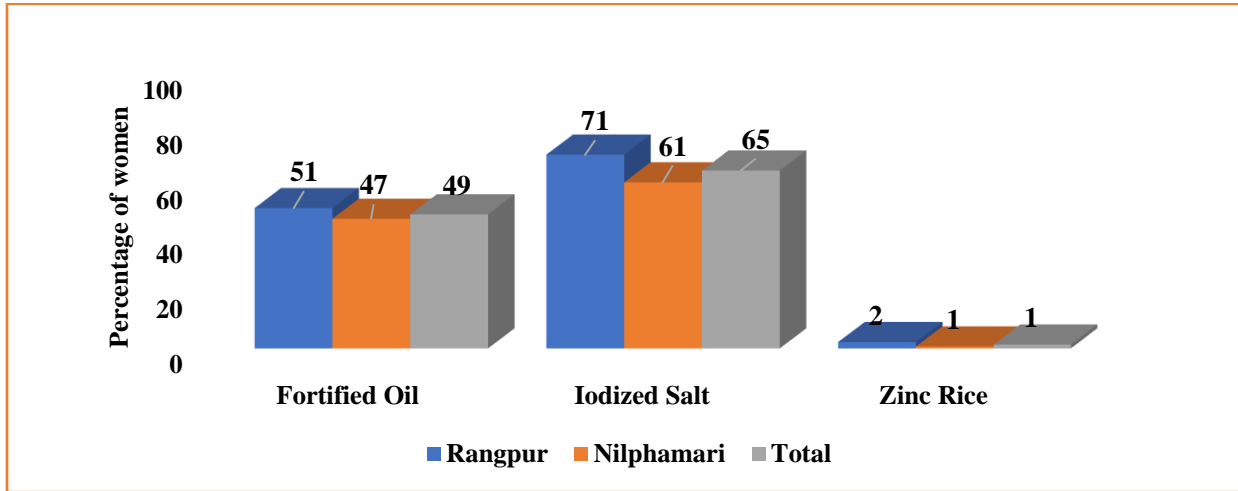
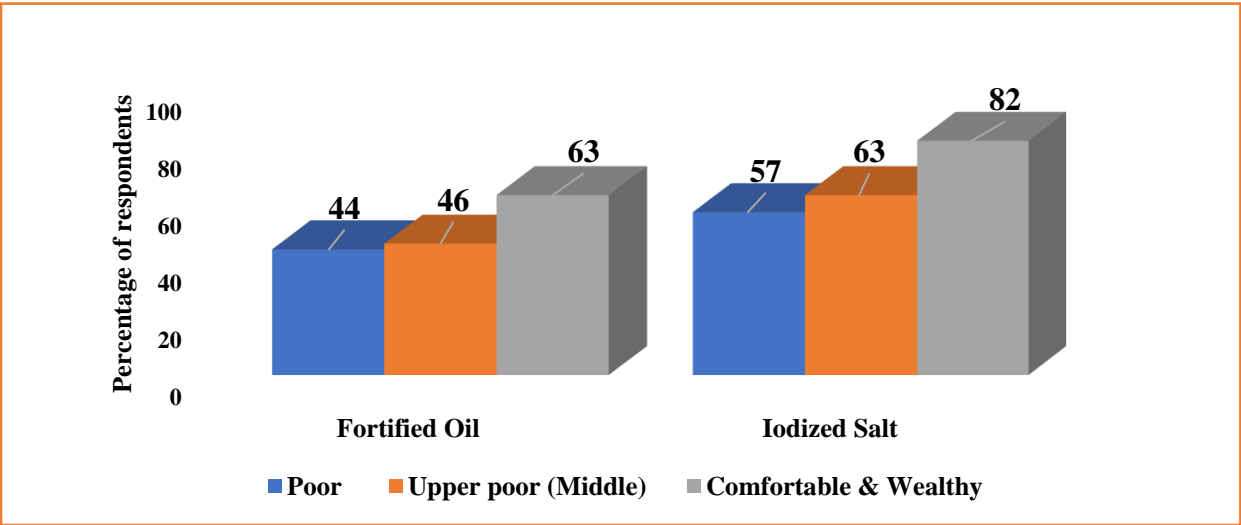


Figure 7: Use of fortified food





**Figure 8: Use of fortified food by socio-economic group**

We wanted to explore whether socio-economic conditions have any influence on the use of fortified food. We found that women in the comfortable & wealthy group were more likely to use fortified food compared to women in upper poor (middle) and poor groups (*figure 8*).

Apart from the socio-economic condition, data from the market observation (presented in *table 16*), revealed that people living nearby the market/ shops (within 4 km distance from the shops) and urban areas usually buy more fortified food.



### Food intake habit of the respondents

From the survey, we wanted to explore the food intake status of the respondents. All the respondents (100%) mentioned that they intake rice daily two-three times per day and 59% respondents' intake potato daily. Almost half of respondents (47%) eat egg 1-2 times per week, 43% eat meat 1-3 times per month and 41% eat fish 3-4 times per week. On the other hand, intake for milk or milk products was consumed never or rarely in a month by almost half of the respondents. Findings suggest, families are heavily relying on carbohydrate followed by protein but rarely having calcium, vitamin and mineral containing foods.

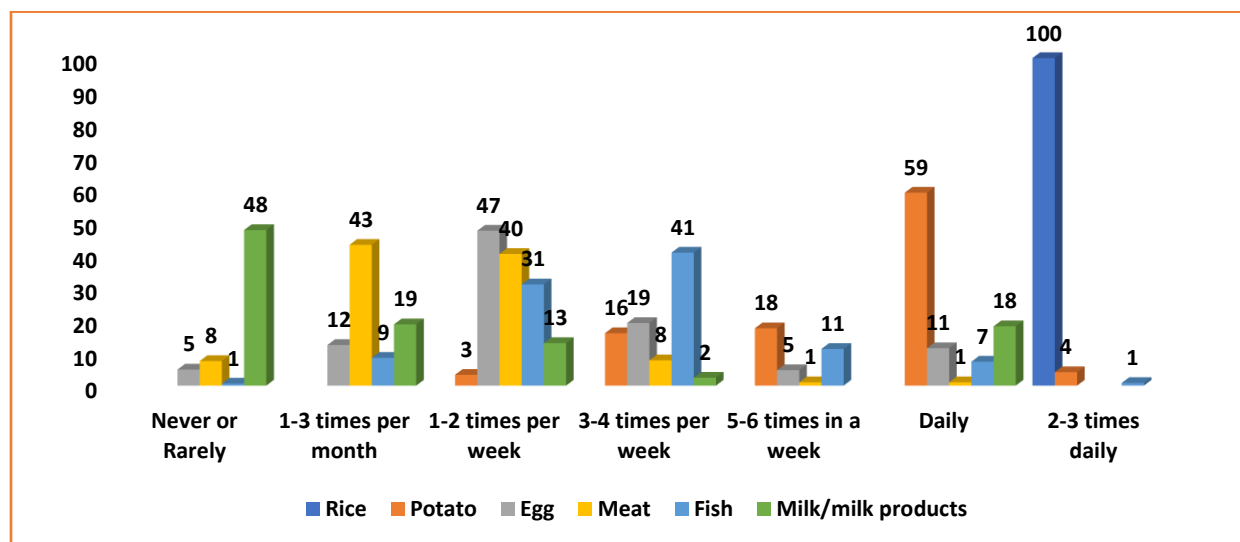


Figure 8a: Food intake status

### 4.3.3 Effect of covid-19 on the consumption of fortified food

Respondents who were from lower socio-economic background (daily labours, no fixed monthly income, loss of job) reported that they had faced difficulty financially due to the Covid-19 pandemic. They had to switch to foods that were cheaper and make choices on which food would last longer at a cheaper price; for example, most of them bought lentils or potatoes instead of buying meat or fish, and those who consumed fortified food (bottled oil & iodized salt) they reduced the quantity but did not stop consuming. Some skip meals and prioritize feeding family members such as elderly parents, pregnant wives, and children.

One small businessman said,

*“I have been spending from my savings, the state of saving is not good now. I am having to spend the money I had saved; covid-19 has been going on for two years now, who know how long it will go on like this” -IDI 42, Businessman, Nilphamari*

Another pregnant woman from a daily wage-earning household reported,

*“Price of everything has increased due to corona, my business was closed for many days, [for which] my income reduced. We ate vegetables that we grew; fruits, meat and milk are expensive, so we ate less of these” -IDI 41, Pregnant Women, Rangpur*

In the quantitative data, presented in table 14, 87% reported that there has been an increase in the price of fortified foods. However, 37% had faced difficulty in buying fortified food and 40% had not been able to buy fortified foods. The most common reason mentioned for not being able to buy fortified food during covid-19 was decrease in income (97%).

## **CHAPTER 5: CHALLENGES IN SUPPLY CHAIN AND MARKET SYSTEM**

### **5.1 COST**

Most of the retailers are bulk oil seller. Retailers said that selling in bulk is profitable and easy to procure with small capital. On the other hand, selling bottle oil requires more capital, which demotivates them to sell fortified oil. Most of the retailers procure bottle oil from local wholesalers with increased price. As a result, they must sell bottle oil with increased price. They enjoy payment flexibility and incentive from the wholesalers based on their business relationship.

People’s current practice of consuming non-bottled oil mostly creates persistent demand of non-bottled oil in the local market especially in the rural areas. Retailers reported that the profit level is low for bottled oil, so local sellers are less interested in selling bottled oil and they influence customer to buy non-bottled or bulk oil. Consumers have mistrust about the biofortification of edible oil that influences their decision of purchasing non-bottled oil. People also have the perception that the price for bottled oil is higher compared to non-bottled oil. Large-scale availability of non-bottled cooking oil at low prices ensures people’s easy access to non-bottled oil. As consumers do not consider fortification status in purchasing decisions. Availability of adulterated oil at large scale in the local market with low prices makes it difficult for companies producing quality products to compete with other companies in terms of price. Quality products

generally have higher prices. The law enforcement department can play a vital role to solve this problem making the market stable.

From market observation, almost 95% (table 16) of the sellers had also identified high price of fortified food as an obstacle in selling fortified food products.

## 5.2 ADULTERATION

Many of the food seller expressed that there are smaller local companies in the market who distribute bottled soybean oil mixed with palm oil which is then sold as fortified soybean oil. This adulteration effects the relationship between the shopkeeper and the customer because of the compromised quality of the oil. In this regard, one of the shopkeepers (retailer) said,

*“In the winter session, most companies stop delivering adulterated oil (the little dark-colored oil) as it freezes in the winter and people do not want to buy it. It also causes confusion with the customer and sometimes creates bad relationships between shopkeepers and customers”. IDI 91, Sadar, Retailer, Nilphamari*

Sometimes non-established companies distribute oil and salt in the market using similar packaging by coping the labels of established brands. Many customers get confused and cannot distinguish between the original and duplicate products. In this regard, one of the retailers said,

*“In the village small shopkeepers who used to buy oil from another big shopkeeper usually sell this kind of duplicate bottled up soybean oil and salt to get some extra benefits”. IDI-87, Sadar, Retailer, Nilphamari*

On the same issue, one of the retailers explained,

*“The rural shopkeepers are taking advantages [rather] than the shopkeepers are in the city as the rural people are not that much aware about this”. IDI 98, Domar, Retailer, Nilphamari*

Shopkeepers said most companies do not want to put the expiration date on the product label, rather they prefer to write the date on the bottle where it is not visible. They also said, the common people are not aware about expiration dates. Shopkeepers are facing problems dealing with such

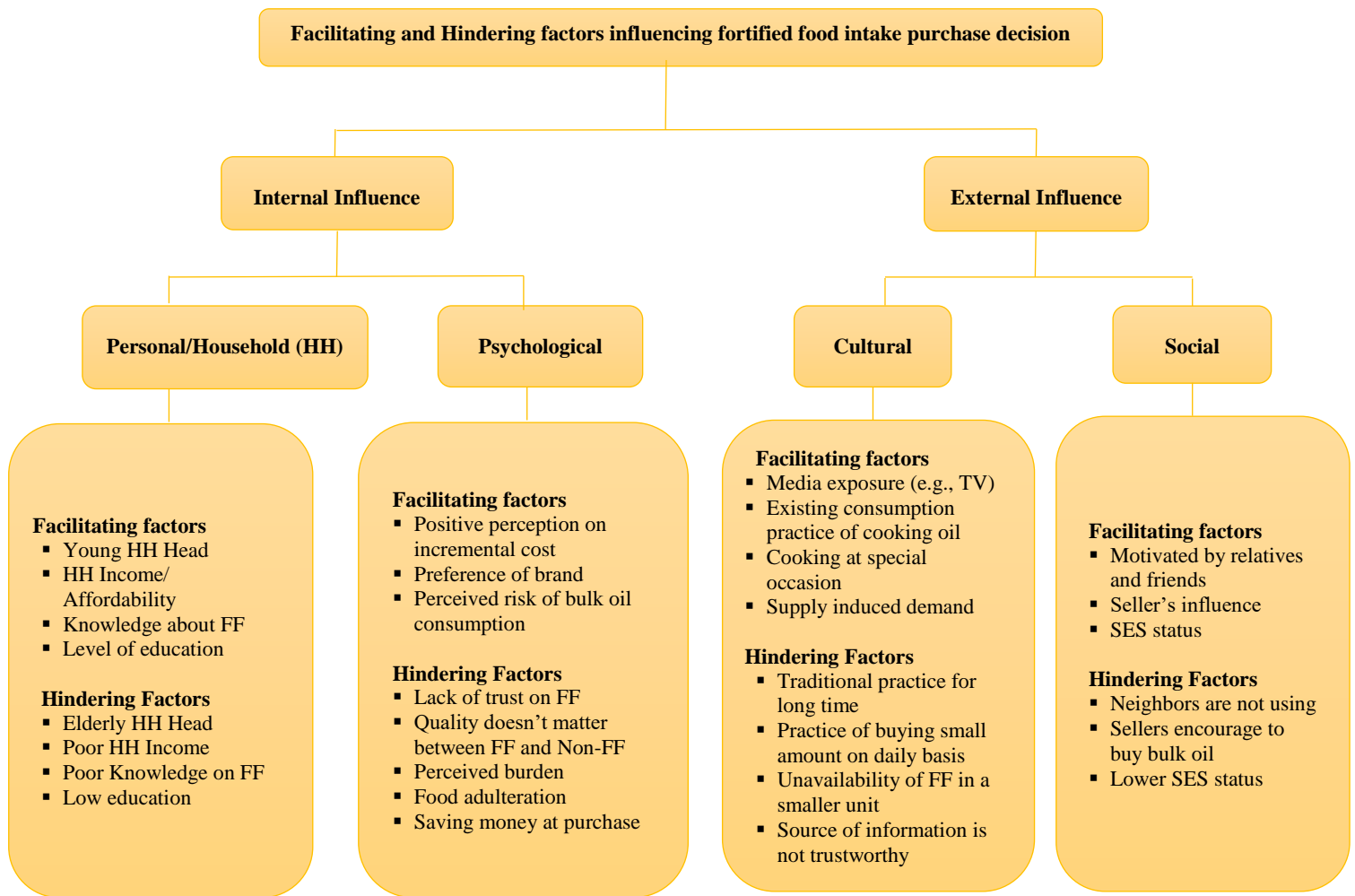
companies; they said they can return date-expired unsold products to a few established companies while some companies don't take it back. Most of the companies show the nutritional values or list of ingredients on their products with very small font size, which is difficult to read.

Private sector actors, including dealers, wholesalers, and retailers, have raised issues that could hinder the distribution of food products at the local level. Retailers have reported that some companies stop marketing palm oil in the winter on soybean oil. As a result, the demand for pure soybean oil increases. Taking this as an opportunity, the wholesalers stockpile huge quantities of soybean oil just before the onset of winter. Which further results in an increase of the price of cooking oil. This affects the accessibility of low-income customers to fortified oil. Retailers also pointed out that many low-income people turn to non-bottled oil because of the high price of soybean oil.

Representatives of the private soybean oil company explained that they simply want to speed up sales and do not support stock piling. They have no system to monitor the stockpile, but they have mentioned that the concerned government bodies should strictly monitor this. They further stated that the demand for soybean oil is low in winter. So overall, the companies are facing the challenge of selling soybean oil in winter, reported that cooking oil is widely adulterated at this time. Local retailers mix palm oil with soybean oil and sell it at a lower price. They further said that this is widely adulterated in village level markets. Wholesalers and private sector dealers are only interested in distributing cooking oils that companies pay commissions and gifts on their sales. For this reason, they promote and sell low quality food products including oil and salt.

## CHAPTER 6: KEY FACTORS INFLUENCING CHOICE

There are several factors that influence consumer behavior when purchasing fortified foods, including cooking oil and salt. Influential factors based on the assessment of the communities of Rangpur and Nilphamari are categorized in the following figure.



**Figure 9: Factors Influencing Choice**

From the study findings, the research team identified and grouped some of the factors that hindered the consumption of fortified food in the study area. In the personal or household level, it has been found that older household heads prefer bulk oils and non-iodized salts due to the increasing costs that are listed in the box of the psychological factors. Also, many families cannot choose fortified products due to poor knowledge about the benefits of fortified food. Affordability has been found to be one of the most negatively influential factors in purchasing fortified food for daily earning

families. Among the psychological factors, people did not trust the fortification of food, whereas many of them wanted to save money when buying products. From market observation data, about 43% of the sellers had identified trust as a barrier to selling fortified foods thinking that consumers did not trust that fortified foods have any nutritional value.

As cultural factors, it was found that the traditional practice of using non-fortified foods prevented them from consuming fortified foods. Also, the habit of buying a small number of products every day and the unavailability of fortified food (oil and salt) in small units prevents them from buying fortified food. The team explored social factors that affect the use of fortified products by relatives and friends who consume non-fortified foods frequently. In some cases, it has been found that sellers recommend buying non-fortified foods that support the buyer’s idea of saving money. Many respondents think they are economically unable to purchase and cannot afford fortified food.

### 6.1 DECISION MAKER OF THE FAMILY

Though the target population are the pregnant, lactating and adolescents, from the qualitative and quantitative data (*figure 10*) it is understood that it is not only important to educate pregnant, lactating and adolescents but also to educate the household heads such as fathers-in-laws and husbands because the purchasing decision comes from them. Therefore, the program implementers should also target the household heads.

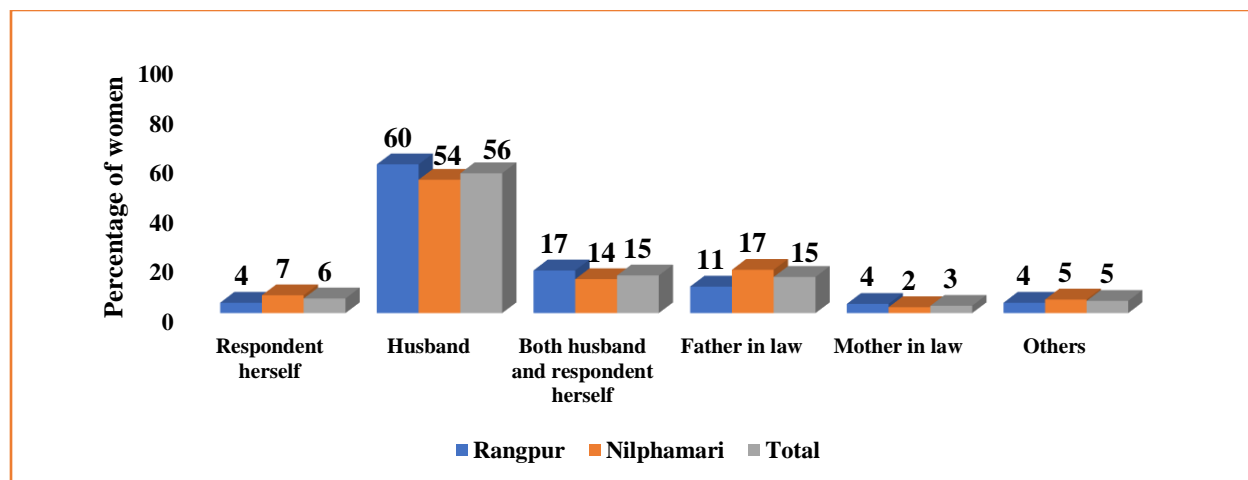


Figure 10: Main decision maker in the household to buy fortified food

Besides these, from the market observation data we saw that, almost 50% sellers suggested to the consumers to buy fortified food. They also informed the consumers on the advantage and disadvantages of fortified foods.

## **6.2 AFFORDABILITY**

Across the income groups, most of the participants mentioned affordability as a prime factor for purchasing fortified foods. They decide to purchase a product considering their level of affordability. Participants consider the product's cost for fortified foods. Some of the participants said their product choice changes with market price change.

One of the housewives (pregnant woman) mentioned,

*“We always purchase bottle oil for cooking but recently the price has increased so we use the cooking oil sold openly. We cannot pay all our money for one product. We need to buy other product such as rice, pulse and vegetables as well. If I spend more money on bottle oil then I will not be able to buy other necessary products.” -IDI 10, Pregnant Women, Rangpur*

## **6.3 AVAILABILITY**

Most of the fortified cooking oil users said that there is no brand for their choice, but they prefer to buy bottled oil. A few participants use branded cooking oil and they have been using this oil for many years. Some participants said they often switch to brands for quality and taste. Another portion of respondents said that they buy bottled oil that is sold at a lower price and that is available in local stores. One husband said,

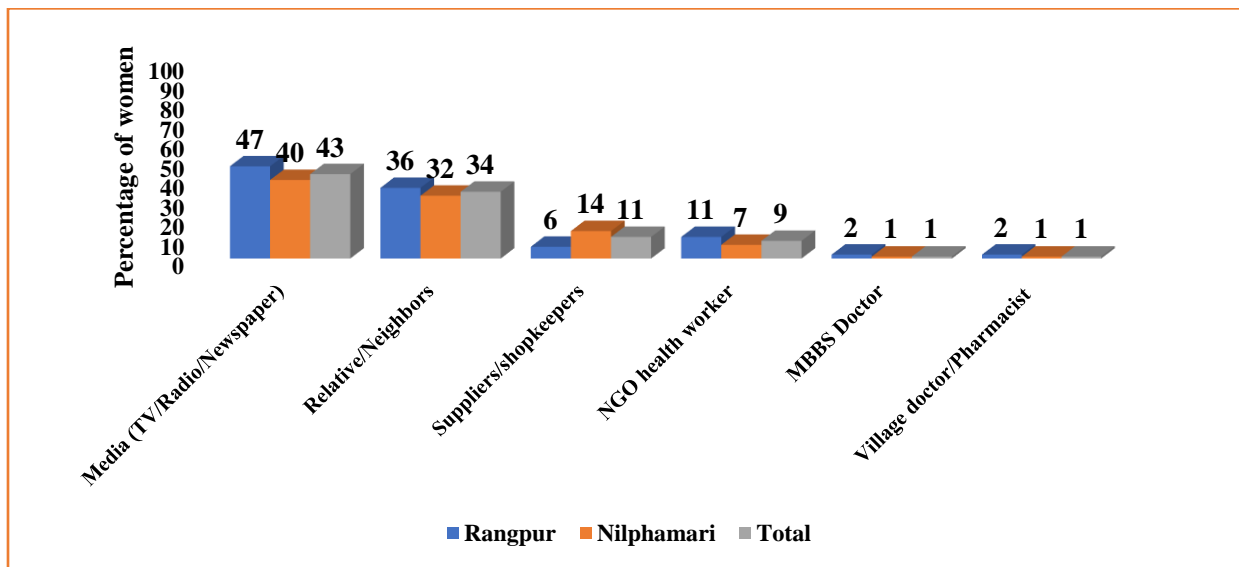
*“I always like bottled oil for cooking. Because bottled oil is clean. I buy whichever oil is available in the shop. I do ensure that they are not giving palm oil.” -IDI 05, Husband, Rangpur*

## **6.4 SOURCE OF INFORMATION**

Majority of the participants had access to a television set in their home and some of the participants reported that they had seen advertisements for cooking oil. However, most of them did not recognize them as fortified cooking oils. A small number of participants reported that they had heard of the use of fortified cooking oil from the courtyard meeting of the JANO project. A small

number of them said they have learned from doctors that cholesterol from soybean can be harmful to health. Very few participants said they saw the text ‘fortified’ in the logo stamped on the fortified cooking oil package.

From the survey data, presented in *table-13*, 61% had television at their home almost and 43% of the respondents reported that they became learned about fortified food from media (TV/Radio/Newspaper) whereas the percentage was slightly higher in Rangpur than Nilphamari, 47% & 40%, respectively. However, 34% of respondents learned about it from relatives or neighbors. At the same time, parents also reported to have learned about fortified food from their school-going children. We did not find community health workers or community mobilization teams as a source of their information; so, there is an opportunity to utilize this platform as they are trustworthy at the community level.



**Figure 11: Source of Information for Fortified food**



## CHAPTER 7: POTENTIALS FOR PROGRAMMATIC IMPLICATIONS

This section presents the current food distribution channels in districts and sub-districts levels. Also, it includes the barriers and opportunities of distributing fortified foods through these channels.

### 7.1 POTENTIAL FOR DIGITAL INTERVENTION

All respondents had exposure to different kinds of media. Presented in *table 13*, a small percentage (4%) of the respondents read newspaper or magazine, among those who read newspaper or magazine (28%) reported to have read them at least one a week. On the contrary, almost 49% of the respondents watched television and 70% reported to watch television almost every day. Sixty-four percent of the respondents reported to own cell phones and 33% owned smartphones. Almost 65% said they had access to their phones though out the day. Eighty one percent of the cell phone users could read SMS in their phones and 47% could read both English and Bengali. Hence, digital interventions can be a potential platform for reaching out to the population.

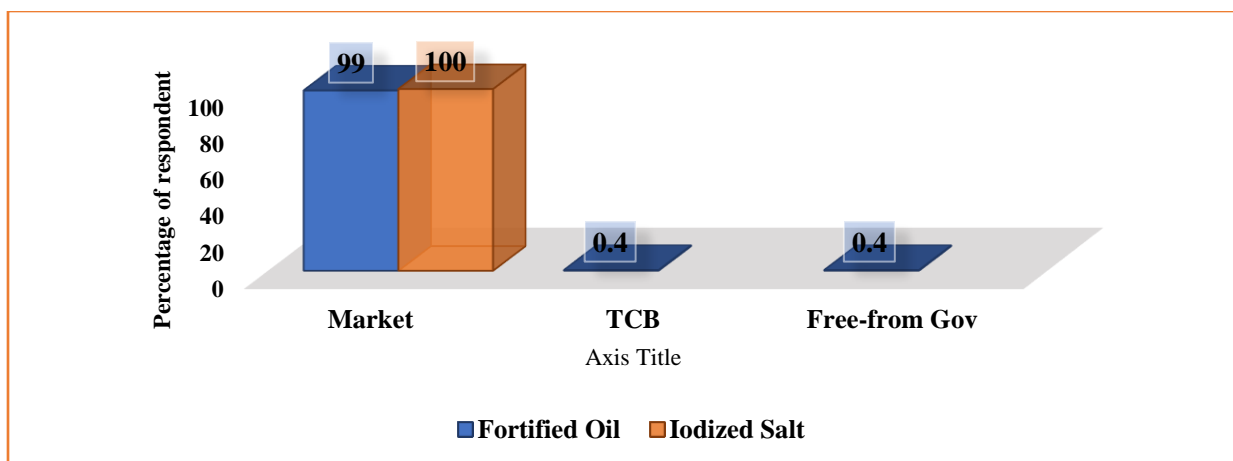
### 7.2 POTENTIAL LOCAL GOVERNMENT PLATFORM

There are a number of food distribution programs, namely Food Friendly Programs (FFP) along with safety net initiatives. Food Friendly Program provides 30 kg rice every month to the enlisted households through March to April and from September to November. Beneficiaries can buy rice at 18 BDT per kg that helps create mass access for low-income people to this food distribution channel.

One government official the Upazila Controller of Food described,

*“In this case, if the government did not initiate the scheme, the effect of this demand would fall on the market. Poor people especially the low earners would suffer much. Now it is up to us to sell through our dealers. We have to supervise with some of our own officers to see if they are selling properly. Because of the low-priced selling it has created a massive access of low-income people to this channel of food supply.” -UCF Nilphamari*

The government of Bangladesh assumed that the COVID-19 might affect the poor people’s consumption, so they expanded the Food Friendly Program to additional months. But the quality of food distribution may not be up to the mark due to shortage in human resources.



**Figure 12: Source from where fortified food usually bought**

*“I told our officers to monitor whether the dealers are distributing food properly to the right beneficiaries. But we have not enough number of officers for monitoring. So, it would be wrong to say that the food is going to the ultra-poor class only rather some other income class may be benefited from this service.”- UCF Nilphamari*

*“We have some weaknesses in the matter of monitoring because we should have 6 food controllers in six upazilas where there are only 2 people. Three upazilas are monitored by two officers so the quality of in person monitoring is difficult to achieve. It is not possible for one person to go to number of upazilas every day. You can't even if you want to. One should not expect so much service for a person.”- Food officer Nilphamari*

The FFP has the strength to reach out to low-income groups. In Saidpur, 6 dealers distribute 4 tons of flour and 6 tons of rice every day. Another rice distribution scheme which provides rice at 10 BDT per kg. The program is also effective at the sub-district level where an eligible family gets 30 kg of rice at 300 BDT. The scheme has an agreement with the World Food Program (WFP) and in Saidpur they cover 15,286 families with this service. Open Market Sales (OMS) is another channel through which dealers sell rice to the poor people. The Trading Corporation of Bangladesh (TCB) has deployed dealers to deliver rice to the poor. Dealers said that a lot of people come in queues to purchasing rice. But sometimes it gets out of control when a lot of people come together. So, they recommended providing cards to the target population so that only cardholders come to the Open Market Sale (OMS) queue. These channels have the strength to reach people at the

community level. Thus, such sources can be a potential platform for fortified food distribution. The strength of the FFP channel is revealed in the interview of the food officer.

*“In Nilphamari Sadar Municipality, 5 metric tons of flour per day and 5 metric tons of rice per day are distributed. Our total supply of 180 metric tons of wheat per day. From there we sift the wheat flour from our licensed miller, and we get 131 metric tons of flour, which we sell in 22 to 24 days except public holidays and Fridays. We have five dealers allowed here, open at five points every day where we sell five metric tons of flour to consumers through them. And the consumer per head gets 5 kg of flour at 90 BDT per kg for 18 kg. Here our department has our own officers and employees as supervisory officers. Since the food-friendly program runs for five months in a year, we have designated dealers in each upazila and union level. We may have one dealer or two in each case if the order is large. In that case there is a fixed number of dealers in an upazila through which we sell food-friendly rice.”-Food officer Nilphamari*

The UCF of Nilphamari raised issue about fortified cooking oil distribution as they do not distribute oil, and this can be a challenge if there is the plan to add fortified oil to the service of this channel right now.

*“In our channel there is no oil distribution scheme. We only provide rice, nutritious rice. We have an agreement with the World Food Program. We will get 30 kg of rice for five months in a year. But we need to discuss about adding oil to this service.”- UCF Nilphamari*

One of the food officers mentioned costing of fortified foods can be a barrier for the government to initiate this in the current food distribution channels.

*“...about rice fortification is that we need some assessment that we are talking about rice fortification here, but the government has a huge amount of costing. Fortified rice here means nutritious rice. Normal rice mixing again with micronutrient, transport here but the government has a huge amount of cost. So, to us we are distributing on different channels. But we have very little chance of knowing from the consumers. Since we have a huge shortage of manpower at the field level. We cannot actually do the assessment even if we want to. The reason we don't have any kind of data for analysis whether it is working or not.”-Food officer Nilphamari*

### ***Potential Local GoB Platforms for Product Distribution***

Although the food distribution channels are working well, there are a number of issues affecting the distribution source. Lack of accurate information about household selection criteria and supply chain disruptions can affect food distribution channels. But the local food office has confirmed that they can work in all conditions to sustain these channels, even the Covid-19 pandemic did not affect the distribution channel.

***“The food department always work with the people. The people of the food department here are never afraid of Corona. Well, no matter how much Corona grows, the food department is in the field. The food department and the health department will always be there with the proper information and service.”- UCF Nilphamari***

The local level suppliers including dealers and retailers raised concern about their profit on fortified oil selling, saying that they cannot make much profit from selling fortified foods and hence prefer selling non-fortified foods. However, the suppliers ensured that the product quality of fortified oil is good and there is huge demand at the community level.

***“.....the profit is limited in these vitamin products such as packet rice, bottled oil. In this case, if we sell 100-taka products, we get profit of two to four takas profit. Profits are very limited, absolutely limited for these products. Food Supplier (dealer) Nilphamari***

***“All these products are of good quality and are locally available. Most of the people in the area think that they are locals. The rich and the poor come to me for collecting these products.”- Food Supplier (retailer), Rangpur***

Another supplier perspective mentioned that affordability is an important factor that influence customer for purchasing the foods. He further recommended the fortified product should be sold at lower price so that people from lower socioeconomic background can afford them. One of the retailers said,

***“If the income is good, even the poor class, want to eat a little better, and if there is less money in the pocket, then they buy non-bottle oil.” Food Supplier (dealer) Nilphamari.***

But it will be difficult because the market price of soybean oil fluctuates rampantly. It might be a barrier for the poor people when they face sudden price hike. Also, for the supplier's perspective the sudden price hike issue limits their profit margin.

*“.....Now that the soybean [oil] market is unpredictable. Like today we sell on a certain price and another price tomorrow. I mean, I think I bought it today for 30 taka, I think I will have to buy it for 32 taka tomorrow. It goes on like this in the market. A few days ago it was 120 taka and now we have to buy it with 130 taka.”- Food Supplier (dealer), Nilphamari.*

## **CHAPTER 8: CONCLUSION AND RECOMMENDATIONS**

### **SECTION-8.1: CONCLUSION**

This study explored attitudes, preferences, knowledge, and practices related to fortified food products and fortified product supply chain actors. This assessment has identified reasons for influencing consumers' decisions to purchase fortified and non-fortified oils. It is important to educate family heads like in-laws and husbands as the purchasing decision comes from them. Thus, household heads should be targeted by program implementers. The study has identified several key challenges for supply chain actors for distributing fortified products. First, the consumer perspectives such as people's current practice of consuming non-bottled oil mostly create a persistent demand for non-bottled oil in the local market, especially in rural areas. Consumers have mistrust about the biofortification of edible oils which influences their decision to buy non-bottled oil and they think that the price of preserved oil is high. Furthermore, consumers do not consider the fortification status in their purchasing decisions. Second, the company's perspective is the availability of large quantities of adulterated oil in the local market at such low prices. Companies that produce quality products cannot compete with other companies in terms of price. Quality products usually have high prices. Shopkeepers are also less interested in selling fortified oil as the profit from fortified oil is less. Thirdly, policy perspectives such as inconsistent law enforcement in the market is responsible for adulteration problems.

The Food Friendly Program serves as an important safety net for the poor people of Rangpur and Nilphamari. Low-income people also had the opportunity to buy essential food products during the COVID-19 pandemic through it. Now these programs have become an important platform to

reach out to people living at the union level. While these programs are overlapping, the distribution of low-cost products has created greater access for poor people to these food distribution channels.

Although there are some established food distribution channels that can be used to deliver fortified food, some additional behavior changes programs need to be introduced. The perceived benefits of safe food intake need to be increased among the target population. In addition, trust-building efforts are needed to create fortified food and community demand generation. There is a need to counsel people about the incremental cost and benefits of fortified food. Finally, the supply chain needs to be monitored regularly to ensure that all bottlenecks are clean and that the availability of quality fortified food is promoted. Also, the government distribution of staples through TCB should be redesigned to meet the needs at the last mile as TCB services are only available in the cities and upazila level and does not reach the villages.

## **SECTION-8.2: RECOMMENDATION**

### **Community based SBCC intervention**

A set of behavior change interventions need to be initiated in the target areas that systematically combine elements of interpersonal communication, social and nutrition issues of food consumption, community mobilization activities, mass media exposure and advocacy to increase awareness and support individuals, households, communities, and local institutions to promote the use of fortified food.

### **Customer motivation at market level**

Suppliers are found to be a major source of information. To create an enabled environment for customer motivation activities, retailers are needed to be trained. To do this, the program must advocate local government (Upazila Parishad) to organize meeting with retailers at the sub-district level. Local government can influence retailers on promoting fortified foods through meeting and orientation on the importance of fortified food. Retailers may then motivate their customers to buy fortified foods. Since husbands purchase household's necessities, so information will reach them by this strategy.

### **Motivation at household level**

Study found lack of involvement from the community health workers (CHW) and community mobilization group (e.g., CSG) to be a source of information for the fortified food. CHWs and CSGs are the trustworthy to the community people; so they can be utilized to initiate household level discussion about the importance of fortified food. A large group of pregnant and lactating mothers, adolescents and husbands can be reached with their involvement and activities.

### **Market monitoring**

Effective establishment of law which requires consistent inspection and enforcement conducted at the markets. Market committees can be engaged with the monitoring activities. This committee will collaborate with the law enforcement authorities to promote product quality and deal with artificial blocks or crisis at the supply chain of fortified foods. Besides, strong monitoring system by relevant government departments can prevent the food adulterations and regain the trust of community people to promote fortified food practice.

### **Role of Producer and suppliers**

Local retailers making more profit from selling non-fortified oil that hinders promoting fortified oil. Producers and suppliers should think of profit margin for the local retailers that can prevent adulterations as well and promote fortified oil in the community.

### **Subsidy to reach the last mile**

Findings suggest lack of affordability is one the major barriers in using fortified food for the poor community. To reach the last mile with fortified foods, the GoB should modify policies to involve TCB in the supply chain to provide fortified food with subsidized cost in the rural areas. Private investors/distributors should consider making fortified food (eg. Soybean oil, iodized salt) available in affordable sizes with subsidized prices according to reach the last mile as a corporate social responsibility.

## ANNEX-1: LIST OF TABLES

**TABLE 5: KNOWLEDGE ABOUT NUTRITION AND PRACTICE OF NUTRITIOUS FOOD**

Traits	Rangpur n=215 (%)	Nilphamari n=292 (%)	Total N=507 (%)
<b>Knowledge</b>			
<b>Nutritive elements present in food</b>			
Carbohydrate	82 (38.14)	112 (38.36)	194 (38.26)
Protein	106 (49.30)	137 (46.92)	243 (47.93)
Fat	57 (26.51)	76 (26.03)	133 (26.23)
Vitamin	134 (62.33)	174 (59.59)	308 (60.75)
Mineral	56 (26.05)	72 (24.66)	128 (25.25)
Water	5 (2.33)	4 (1.37)	9 (1.78)
Others	1 (0.47)	0.00	1 (0.20)
Don't know	46 (21.40)	67 (22.95)	113 (22.29)
<b>Carbo- hydrate food available in respective area</b>			
Bread	63 (29.30)	80 (27.40)	143 (28.21)
Rice	144 (66.98)	203 (69.52)	347 (68.44)
Noodles/Pasta	3 (1.40)	4 (1.37)	4 (1.38)
Oats	0.00	0.00	0.00
Potato	0.00	0.00	0.00
Corn	6 (5.12)	11 (3.77)	22 (4.34)
Pumpkin	6 (2.79)	4 (1.37)	10 (1.97)
Others	1 (0.47)	3 (1.03)	4 (0.79)
Don't know	61 (28.37)	76 (26.03)	137 (27.02)
<b>Protein foods available in respective area</b>			
Meat	130 (60.47)	191 (65.41)	321 (63.31)
Fish	156 (72.56)	217 (74.32)	373 (73.57)
Egg	105 (48.84)	167 (57.19)	272 (53.65)
Dairy products such as milk, yogurt	73 (33.95)	102 (34.93)	175 (34.52)
Beans	4 (1.86)	2 (0.68)	6 (1.18)
Pulses	19 (8.84)	32 (10.96)	51 (10.06)
Nuts	0.00	1 (0.34)	1 (0.20)
Soya	0.00	2 (0.68)	2 (0.39)
Others	0.00	0.00	0.00
Don't know	46 (21.40)	51 (17.47)	19.13
<b>Fat foods available in respective area</b>			
Meat fat	185 (86.05)	243 (83.22)	428 (84.42)
Butter	9 (4.19)	21 (7.19)	30 (5.92)
Dairy food such as milk, yogurt	30 (13.95)	33 (11.30)	63 (12.43)
Coconut oil	2 (0.93)	6 (2.05)	8 (1.58)
Peanut oil	16 (7.44)	28 (9.59)	44 (8.68)
Egg	8 (3.72)	15 (5.14)	23 (4.54)
Palm oil	4 (1.86)	1 (0.34)	5 (0.99)
Products made from coconut	3 (1.40)	4 (1.37)	7 (1.38)
Ghee	17 (7.91)	28 (9.59)	45 (8.88)
Soya bin oil	73 (33.95)	122 (41.78)	195 (38.56)
Mustard oil	14 (6.51)	23 (7.88)	37 (7.30)
Fish oil	83 (38.60)	90 (30.82)	173 (34.12)
Don't know	16 (7.44)	23 (7.88)	39 (7.69)



<b>Traits</b>	<b>Rangpur n=215 (%)</b>	<b>Nilphamari n=292 (%)</b>	<b>Total N=507 (%)</b>
<b>Knowledge about balanced diet</b>			
Having correct knowledge	54 (25.12)	71 (24.32)	125 (24.65)
Having Wrong Knowledge	1 (0.47)	1 (0.34)	2 (0.39)
Don't know	160 (74.42)	220 (75.34)	380 (74.95)
<b>Importance of taking balanced diet</b>			
To give us energy	40 (72.73)	53 (73.61)	93 (73.23)
To maintain body's function properly	33 (60.0)	41 (56.94)	74 (58.27)
Help in body's growth	19 (34.55)	32 (44.44)	51 (40.16)
To minimize body fat	1 (1.82)	2 (2.78)	3 (2.36)
Don't know	1 (1.82)	0	1 (0.79)
Total	(n=55)	(n=72)	(N=127)
<b>Knowledge about processed food</b>			
Yes	121 (56.28)	153 (52.40)	274 (54.04)
No	94 (43.72)	139 (47.60)	233 (45.96)
<b>Availability of processed food in respective area</b>			
Processed Bread/porota	17 (14.05)	26 (16.99)	43 (15.69)
Processed Rice	11 (9.09)	22 (14.38)	33 (12.04)
Processed noodles	107 (88.43)	127 (83.01)	234 (85.40)
Total	(n=121)	(n=153)	(N=274)
<b>Food Intake Practice</b>			
<b>Rice</b>			
Daily 2-3 times per day	215 (100)	292 (100)	507 (100)
<b>Bread</b>			
Never or Rarely	42 (19.53)	59 (20.21)	101 (19.92)
1-3 times per month	59 (27.44)	82 (28.08)	141 (27.81)
1-2 times per week	81 (37.67)	97 (33.22)	178 (35.11)
3-4 times per week	13 (6.05)	21 (7.19)	34 (6.71)
5-6 times per week	4 (1.86)	6 (2.05)	10 (1.97)
Daily	16 (7.44)	27 (9.25)	43 (8.48)
<b>Potato</b>			
Never or Rarely	1 (0.47)	1 (0.34)	2 (0.39)
1-2 times per week	5 (2.33)	12 (4.11)	17 (3.35)
3-4 times per week	25 (11.63)	56 (19.18)	81 (15.98)
5-6 times per week	30 (13.95)	59 (20.21)	89 (17.55)
Daily	146 (67.91)	151 (51.71)	297 (58.88)
2-3 times per day	8 (3.72)	13 (4.45)	21 (4.14)
<b>Lady's fingers (okra)</b>			
Never or Rarely	120 (55.81)	187 (64.04)	307 (60.55)
1-3 times per month	49 (22.79)	53 (18.15)	102 (20.12)
1-2 times per week	37 (17.21)	38 (13.01)	75 (14.79)
3-4 times per week	8 (3.72)	13 (4.45)	21 (4.14)
5-6 times per week	1 (0.47)	1 (0.34)	2 (0.39)
<b>Banana/taro</b>			
Never or Rarely	18 (8.37)	27 (9.25)	45 (8.88)
1-3 times per month	43 (20.00)	71 (24.32)	114 (22.49)
1-2 times per week	124 (57.67)	164 (56.16)	288 (56.80)
3-4 times per week	26 (12.09)	24 (8.22)	50 (9.86)
5-6 times per week	3 (1.40)	4 (1.32)	7 (1.38)

Daily	1 (0.47)	2 (0.68)	3 (0.59)
<b>Traits</b>	<b>Rangpur n=215 (%)</b>	<b>Nilphamari n=292 (%)</b>	<b>Total N=507 (%)</b>
<b>Green peas</b>			
Never or Rarely	193 (89.77)	273 (93.49)	466 (91.91)
1-3 times per month	17 (7.91)	9 (3.08)	26 (5.13)
1-2 times per week	5 (2.33)	10 (3.42)	14 (2.96)
<b>Cabbage</b>			
Never or Rarely	189 (87.91)	258 (88.36)	447 (88.17)
1-3 times per month	3 (1.40)	0.00	3 (0.59)
1-2 times per week	6 (2.79)	10 (3.42)	16 (3.16)
3-4 times per week	11 (5.12)	12 (4.11)	23 (4.54)
5-6 times per week	5 (2.33)	8 (2.74)	13 (2.56)
Daily	1 (0.47)	4 (1.37)	5 (0.99)
<b>Carrot</b>			
Never or Rarely	185 (86.05)	267 (91.44)	452 (89.15)
1-3 times per month	13 (6.05)	7 (2.04)	20 (3.94)
1-2 times per week	14 (6.51)	12 (4.11)	26 (5.13)
3-4 times per week	2 (0.93)	4 (1.37)	6 (1.18)
5-6 times per week	0.00	1 (0.34)	1 (0.20)
Daily	1 (0.47)	1 (0.34)	2 (0.39)
<b>Lemon</b>			
Never or Rarely	56 (26.05)	57 (19.52)	113 (22.29)
1-3 times per month	66 (30.70)	115 (39.38)	181 (35.70)
1-2 times per week	49 (22.79)	56 (19.18)	105 (20.71)
3-4 times per week	17 (7.91)	29 (9.93)	46 (9.07)
5-6 times in a week	3 (1.40)	8 (2.74)	11 (2.17)
Daily	24 (11.16)	27 (9.25)	51 (10.08)
<b>Egg</b>			
Never or Rarely	13 (6.05)	12 (4.11)	25 (4.93)
1-3 times per month	22 (10.23)	41 (14.04)	63 (12.43)
1-2 times per week	102 (47.44)	138 (47.26)	240 (47.34)
3-4 times per week	37 (17.21)	60 (20.55)	97 (19.13)
5-6 times in a week	12 (5.58)	12 (4.11)	24 (4.73)
Daily	29 (13.49)	29 (9.93)	58 (11.44)
<b>Meat</b>			
Never or Rarely	12 (5.58)	26 (8.90)	38 (7.50)
1-3 times per month	84 (39.07)	134 (45.89)	218 (43.00)
1-2 times per week	100 (46.51)	104 (35.62)	204 (40.24)
3-4 times per week	18 (8.37)	21 (7.19)	39 (7.69)
5-6 times in a week	1 (0.47)	4 (1.37)	5 (0.99)
Daily	0 (0.0)	3 (1.03)	3 (0.59)

Traits	Rangpur n=215 (%)	Nilphamari n=292 (%)	Total N=507 (%)
<b>Fish</b>			
Never or Rarely	3 (1.40)	0 (0.00)	3 (0.59)
1-3 times per month	16 (7.44)	27 (9.25)	43 (8.48)
1-2 times per week	75 (34.88)	82 (28.08)	157 (30.97)
3-4 times per week	84 (39.07)	122 (41.78)	206 (40.63)
5-6 times in a week	18 (8.37)	39 (13.36)	57 (11.24)
Daily	18 (8.37)	19 (6.51)	37 (7.30)
2-3 times daily	1 (0.47)	3 (1.03)	4 (0.79)
<b>Pulse (lentil, mung daal, mashkolai)</b>			
Never or Rarely	9 (4.19)	8 (2.74)	17 (3.55)
1-3 times per month	16 (7.44)	18 (6.16)	34 (6.71)
1-2 times per week	98 (45.58)	144 (49.32)	242 (47.73)
3-4 times per week	61 (28.37)	89 (30.48)	150 (29.59)
5-6 times in a week	14 (6.51)	23 (7.88)	37 (7.30)
Daily	17 (7.91)	10(3.42)	27 (5.33)
<b>Milk/milk products</b>			
Never or Rarely	95 (44.19)	146 (50.00)	241 (47.53)
1-3 times per month	44 (20.47)	51 (17.47)	95 (18.74)
1-2 times per week	32 (14.88)	34 (11.64)	66 (13.02)
3-4 times per week	4 (1.86)	8 (2.74)	12 (2.37)
5-6 times in a week	1 (0.47)	0 (0.00)	1 (0.20)
Daily	39 (18.14)	53 (18.15)	92 (18.14)
<b>Dried Fish</b>			
Never or rarely	24 (11.16)	45 (15.41)	69 (13.61)
1-3 times per month	55 (25.58)	73 (25.00)	128 (25.25)
1-2 times per week	71 (33.02)	106 (36.30)	177 (34.91)
3-4 times per week	39 (18.14)	49 (16.78)	88 (17.36)
5-6 times in a week	23 (10.70)	12 (4.11)	35 (6.90)
Daily	3 (1.40)	7 (2.40)	10 (1.97)

**TABLE 6: KNOWLEDGE AND PRACTICE OF FORTIFIED FOOD**

Traits	Rangpur n=215 (%)	Nilphamari n=292 (%)	Total N=507 (%)
<b>Knowledge of Food Fortification</b>			
<b>Heard about food fortification</b>			
Yes	98 (45.58)	112 (38.36)	210 (41.42)
No	117 (54.42)	180 (61.64)	297 (58.58)
<b>Knowledge about food fortification</b>			
Process where micronutrients are added to foods	27 (27.55)	44 (39.29)	71 (33.81)
Micronutrients added to main or staple foods to make it safe	11 (11.22)	8 (7.14)	19 (9.05)
Recognized as an effective public health intervention to alleviate nutritional deficiency	8 (8.16)	7 (6.25)	15 (7.14)
Don't know	54 (55.10)	56 (50.00)	110 (52.38)
Total	(n=98)	(n=112)	(N=210)

Traits	Rangpur n=215 (%)	Nilphamari n=292 (%)	Total N=507 (%)
<b>Availability of fortified foods in respective area</b>			
Fortified rice	4 (4.08)	0(0.00)	4 (1.90)
Fortified Biscuits	3 (3.06)	4 (3.57)	7 (3.33)
Iodized salt	85 (86.73)	105 (93.75)	190 (90.48)
Fortified edible oil	59 (60.20)	80 (71.43)	139 (66.19)
Zinc rice	0(0.00)	1 (0.89)	1 (0.48)
Fortified milk/Yogurt	10 (10.20)	8 (7.14)	18 (8.57)
Don't know	8 (8.16)	6 (5.36)	14 (6.67)
Total	(n=98)	(n=112)	(N=210)
<b>Source of knowledge for Food Fortification</b>			
Media (TV/Radio/Newspaper)	46(46.9)	45(40.2)	91(43.3)
Relative/Neighbors	35(35.7)	36(32.1)	71(33.8)
Suppliers/shopkeepers	6 (6.1)	16 (14.3)	22 (10.5)
NGO health worker	11(11.2)	8(7.1)	19(9.0)
MBBS Doctor	2 (2.0)	1 (0.9)	3 (1.4)
Village doctor/Pharmacist	2 (2.0)	1 (0.9)	3 (1.4)
CmSS member/Up member	1 (1.0)	0 (0.00)	1 (0.5)
Private organization	1 (1.0)	0 (0.00)	1 (0.5)
FWA/HA	1 (1.0)	0 (0.00)	1 (0.5)
CHCP	0 (0.00)	1 (0.9)	1 (0.5)
Banners/posters/brochure	1 (1.0)	0 (0.00)	1 (0.5)
Others	26(26.5)	51 (45.5)	77(36.7)
Do not know	0 (0.00)	1 (0.9)	1 (0.5)
Total	(n=98)	(n=112)	(N=210)
<b>Benefit of fortified food among pregnant women, lactating mother, adolescent girl &amp; babies</b>			
Yes	98 (100)	110 (98.21)	208 (99.05)
No	0 (0)	2 (1.79)	2 (0.95)
Total	(n=98)	(n=112)	(N=210)
<b>Benefits of adolescent girl</b>			
Help adolescent girls become healthy women	39 (39.80)	41 (37.27)	80 (38.46)
Improved their overall health	59 (60.20)	65 (59.09)	124 (59.42)
Reducing the risk of bearing LBW babies	3 (3.06)	5 (4.55)	8 (3.85)
Increased productivity	21 (21.43)	14 (12.73)	35 (16.83)
Prevent micronutrient deficiency	24 (24.49)	25 (22.73)	49 (23.56)
Increased appetite	6 (6.12)	4 (3.64)	10 (4.81)
Prevent anaemia	22 (22.45)	18 (16.36)	40 (19.23)
Prevent goiter	23 (23.47)	15 (13.64)	38 (18.27)
Brain development	9 (9.18)	12 (10.91)	21 (10.10)
Maternal mortality decreased among adolescent mothers	4 (4.08)	4 (3.64)	8 (3.85)
Others	2 (2.04)	1 (0.91)	3 (1.44)
Don't know	8 (8.16)	10 (9.09)	18 (8.65)
Total	(n=98)	(n=110)	(N=208)

<b>Traits</b>	<b>Rangpur n=215 (%)</b>	<b>Nilphamari n=292 (%)</b>	<b>Total N=507 (%)</b>
<b>Benefits of pregnant women/lactating mother</b>			
Improved their overall health	67 (68.37)	79 (71.82)	146 (70.19)
Maternal mortality decreased	2 (2.04)	5 (4.55)	7 (3.37)
Increased productivity	19 (19.39)	11 (10)	30 (14.42)
Improved food quality	1 (1.02)	2 (1.82)	3 (1.44)
Healthy pregnancy outcome	56 (57.14)	72 (65.45)	128 (61.54)
Prevent micronutrient deficiency	34 (34.69)	26 (23.64)	60 (28.85)
Increased appetite	7 (7.14)	3 (2.73)	10 (4.81)
Prevent anaemia	23 (23.47)	15 (13.64)	38 (18.27)
Prevent goiter	14 (14.29)	25 (22.73)	39 (18.75)
Reducing the risk of bearing LBW babies	6 (6.12)	6 (5.45)	12 (5.77)
Others	1 (1.02)	00	1 (0.48)
Don't know	2 (2.04)	2 (1.82)	4 (1.92)
Total	(n=98)	(n=110)	(N=208)
<b>Benefits of baby</b>			
Increase educability in children	2 (2.04)	1 (0.91)	3 (1.44)
Brain development	22 (22.45)	31 (28.18)	53 (25.48)
Child mortality decreased	1 (1.02)	00	1 (0.48)
Child diseases decreased	41 (41.84)	54 (49.09)	95 (45.67)
Improved health status of children	77 (78.57)	89 (80.91)	166 (79.81)
Improved food quality	1 (1.02)	1 (0.91)	2 (0.96)
Prevent micronutrient deficiency	28 (28.57)	22 (20)	50 (24.04)
Increased appetite	4 (4.08)	5 (4.55)	9 (4.33)
Prevent anaemia	15 (15.31)	10 (9.09)	25 (12.02)
Prevent goiter	8 (8.16)	12 (10.91)	20 (9.62)
Increase IQ level	26 (26.53)	33 (30.00)	59 (28.37)
Don't know	4 (4.08)	3 (2.73)	7 (3.37)
Total	(n=98)	(n=110)	(N=208)
<b>Micro nutrients used in fortified food</b>			
Vitamin A	91 (42.33)	115 (39.38)	206 (40.63)
Zinc	18 (8.37)	22 (7.53)	40 (7.89)
Iron	42 (19.53)	52 (17.81)	94 (18.54)
Folic acid	11 (5.12)	9 (3.08)	20 (3.94)
Iodine	159 (73.95)	193 (66.10)	352 (69.43)
Vitamin C	25 (11.63)	37 (12.67)	62 (12.23)
Vitamin D	20 (9.30)	25 (8.56)	45 (8.88)
Vitamin E	15 (6.98)	25 (8.56)	40 (7.89)
Calcium	23 (10.70)	33 (11.30)	56 (11.05)
Every option unknown	51 (23.72)	85 (29.11)	136 (26.82)

**TABLE 7: KNOWLEDGE ABOUT VITAMIN A, VITAMIN A RICH FOOD, DEFICIENCY, AND CONSUMPTION OF VITAMIN A FORTIFIED OIL**

<b>Traits</b>	<b>Rangpur n=215 (%)</b>	<b>Nilphamari n=292 (%)</b>	<b>Total N=507 (%)</b>
<b>Heard about vitamin A deficiency</b>			
Yes	201 (93.49)	262 (89.73)	463 (91.32)
No	14 (6.51)	30 (10.27)	44 (8.68)
<b>Symptoms of Vitamin A deficiency</b>			
Weakness	75 (37.31)	100 (38.17)	175 (37.80)
Be more likely to become sick	25 (12.44)	48 (18.32)	73 (15.77)
Eye problem (night blindness)	143 (71.14)	171 (65.27)	314 (67.82)
Others	10 (4.98)	17 (6.49)	27 (5.83)
Total	(n=201)	(n=262)	(N=463)
<b>Causes of vitamin A deficiency</b>			
Poor variety of food	26 (12.94)	38 (14.50)	64 (13.82)
eat too little	38 (18.91)	43 (16.41)	81 (17.49)
Not intake of vitamin A rich food	147 (73.13)	199 (75.95)	346 (74.73)
Don't know	26 (12.94)	27 (10.31)	53 (11.45)
Total	(n=201)	(n=262)	(N=463)
<b>Prevention of vitamin A deficiency</b>			
Eat vitamin A rich foods	186 (92.54)	244 (93.3)	430 (92.87)
Taking vitamin-A rich fortified food	10 (4.98)	4 (1.53)	14 (3.02)
Taking vitamin-A capsule or supplements	40 (19.90)	49 (18.70)	89 (19.22)
Don't know	6 (2.99)	8 (3.05)	14 (3.02)
Total	(n=201)	(n=262)	(N=463)
<b>Mixing of different vitamin-A rich food in household</b>			
Yes	114 (53.02)	155 (53.08)	269 (53.06)
No	101 (46.98)	137 (46.92)	238 (46.94)
Total	(n=215)	(n=292)	(N=507)
<b>Prepare such mixing easy or not</b>			
Too much difficult	30 (13.95)	37 (12.67)	67 (13.21)
Difficult	76 (35.35)	134 (45.89)	210 (41.42)
Comparatively easy	74 (34.42)	97 (33.22)	171 (33.73)
Very easy	35 (16.28)	24 (8.22)	59 (11.64)
<b>Availability of foods fortified with vitamin A</b>			
Edible oil (Fortified oil)	80 (37.21)	103 (35.27)	183 (36.09)
Palm oil	1 (0.47)	2 (0.68)	3 (0.59)
Fortified rice	1 (0.47)	00	1 (0.20)
Fortified Flour	5 (2.33)	4 (1.37)	9 (1.78)
Others	1 (0.47)	1 (0.34)	2 (0.39)
Don't know	131 (60.93)	187 (64.04)	318 (62.72)

<b>Traits</b>	<b>Rangpur n=215 (%)</b>	<b>Nilphamari n=292 (%)</b>	<b>Total N=507 (%)</b>
<b>Type of oil purchased for cooking</b>			
Packet or bottled Soya bin oil	118 (54.880)	148 (50.68)	266 (52.47)
Bulk Soya bin oil	96 (44.65)	138 (47.26)	234 (46.15)
Bulk Palm Oil	00	1 (0.34)	1 (0.20)
Packet or bottle mustard oil	1 (0.47)	1 (0.34)	2 (0.39)
Bulk Mustard oil	00	1 (0.34)	1 (0.20)
Others	00	3 (1.03)	3 (0.59)
<b>From where purchased fortified oil</b>			
Market shop	117 (99.15)	147 (99.32)	264 (99.25)
TCB	1 (0.85)	00	1 (0.38)
Free from Govt.	00	1 (0.38)	1 (0.38)
Total	(n=118)	(n=148)	(N=266)
<b>Practice of fortified oil in preparing food</b>			
Yes	110 (93.22)	138 (93.24)	248 (93.23)
No	8 (6.78)	10 (6.76)	18 (6.77)
Total	(n=118)	(n=148)	(N=266)
<b>Consumption of fortified oil in a week (in ml)</b>			
250-500 ml	41 (34.75)	42 (28.38)	83 (31.20)
501-1000ml	61 (51.69)	77 (52.03)	138 (51.88)
1001 and above	16 (13.56)	29 (19.59)	45 (16.92)
Total	(n=118)	(n=148)	(N=266)
<b>Amount of money spend for fortified oil to prepare food</b>			
BDT 25-50	5 (4.2)	1 (0.7)	6 (2.3)
BDT 51-100	38 (32.2)	50 (33.8)	88 (33.1)
BDT 101-200	62 (52.6)	69 (46.6)	131 (49.2)
BDT 201-700	9 (7.6)	21 (14.2)	30 (11.3)
Do not know	4(3.39)	7(4.73)	11(4.14)
Mean	122.5	140.9	132.7
Total	(n=118)	(n=148)	(N=266)
<b>Amount of money spend for non-fortified oil</b>			
No amount spent for non-fortified oil	109(50.7)	138(47.26)	247(48.72)
BDT 1-50	12 (5.6)	15 (5.1)	27 (5.3)
BDT 51-100	54 (25.1)	63 (21.6)	117 (23.0)
BDT 101-150	27 (12.58)	58 (19.85)	85 (16.78)
BDT 151 or above	8 (3.75)	14 (4.76)	22 (4.34)
Do not know	5(2.33)	4(1.37)	9(1.78)
Mean	53.2	70.0	62.9

Traits	Rangpur n=215 (%)	Nilphamari n=292 (%)	Total N=507 (%)
<b>For using fortified oil increase the cost of household</b>			
Yes	70(59.32)	89(60.14)	159(59.77)
No	45(38.14)	54(36.49)	99(37.22)
Don't know	3(2.54)	5(3.38)	8(3.01)
Total	(n=118)	(n=148)	(N=266)
<b>Cost increase for buying fortified oil in a week</b>			
BDT 0-20	26 (37.1)	36 (40.45)	62 (39.)
BDT 21-50	28 (40.0)	39 (43.82)	67 (42.1)
BDT 51-100	9 (12.0)	4 (4.5)	13 (8.2)
BDT 101-200	1 (1.4)	4 (4.5)	5 (3.1)
Don't know	6(8.57)	6(6.74)	12(7.55)
Mean	36.9	35.3	36.0
Total	(n=70)	(n=89)	(N=159)
<b>Willing to spend for buying for fortified oil</b>			
Mean	98.5	113.9	107.3

**TABLE 8: KNOWLEDGE ABOUT IODINE AND CONSUMPTION OF IODIZED SALT**

Traits	Rangpur n=215 (%)	Nilphamari n=292 (%)	Total N=507 (%)
<b>Heard about Iodine deficiency</b>			
Yes	172 (80)	220 (75.34)	392 (77.32)
No	43 (20)	72 (24.66)	115 (22.68)
<b>Sign and symptoms of iodine deficiency</b>			
Fatigue	29 (16.86)	61 (27.73)	90 (22.96)
Having difficulty in studying and working	00	3 (1.36)	3 (0.77)
Muscle weakness	31 (18.02)	40 (18.18)	71 (18.11)
Puffy face	11 (6.40)	17 (7.73)	28 (7.14)
Weight gain	2 (1.16)	00	2 (0.51)
Thinning of hair	1 (0.58)	00	1 (0.26)
Depression	2 (1.16)	8 (3.64)	10 (2.55)
Goiter	105 (61.05)	128 (58.18)	233 (59.44)
Don't know	39 (22.67)	38 (17.27)	77 (19.64)
Total	(n=172)	(n=220)	(N=392)
<b>Prevention of Iodine deficiency</b>			
Eat iodized salt	99 (57.56)	112 (50.91)	211 (53.83)
Prepare foods with iodized salt	69 (40.12)	92 (41.82)	161 (41.07)
Eating fruits or vegetables	54 (31.40)	68 (30.91)	122 (31.12)
Eating meat, fish, sea fish	29 (16.86)	49 (22.27)	78 (19.90)
Don't know	15 (8.72)	18 (8.22)	33 (8.44)
Total	(n=172)	(n=220)	(N=392)



<b>Traits</b>	<b>Rangpur n=215 (%)</b>	<b>Nilphamari n=292 (%)</b>	<b>Total N=507 (%)</b>
<b>Knowledge about iodized salt</b>			
Yes	200 (93.02)	268 (91.78)	468 (92.31)
No	15 (6.98)	24 (8.22)	39 (7.69)
<b>Type of salt use in household for cooking or eating</b>			
Packet salt	161 (74.88)	198 (67.81)	359 (70.81)
Bulk salt	54 (25.12)	94 (32.19)	148 (29.19)
<b>Consumption of Bulk salt and cause</b>			
Less price	50 (92.59)	88 (93.62)	138 (93.24)
Easily available	10 (18.52)	16 (17.02)	26 (17.57)
During cooking packet salt is not necessary	2 (3.70)	6 (6.38)	8 (5.41)
Others	2 (3.70)	2 (2.13)	4 (2.70)
Total	(n=54)	(n=94)	(N=148)
<b>Availability of iodine in salt</b>			
Yes	152 (70.70)	177 (60.62)	329 (64.89)
No	43 (20)	66 (22.60)	109 (21.50)
Don't know	20 (9.30)	49 (16.78)	69 (13.61)
<b>From where purchased salt</b>			
Market shop	215 (100)	292 (100)	507 (100)
<b>Use of iodine salt in last 24 hours for preparing food</b>			
Yes	152 (76)	188 (70.15)	340 (72.65)
No	48 (24)	80 (29.85)	128 (27.35)
Total	(n=200)	(n=268)	(N=468)
<b>Use of iodine salt in last 24 hours while eating rice</b>			
Yes	76 (38)	106 (39.55)	182 (38.89)
No	124 (62)	162 (60.45)	286 (61.11)
Total	(n=200)	(n=268)	(N=468)
<b>Where to Keep salt for household use</b>			
In kitchen	101 (46.98)	176 (60.27)	277 (54.64)
In store room	5 (2.33)	4 (1.37)	9 (1.78)
In bed room	109 (50.70)	110 (37.67)	219 (43.20)
Others	00	2 (0.68)	2 (0.39)
<b>How to store salt for Household use</b>			
Container with lid	206 (95.81)	282 (96.58)	488 (96.25)
Container without lid	4 (1.86)	5 (1.71)	9 (1.78)
In salt packet	5 (2.33)	5 (1.71)	10 (1.97)
<b>Average amount of money spend for buying iodized salt in a week</b>			
Mean	21.3	15.0	17.8

Traits	Rangpur n=215 (%)	Nilphamari n=292 (%)	Total N=507 (%)
<b>For using iodized salt increase the cost of household</b>			
Yes	48 (31.37)	64 (33.68)	112 (32.65)
No	99 (64.71)	122 (64.21)	221 (64.43)
Don't know	6 (3.92)	4 (2.11)	10 (2.92)
<b>Amount of increasing cost due to purchasing iodized salt in a week</b>			
BDT ≤ 10	38 (79.2)	49 (76.6)	77 (77.7)
BDT 11-20	5 (10.4)	9 (14.1)	14 (12.5)
BDT 21-30	2 (4.2)	1 (1.6)	3 (2.7)
Don't know	3 (6.2)	5 (7.8)	8 (7.1)
Mean	9.0	8.4	8.7
Total	(n=48)	(n=64)	(N=112)
<b>Increased cost making burden for family</b>			
Yes	39 (81.25)	52 (81.25)	91 (81.25)
No	9 (18.75)	12 (18.75)	21 (18.75)
Total	(n=48)	(n=64)	(N=112)
<b>Willing to spend for buying iodized salt</b>			
BDT ≤10	103 (47.9)	118 (40.4)	221 (43.6)
BDT 11-20	76 (35.4)	120 (41.1)	196 (38.7)
BDT 21-50	20 (9.3)	23 (7.9)	43 (8.5)
Can't say at this moment/Not sure	16(7.44)	31(10.6)	47(9.23)
Mean	14.0	16.1	15.2

**TABLE 9: KNOWLEDGE ABOUT ZINC AND CONSUMPTION OF ZINC**

Traits	Rangpur n=215 (%)	Nilphamari n=292 (%)	Total N=507 (%)
<b>Heard about zinc deficiency in the body</b>			
Yes	73 (33.95)	76 (26.03)	149 (29.39)
No	142 (66.05)	216 (73.97)	358 (70.61)
<b>Signs and symptoms of Zinc deficiency</b>			
Unexplained weight loss	12 (16.44)	15 (19.74)	27 (18.12)
Wounds that won't heal	1 (1.37)	2 (2.63)	3 (2.01)
Lack of alertness	1 (1.37)	2 (2.63)	3 (2.01)
Decreased sense of smell and taste	2 (2.74)	3 (3.95)	5 (3.36)
Diarrhoea	11 (15.07)	15 (15.74)	26 (17.45)
Loss of appetite	15 (20.55)	19 (25)	34 (22.82)
Open sores on the skin	7 (9.59)	2 (2.63)	9 (6.04)
Feel dizzy or nauseous	21 (28.77)	10 (13.16)	31 (20.81)
Don't know	24 (32.88)	33 (43.42)	57 (38.26)
Total	(n=73)	(n=76)	(N=149)

<b>Traits</b>	<b>Rangpur n=215 (%)</b>	<b>Nilphamari n=292 (%)</b>	<b>Total N=507 (%)</b>
<b>Prevention of zinc deficiency</b>			
Eat zinc-rich foods	56 (76.71)	57 (75)	113 (75.84)
Eat foods fortified with zinc	4 (5.48)	00	4 (2.68)
Give zinc supplements/Capsules	21 (28.77)	19 (25.00)	40 (26.85)
Don't know	11 (15.07)	15 (19.74)	26 (17.45)
Total	(n=73)	(n=76)	(N=149)
<b>Locally available names of fortified foods that are rich in zinc</b>			
Zinc rice	00	1 (0.34)	1 (0.20)
Fortified rice	3 (1.40)	00	3 (0.59)
Pushti rice	1 (0.47)	00	1 (0.20)
Don't know	212 (98.60)	291 (99.66)	503 (99.21)
<b>Heard about zinc rice</b>			
Yes	15 (6.98)	9 (3.08)	24 (4.73)
No	167 (77.67)	222 (76.03)	389 (76.73)
Listening first time	33 (15.35)	61 (20.89)	94 (18.54)
<b>Consumption of Zinc rice by the respondent or her family</b>			
Yes	5 (33.33)	2 (22.22)	7 (29.17)
No	10 (66.67)	7 (77.78)	17 (70.83)
Total	(n=15)	(n=9)	(N=24)
<b>Consumption of Zinc rice or Zinc fortified food by the respondent for last 24 hours</b>			
Yes	1 (0.47)	2 (0.68)	3 (0.59)
No	4 (1.86)	0(0.00)	4 (0.79)
Never eaten	210 (97.67)	290 (99.32)	500(98.62)
<b>Amount of money spend for buying rice in a week</b>			
BDT ≤250	31(14.46)	45 (15.4)	76 (15.00)
BDT 251-500	89 (41.44)	106 (36.25)	195 (38.46)
BDT 500 or above	93 (43.41)	129 (44.11)	222 (43.88)
Don't know	2(0.93)	12(4.11)	14(2.76)
Mean	510.3	551.3	533.6
<b>Amount of cost increase due to buying fortified rice or zinc rice</b>			
Yes	1 (0.47)	0(0.00)	1 (0.2)
No	4 (1.86)	2(0.68)	6 (1.18)
Never eaten before	210 (97.67)	290(99.32)	500(98.62)
<b>Increased cost making burden for family</b>			
Yes	1 (100.0)	0(0.00)	1(100.0)
Total	(n=1)	(n=0)	(N=1)

Traits	Rangpur n=215 (%)	Nilphamari n=292 (%)	Total N=507 (%)
<b>Willing to spend money for buying zinc fortified rice in a week</b>			
BDT ≤ 250	24 (11.1)	22 (7.6)	46 (9.1)
BDT 251 -500	78 (36.3)	102 (34.9)	180 (35.5)
BDT 501 or above	77 (35.9)	104 (35.6)	181 (35.7)
Can't say at this moment/Not sure	36(16.7)	64(21.9)	100(19.7)
Mean	502.6	578.6	545.2

**TABLE 10: KNOWLEDGE ABOUT IRON RICH FOOD AND CONSUMPTION OF IRON RELATED FOOD**

Traits	Rangpur n=215 (%)	Nilphamari n=292 (%)	Total N=507 (%)
<b>Heard about iron deficiency</b>			
Yes	177 (82.33)	243 (83.22)	420 (82.84)
No	38 (17.67)	49 (16.78)	87 (17.16)
<b>Signs and symptoms of iron deficiency</b>			
Skin colour looks pale or yellow	70 (39.55)	86 (35.39)	156 (37.14)
Feel dizziness	117 (66.10)	145 (59.67)	262 (62.38)
No appetite	6 (3.39)	8 (3.29)	14 (3.33)
Muscle weakness	91 (51.41)	131 (53.91)	14 (3.33)
Total	(n=177)	(n=243)	(N=420)
<b>Prevention of iron deficiency in the body</b>			
By eating enough iron foods	145 (81.89)	199 (81.89)	344 (81.90)
By taking iron capsule/medicine	69(38.98)	104(42.79)	173(41.19)
By taking iron rich fruits	44(24.85)	59(24.27)	103(24.52)
By taking iron rich vegetables	85 (48.09)	114 (46.91)	199 (47.38)
Don't know	3(1.69)	7(2.88)	10(2.38)
Total	(n=177)	(n=243)	(N=420)
<b>Amount of money spend for buying iron fortified food in a week</b>			
≤ 100 BDT	70 (32.6)	92 (31.5)	162 (32.0)
101-250 BDT	39 (18.1)	60 (20.5)	99 (19.5)
≥ 251 BDT or more	20 (9.3)	30 (10.3)	50 (9.9)
Can't say at this moment/Not sure	86 (40.0)	110 (37.7)	196 (38.6)
Mean	150.7	149.5	150.0

**TABLE 11: KNOWLEDGE ABOUT VITAMIN B12 RICH FOOD AND CONSUMPTION OF VITAMIN B12 RELATED FOOD**

<b>Traits</b>	<b>Rangpur n=215 (%)</b>	<b>Nilphamari n=292 (%)</b>	<b>Total N=507 (%)</b>
<b>Heard about vitamin B12 deficiency</b>			
Yes	28 (13.0)	40 (13.7)	68 (13.4)
No	145 (67.4)	189 (64.7)	334 (65.8)
Don't know	42 (19.5)	63 (21.6)	105 (20.7)
<b>Signs and symptoms of Vitamin B12 deficiency</b>			
Skin colour looks pale or yellow	4 (14.3)	1 (2.5)	5 (7.4)
Feel dizziness	5 (17.9)	4 (10.0)	9 (13.2)
No appetite	0 (0.0)	1 (2.5)	1 (1.5)
Weight loss	1 (3.6)	0 (0.0)	1 (1.5)
Muscle weakness	6 (21.4)	8 (20.0)	14 (20.6)
Others	1 (3.6)	0 (0.0)	1 (1.5)
Don't know	18 (64.3)	30 (75.0)	48 (70.6)
Total	(n=28)	(n=40)	(N=68)
<b>Prevention of Vitamin B12 deficiency in the body</b>			
Eat vitamin B12 rich food	18 (64.3)	24 (60.0)	42 (61.8)
Eat vitamin B12 rich fortified food	1 (3.6)	0 (0.0)	1 (1.5)
Taking vitamin B12 capsule	3 (10.7)	12 (30.0)	15 (22.1)
Taking iron rich fruit	2 (7.1)	1 (2.5)	3 (4.4)
Taking Iron rich vegetables	7 (25.0)	5 (12.5)	12 (17.7)
Don't know	7 (25.0)	9 (22.5)	16 (23.5)
Total	(n=28)	(n=40)	(N=68)
<b>Willing to spend for buying vitamin B12 rich fortified foods in a weak</b>			
≤ 100 BDT	72 (35.5)	75 (25.7)	147 (29.0)
101-250 BDT	24 (11.2)	51 (17.5)	75 (14.8)
≥ 251 BDT or more	6 (2.8)	13 (4.4)	19 (3.7)
Can't say at this moment/Not sure	113 (52.5)	153 (52.4)	266 (52.5)
Mean	110.0	134.4	124.0

**TABLE 12: DOCTOR’S SUGGESTION FOR TAKING FORTIFIED FOOD**

<b>Traits</b>	<b>Rangpur n=215 (%)</b>	<b>Nilphamari n=292 (%)</b>	<b>Total N=507 (%)</b>
<b>During pregnancy period doctors suggest to take fortified food</b>			
Yes	6 (2.8)	5 (1.7)	11 (2.2)
No	209 (97.2)	287 (98.3)	496 (97.8)
<b>Type of fortified food suggested by doctor</b>			
Take foods making with iodized salt	0 (0.0)	3 (60.0)	3 (27.3)
Eat foods making with fortified oil	2 (33.3)	2 (40.0)	4 (36.4)
Fortified milk/shokti doi	4 (66.7)	1 (20.0)	5 (45.5)
Don't know	0 (0.0)	1 (20.0)	1 (9.1)
Total	(n=6)	(n=5)	(N=11)
<b>During last pregnancy period taking fortified food</b>			
Yes	145 (67.4)	143 (49.0)	288 (56.8)
No	70 (32.6)	149 (51.0)	219 (43.2)
<b>Fortified foods taken during last pregnancy period</b>			
Zinc rice	1 (0.7)	0 (0.0)	1 (0.3)
Take foods making with iodized salt	127 (87.6)	127 (88.8)	254 (88.2)
Eat foods making with fortified oil	111 (76.6)	123 (86.0)	234 (81.2)
Fortified milk/shokti doi	7 (4.8)	1 (0.7)	8 (2.8)
Total	(n=145)	(n=143)	(N=288)
<b>During lactating period consumption of fortified food</b>			
Yes	130 (60.5)	139 (47.6)	269 (53.1)
No	85 (39.5)	153 (52.4)	238 (46.9)
<b>Fortified foods taken during lactating period</b>			
Fortified rice	1 (0.8)	0 (0.0)	1 (0.4)
Fortified biscuit	1 (0.8)	0 (0.0)	1 (0.4)
Take foods making with iodized salt	108 (83.1)	119 (85.6)	227 (84.4)
Eat foods making with fortified oil	104 (80.0)	113 (81.3)	217 (80.7)
Fortified milk/shokti doi	4 (3.1)	0 (0.0)	4 (1.5)
Total	(n=130)	(n=139)	(N=269)
<b>Doctors suggestion for children to take fortified foods</b>			
Yes	5 (2.3)	5 (1.7)	10 (2.0)
No	210 (97.7)	287 (98.3)	497 (98.0)
<b>Type of fortified foods doctors suggest for children</b>			
Take foods making with iodized salt	3 (60.0)	3 (60.0)	6 (60.0)
Eat foods making with fortified oil	3 (60.0)	4 (80.0)	7 (70.0)
Fortified milk/shokti doi	2 (40.0)	1 (20.0)	3 (30.0)
Total	(n=5)	(n=5)	(N=10)

<b>Traits</b>	<b>Rangpur n=215 (%)</b>	<b>Nilphamari n=292 (%)</b>	<b>Total N=507 (%)</b>
<b>Fortified foods given by respondent to children</b>			
Yes	110 (51.2)	115 (39.4)	225 (44.4)
No	105 (48.8)	177 (60.6)	282 (55.6)
<b>Type of fortified foods given by respondent to children</b>			
Zinc rice	1 (0.9)	0 (0.0)	1 (0.4)
Take foods making with iodized salt	95 (86.4)	98 (85.2)	193 (85.8)
Eat foods making with fortified oil	84 (76.4)	90 (80.0)	176 (78.0)
Fortified milk/shokti doi	3 (2.7)	3 (2.6)	6 (2.7)
Total	(n=110)	(n=115)	(N=225)
<b>Fortified foods given by respondent to adolescent members</b>			
Yes	73 (34.0)	82 (28.0)	155 (30.6)
No	55 (25.6)	92 (31.5)	147 (29.0)
No adolescent member available	87 (40.5)	118 (40.4)	205 (40.4)
<b>Type of fortified foods given by respondent to adolescent</b>			
Zinc rice	1 (1.4)	0 (0.0)	1 (0.6)
Red sweet potato	1 (1.4)	0 (0.0)	1 (0.6)
Take foods making with iodized salt	62 (84.9)	70 (85.4)	132 (85.2)
Eat foods making with fortified oil	53 (72.6)	70 (85.4)	123 (79.3)
Fortified milk/shokti doi	8 (11.0)	1 (1.2)	9 (5.8)
Total	(n=73)	(n=82)	(N=155)
<b>Decision maker to purchase daily needs</b>			
Respondent herself	9 (4.2)	20 (6.9)	29 (5.7)
Respondents husband	129 (60.0)	161 (55.1)	290 (57.2)
Both husband and respondent	37 (17.2)	38 (13.0)	75 (14.8)
Father in law	22 (10.2)	51 (17.5)	73 (14.4)
Mother in law	9 (4.2)	7 (2.4)	16 (3.2)
Father	5 (2.3)	10 (3.4)	15 (3.0)
Brother in law	3 (1.4)	2 (0.7)	5 (1.0)
Others	1 (0.5)	3 (1.0)	4 (0.6)

**TABLE 13: MASS MEDIA EXPOSURE**

<b>Traits</b>	<b>Rangpur n=215 (%)</b>	<b>Nilphamari n=292 (%)</b>	<b>Total N=507 (%)</b>
<b>Read newspaper or magazine</b>			
Yes	8 (3.7)	13 (4.5)	21 (4.1)
No	207 (96.3)	279 (95.5)	486 (95.9)
<b>Frequency of reading newspaper or magazine</b>			
Almost everyday	0 (0.0)	1 (7.7)	1 (4.8)
At least once a week	4 (50.0)	2 (15.4)	6 (28.0)
Less than once a week	4 (50.0)	10 (76.9)	14 (66.7)
Total	(n=8)	(n=13)	(N=21)
<b>Have television at home</b>			
Yes	134(62.3)	178(61.0)	312(61.5)
No	81 (37.7)	114 (39.0)	195 (38.5)
<b>Watching television</b>			
Yes	98 (45.6)	149 (51.0)	247 (48.7)
No	117 (54.4)	148 (49.0)	260 (51.3)
<b>Frequency of watching television</b>			
Almost everyday	70 (71.4)	104 (69.8)	174 (70.4)
At least once a week	21 (21.4)	39 (26.2)	60 (24.3)
Less than once a week	7 (7.1)	6 (4.0)	13 (5.3)
Total	(n=98)	(n=149)	(N=247)
<b>Cell phones owned by respondent</b>			
Yes	129 (60.0)	197 (67.5)	326 (64.3)
No	86 (40.0)	95 (32.5)	181 (35.7)
<b>Smartphone own by respondent or family members</b>			
Yes	74 (34.4)	95 (32.5)	169 (33.3)
No	141 (65.6)	197 (67.5)	338 (66.7)
<b>24 hour access to mobile phone by the respondent</b>			
Yes	130 (60.5)	197 (67.5)	327 (64.5)
No	85 (39.5)	95 (32.5)	180 (35.5)
<b>Capability of reading SMS</b>			
Yes	176 (81.9)	234 (80.1)	410 (80.9)
No	39 (18.1)	58 (19.9)	97 (19.1)
<b>Language selection during reading SMS</b>			
Bangla	83 (47.1)	135 (57.7)	218 (53.1)
English	1 (0.6)	0 (0.0)	1 (0.2)
Both	92 (52.3)	99 (42.3)	191 (46.6)
Total	(n=176)	(n=234)	(N=410)



**TABLE 14: EFFECT ON COVID PANDEMIC ON FORTIFIED FOOD CONSUMPTION**

<b>Traits</b>	<b>Rangpur n=215 (%)</b>	<b>Nilphamari n=292 (%)</b>	<b>Total N=507 (%)</b>
<b>Challenges faced in buying fortified foods</b>			
Yes	79 (36.7)	111 (38.0)	190 (37.5)
No	90 (41.9)	72 (24.7)	162 (32.0)
Not eat any fortified food	46 (21.4)	109 (37.3)	155 (30.5)
<b>Price of fortified food increased</b>			
Yes	145 (85.8)	162 (88.5)	307 (87.2)
No	24 (14.2)	21 (11.5)	45 (12.8)
Total	(n=169)	(n=183)	(N=352)
<b>Not able to buy fortified food due to Covid</b>			
Yes	66 (39.0)	78 (42.6)	144 (40.9)
No	103 (61.0)	105 (57.4)	208 (59.1)
Total	(n=169)	(n=183)	(N=352)
<b>Reasons for not being able to buy fortified food</b>			
Reduction in income	65 (98.5)	75 (96.1)	140 (97.2)
Loss of job	2 (3.0)	1 (0.3)	3 (2.1)
Priority shifted to another	10 (15.1)	11 (14.1)	21 (14.6)
Health expenditure increased	4 (6.0)	5 (6.4)	9 (6.2)
Others	0 (0.0)	1 (1.3)	1 (0.7)
Lack of Goods supply	3 (4.5)	8 (10.3)	11 (7.6)
Total	(n=66)	(n=78)	(N=144)
<b>Consumption of fortified food decreased</b>			
Yes	76 (45.0)	88 (48.1)	164 (46.6)
No	93 (55.0)	95 (51.9)	188 (53.4)
Total	(n=169)	(n=183)	(N=352)

**TABLE-15: STATUS OF HAVING FORTIFIED FOOD IN THE GROCERY SHOP (MARKET OBSERVATION)**

<b>Traits</b>	<b>Rangpur (n=18)</b>	<b>Nilphamari (n=24)</b>	<b>Total (N=42)</b>
<b>Availability of fortified oil in the grocery shop</b>	18(100%)	21(87.5%)	39(92.1%)
<b>Liters of fortified oil sold in the shop in a month (average)</b>			
≤ 50 liters	4(22.2%)	8(38.1%)	12(30.8%)
51-100 liters	8(44.4%)	8(38.1%)	16(41.0%)
≥101 liters	6(33.3%)	5(23.8%)	11(28.2%)
<b>Category of population who frequently come to buy fortified oil</b>			
Ultra poor	0(0.0%)	0(0.0%)	0(0.0%)
Poor	0(0.0%)	1(4.8%)	1(2.6%)
Middle class	7(38.9%)	3(14.3%)	10(25.6%)
Rich	0(0.0%)	1(4.8%)	1(2.6%)
All	11(61.1%)	16(76.1%)	27(69.2%)
<b>Availability of Iodized salt in the grocery shop</b>	18(100%)	21(87.5%)	39(92.1%)
<b>Amount of iodized salt sold in shops in a month (on an average)?</b>			
≤ 50 Kgs	3(16.7%)	4(19.1%)	7(17.9%)
51-100 Kgs	8(44.4%)	12(57.1%)	20(51.3%)
101-200 Kgs	4(22.2%)	3(14.3%)	7(17.9%)
≥201 Kgs	3(16.7%)	1(4.8%)	4(10.3%)
Do not know	0(0.0%)	1(4.8%)	1(2.6%)
<b>Which category of population frequently come to your shop to buy iodized salt</b>			
Ultra poor	0(0.0%)	0(0.0%)	0(0.0%)
Poor	0(0.0%)	0(0.0%)	0(0.0%)
Middle class	1(5.6%)	0(0.0%)	1(2.6%)
Rich	0(0.0%)	1(4.8%)	1(2.6%)
All	17(94.4%)	20(95.2%)	37(94.8%)
<b>Availability of fortified rice/zinc rice in the grocery shop</b>	0(0.0%)	0(0.0%)	0(0.0%)
<b>Availability of fortified dairy milk products in the grocery shop</b>	8(44.4%)	3(12.5%)	11(26.2%)

**TABLE-16: SELLER’S PERSPECTIVE ON FACTORS AFFECTING FORTIFIED FOOD CONSUMPTION**  
(MARKET OBSERVATION)

<b>Traits</b>	<b>Rangpur (n=18)</b>	<b>Nilphamari (n=24)</b>	<b>Total (N=42)</b>
<b>Sellers themselves give suggestions to the buyer to take fortified food</b>	11(61.1%)	10(41.7%)	21(50.0%)
<b>Sellers informed about the advantage and disadvantage of receiving fortified food to the buyer</b>	11(61.1%)	10(41.7%)	21(50.0%)
<b>People living nearby the market/ shops buy more fortified food (within 4 km)</b>	9(50.0%)	22(91.7%)	31(73.8%)
<b>Urban people buy more fortified food</b>	14(78.0%)	24(100%)	38(90.5%)
<b>Problem faced in selling fortified food</b>	7(38.9%)	14(58.3%)	21(50.0%)
<b>Types of problems faced in selling fortified food products</b>			
People do not want to buy due to high price	7(100%)	13(93.0%)	20(95.2%)
People do not trust that fortified food have additional nutrient value	3(42.9%)	6(42.9%)	9(42.9%)
Most of the people do not know about the fortified foods	7(100%)	11(78.6%)	18(85.7%)

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