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**DEVELOPMENT OF INTEGRATED NUTRITION MESSAGES FOR SCHOOLS  
(FINAL REPORT)**

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**FINAL REPORT**  
**on**  
**“Development of Integrated Nutrition Messages for Schools”**

**BRAC James P Grant School of Public Health, BRAC University**

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# **Development of Integrated Nutrition Messages for Schools**

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## Abbreviations

BMI	Body Mass Index
COVID-19	Corona Virus Disease-19
FAO	Food and Agriculture Organization
FNS	Food and Nutrition Security
GOB	Government of Bangladesh
HH	Household
IDI	In-depth Interview
KII	Key Informant Interview
MDD	Minimum dietary diversity
NCD	Non-communicable Disease
NCTB	National Curriculum and Textbook Board
NGO	Non-Governmental Organization
NPAN	National plan of action for nutrition
TAC	Technical Advisory Committee
TIPs	Trials of Improved Practices
UN	United Nations
USAID	United States Agency for International
Development	
WHO	World Health Organization



# Executive Summary

## 1. Introduction

### 1.1 Background

School-aged children in Bangladesh are more at risk of malnutrition, notably micronutrient deficiencies, which in turn increase the probability of low academic performance, and early drop-out from the school and ultimately affect the country's socioeconomic development (Ahmed *et al.* 2016, Khanam *et al.*, nd; Mridha 2021, Themane *et al.*, 2003). It is evident that, different forms of school-based nutrition education, such as, web-based education, lectures, and supplement provisions could improve healthy dietary patterns, healthy lifestyle and self-efficacy of children and adolescents (Franko *et al.*, 2008; Poddar *et al.*, 2012; Wall *et al.*, 2012). These interventions were found to be effective as these focused on direct behavioral change of target population to improve nutrition (Contento *et al.*, 1995). Integrated nutrition messages that are simple, practical and culturally appropriate are needed on the issues related to nutritional well-being and daily lifestyle. Topics dealing with healthy diets, nutrition, and other associated factors of malnutrition could be a holistic approach to the essential measures required to sensitize school-aged children to maintain a healthy lifestyle. Therefore, it is necessary to generate evidences for developing integrated and impactful nutrition messages for school-aged children in Bangladesh.

### 1.2 Objective

The objective of this study was to develop and propose a set of impactful messages encompassing thematic issues of healthy diet; nutrition; immunity; hygiene and sanitary practices; physical activity and lifestyle; and environment, including COVID-19 context to be incorporated into children's school textbook covers across different grade levels of primary, middle and high-school.

### Specific Objectives

The specific objectives were as follows:

1. Develop and propose a set of impactful messages encompassing thematic issues of healthy diets, nutrition, immunity, hygiene and sanitary practices, physical activity and lifestyle and environment

2. Improve the understanding of messages through trials of improved practices (TIPs) in selected schools and finalization of materials
3. Group the messages into three categories in accordance with grade levels

## 2. Methods

We conducted a series of activities to generate evidence that helped accumulate feasible and culturally appropriate, integrated nutrition messages. Both qualitative and quantitative methods were used for data collection. At the start, contents of relevant school textbooks and curriculums were reviewed along with key informant interviews of the experts for preparing the integrated nutrition messages. To support message development and refinement, a series of quantitative and qualitative studies were conducted in Parbotipur *upazila* of Dinajpur district and Badargonj *upazila* of Rangpur district. We have nutrition and non-communicable disease surveillance sentinel office in Dinajpur. Considering COVID-19 pandemic situation for getting logistic support and ensuring safety of the data collectors, we select Dinajpur district. Socio-economic condition of the people is representative of the majority people in Bangladesh. In order to get variation on data we selected Rangpur district, which is adjacent to Dinajpur district. The respondents of this study were students, their mothers, school teachers and selected key stakeholders. The students were divided into three groups. The first group included the students who were from pre-primary to class-2, the second group from class-3 to 7 and the third group from class-8 to 10. Besides, different stakeholders, such as government bodies working in nutrition, food, agriculture, education and curriculum development; academicians; researchers; nutrition and education experts of non-government organizations and UN bodies were other respondents of the study.

A literature review was conducted on existing textbooks, curriculum and nutrition related policies, data was extracted on six domains, such as, healthy diet, nutrition, immunity, food safety, hygiene and sanitation, physical exercise and life style, and environment and climate change. At the same time, 16 key informant interviews (KIIs) with different stakeholders were carried out through virtual platform. Subsequently, a survey on knowledge assessment of students and their mothers was carried out. Based on the literature review, key informant interviews and a knowledge assessment study, three sets of two-page integrated nutrition messages were developed for the different groups of students. This was followed by comprehension and aesthetic testing through in-depth interviews of mothers, students and schoolteachers to understand their level of understanding and feasibility of using the developed messages. After modification of the developed messages, we conducted a participatory, formative research using trials of improved practices (TIPs) including pre and post-tests.

Content analysis was performed on the extracted data from the literature review and narrative analysis of the information obtained from the KIIs, and IDIs. In case of quantitative data, findings of categorical variables were presented as a percentage (number), continuous variables with normal distribution as 'Mean' (Standard deviation) and the discrete variables as 'Median' (Inter quartile range). At the same time, Chi-square test was also done to compare the data of pre and post TIPs.

### **3. Findings**

Findings of the study have been described systematically aligned with the development stages of the integrated nutrition messages in the following sections. Each of the activities and the results are given below.

#### ***3.1 Formation of Technical Advisory committee (TAC)***

A Technical Advisory Committee (TAC) was formed consisting of 11 members. The TAC members were representatives and experts identified from different food and nutrition security (FNS) relevant ministries of the Government, notably, food, education, agriculture, health and family welfare, academic and research institutions, NGOs, and UN organizations. The TAC provided suggestions and feedback on the study design, guidance on development of integrated nutrition messages based on the findings of results and fine-tuning and finalizing the messages for the three groups of students.

#### **3.2 Exploring existing knowledge on six thematic areas**

The contents of textbooks were analyzed for key integrated issues of nutrition to be identified for analysis and use in the research study. These were analyzed in books from pre-primary to grade 9-10 levels. It appeared that messages focused around the identified themes and sub themes to be used in the research in the following textbooks: Science, Home Science, Physical Education and Health Science, Agriculture, Biology, Bangladesh and Global Studies, and English for Today. Information on each theme was extracted from the textbooks and are given below:

**Healthy diet:** The findings indicated that under the 'healthy diet' theme, the concept of 'balanced diet', two main sources of foods (plant and animal), food sources of different macro- and micronutrients, the main three functions of foods (growth and development, production of heat and energy, and protecting the body from diseases), functions of macronutrients and micronutrients have been covered comprehensively in textbooks. However, there were inconsistencies found in the calorie values derived from macronutrients like protein, carbohydrate and fat, the classification of food groups, and functions of macronutrients.

**Nutrition:** The concept of nutrition, three forms of malnutrition (underweight, overweight/obesity and micronutrient deficiencies), causes, prevention, and management of malnutrition were well-covered in textbooks. Negative consequences of inappropriate infant and young child feeding practices and adolescent nutrition were noted in textbooks. Unfortunately, measurement of nutritional status of adult including body mass index (BMI) was interpreted incorrectly.

**Immunity:** The concept of immunity was unclear in textbooks; rather pathways of getting infected by infectious diseases were interpreted well. Furthermore, we found that a balanced diet with special emphasis on 'fruits and vegetables' might help in enhancing immunity or in other words these foods provided ability to fight against germs and diseases and moderate exercise, getting enough rest and sleep were also recommended to keep the body healthy.

**Hygiene and sanitation:** We found that hygiene and sanitation issues were covered broadly throughout the pre-primary, primary and secondary levels. Daily personal practices, such as, washing hands, brushing teeth, bathing with clean water and soap regularly, wearing clean clothes regularly, caring for our skin, hair, nails, eyes, and ears regularly, not spitting on the road, using masks or handkerchief while coughing and sneezing, importance of physical cleanliness during adolescence including use of sanitary latrine, wearing sandals, when to use toilet, etc were emphasized repeatedly. Only two textbooks included information on menstrual hygiene.

**Physical activity and lifestyle:** Importance of physical exercise, how to perform them, harmful effects of smoking tobacco or drug addiction, excessive physical activity were described mostly in different physical education textbooks. The contents incorporated the importance of taking rest and having sufficient sleep even though requirements of sleeping varied across different textbooks.

**Environment:** The concept of environment introduced to beginners in school and almost each grade textbook had a dedicated chapter on this issue. Definition of environment, main components of environment (air, soil, and water), and environmental pollution particularly air, soil, and water pollution along with sound pollution, causes of pollution, negative consequences of pollution for human and ecosystem were discussed elaborately and explained with texts and images. Weather and climate, and climate change consequences like global warming were also described in a few textbooks. Tree plantation to protect and conserve the environment had been introduced from the primary level.

### **3.3. Expert opinion for developing integrated nutrition messages**

The key informants stressed on maintaining the existing division of grades as: pre-primary, primary and secondary, and incorporating the messages based on the current textbooks and curriculum considering the grade-wise intellectual capabilities of students. They suggested different forms of presentation of key messages for the different grades of students: a) pre-primary to class-2: only picture (plus instruction in teacher's guide); b) class-3 to 7: more picture and less text (big font size for the lower grades); and c) class 8-10: the proportion of text and picture could be same or more text and less picture. A range of ideas came up to integrate six themes in as part of the education curriculum. For instance, comic books could include two or more characters (conversation plus relevant pictures); short and simple rhyme; cartoon and story line with connection to healthy life and well-being.

All participants agreed to present integrated messages on the cover page of the textbooks. However, they also indicated that presenting messages only on the cover page might be too wordy, and unattractive and might get less attention. To address this, they suggested including only one to two focused messages from each six themes to make the information clear and understandable. At the end, all the respondents came to a consensus that the integrated messages should be incorporated into a common textbook.

### **3.4 Existing knowledge on the nutrition and other factors among students and their mothers**

Findings suggested that mothers had better knowledge on purchasing healthy diet for their children (80%), food preparation procedure and food waste and loss (90%). However, they had less knowledge on function of foods (31%), balanced diet (19%) and had moderate knowledge on healthy diet and safe foods. It was also found that they had a better knowledge on prevention of contagious disease (75%) and prevention of food and water borne diseases such as, diarrhoea, dysentery, typhoid and jaundice (62%). Their knowledge on hygiene and sanitation was also very good (92%). Nevertheless, they had a poor knowledge on environment and climate change issues (<30%).

Students had good knowledge on healthy diets (65%), purchasing healthy foods (75%), and maintaining safety measures of food preparation (57%), but were found to have poor knowledge on balanced diet (13%), function of foods and nutrient content of foods. Students of group-3 were reported to have very good knowledge on nutrition and immunity (93%) but have poor knowledge on nutritional deficiency related diseases (30%). On the other hand, students of both group-2 (61%) and group-3 (66%) had better knowledge on prevention of food and water borne diseases. Most of the students had very good knowledge on personal hygiene and sanitation (90%). Students of group-2 had poor knowledge on environment and climate changes (37%). However, this knowledge was good among students of group-3 (60%) as more information were

covered in their textbooks. They also had better knowledge on physical exercise and lifestyle (69%).

### 3.5 Development of integrated nutrition messages

Based on the existing knowledge on the six domains covered in textbooks and the knowledge assessment of students and parents three sets of integrated nutrition messages were developed. The messages comprised of both pictorial and narrative messages. The messages were further shaped based on the expert's opinion. The narratives and pictorial messages that were included in the preliminary messages are given in the following **Box a**:

**Box a:** Integrated nutrition messages according to healthy diet, nutrition, sanitation and hygiene practice, lifestyle and environment

Theme	Messages
Healthy diet and nutrition	<ul style="list-style-type: none"> <li>– Globally recommended ten food groups</li> <li>– Having at least five food groups daily(dietary diversity)</li> <li>– Functions of foods</li> <li>– Classification of food groups according to functions</li> <li>– Drinking appropriate quantity of water(5 glasses of water/day for group 1; 7-8 glasses of water/day for the students of group-2 and 8-11 glasses of water/day for the students of group-3)</li> <li>– Having safe foods</li> </ul>
Sanitation and hygiene practice	<ul style="list-style-type: none"> <li>– Washing hands after defecation and before having meals</li> <li>– Wearing sandals or shoes</li> <li>– Brushing teeth before going to sleep and after having breakfast</li> <li>– Trimming nails</li> <li>– Covering face during coughing and sneezing</li> <li>– Bathing</li> <li>– Household cleanliness</li> </ul>
Lifestyle	<ul style="list-style-type: none"> <li>– Sleeping duration</li> <li>– Participation in sports</li> </ul>
Environment	<ul style="list-style-type: none"> <li>– Tree/plant plantation</li> </ul>

### 3.6 Understanding of narratives and pictorial messages by the students, parents and teachers

All the participants had confusion to recognize the food plate containing ten groups of food. Teachers recognized it as a food chart. They did not understand the images of grains and beef. Students of groups-1 and 2 had problems reading the narratives and relating them with the pictorial messages. Some of the teachers suggested using simple language and easily readable words instead of complex words.

Even though some confusion were still observed among the respondents, the shape, color and expression of the images, such as, hand washing, covering face during coughing and sneezing, wearing sandals or shoes and brushing teeth were mostly understandable to them. One of the students suggested adding green color to the tube-well as a symbol of safe water. In further exploration of hygienic practices, mothers of the group-1 opposed the message on always wearing sandals by their children, which they found not practical for young children. Teachers demanded for age specific pictorial messages reflecting which age category of student should practice what.

Students of group-1 were not familiar with the elements of the pictorial messages of sports like shoes, ball and sport dresses. Their teachers were also confused with the image of sports. They suggested making the playground greener and faces of children livelier and adding narrative for each image of physical exercise. Although students of group-2 and 3 understood the pictorial messages, but they felt challenged for their inability to spend time in sports because of their pre-occupation with coaching classes in the afternoon. All the students easily understood the pictorial messages of tree plantation. The teachers suggested adding rooftop gardening due to current scarcity of lands.

### **3.7 Modification of the pictorial and written integrated nutrition messages**

The comprehension and aesthetic test were conducted with the goal of getting feedback from the field. Findings were presented to the TAC members and modifications were made on the narratives and pictorial messages accordingly.

### **3.8 Trials of improved Practices (TIPs)**

Findings revealed that knowledge on classification of 10 food groups and functions of foods (energy producing foods, promoting growth and maintenance, and preventing diseases) increased significantly from Round1 to Round 2 in group-1, 2 and 3( $p<0.001$ ). Intake of five or more food groups during the last 24-hours of interview was not achieved in any groups between Round 1 and Round2. However, intake of green leafy vegetables increased significantly only among the students of group-2 (42% vs. 64%). It was also found that drinking appropriate quantity of water also increased significantly among all groups of students from Round-1 to Round-2 ( $p<0.001$ ).

Despite having better knowledge among all the groups of students on hand washing with soap after defecation and before meals, findings revealed gaps between knowledge and practices of

washing hands with soap before meals during Round 1. However,, we found that this gap was reduced during Round2. Almost all students in group-1, 2 and 3 started to wash their hands with soap after defecation and before having meals ( $p<0.001$ ). Furthermore, brushing teeth after having breakfast increased significantly among students of group-1 (8% vs. 30%), group-2 (2% vs. 38% ) and group-3 (6% vs. 36%). The proportion of students those who were always wearing sandals or shoes also increased significantly in group-1 (58% vs. 68%), group-2 (56% vs. 78%) and group-3 (74% vs. 90%).

All students had knowledge on regular physical exercise and the benefits of physical exercise or sports, such as, keeping mind joyful, improving concentration in education and reducing illness increased significantly. Students of higher grades had lower tendency of participating physical exercise due to their priority on spending time on studies. In addition, knowledge on the benefits of tree plantation such as, source of fresh fruits and vegetables, source of oxygen, and reduced global warming, and economic growth increased significantly among students of all groups. This trial could not improve tree plantation practices among students between Round 1 and 2. It was also reported that that family members of all students had tendency to keep houses clean inside and outside regularly.

#### **4. Conclusions**

Despite some gaps identified in the knowledge and practices of students, the strength of the study was that the same set of integrated, pictorial nutrition messages was logically developed for all the students regardless of their age. These messages would improve the knowledge and practices of children due to their simplicity, cultural appropriateness, and visibility that it would provide through the school textbooks. The display of messages on the visible pages of the textbooks will act as a constant reminder for improved behavior and practices of the children as well as parents. It is noteworthy that a larger group of the population embracing schoolchildren, parents and schoolteachers will simultaneously be exposed to these important messages, which is likely to disseminate knowledge across the society. To augment nutrition behavior and practices in real life, inclusion of parents in the intervention seemed to be a useful and essential approach so that they could support their children and help to create an enabling environment paving the process from home to the school. As this study has been conducted under the leadership of the Ministry of Food, it is warranted that formal communications with the policy-makers in the Ministry of Education especially the NCTB are set up to consider the incorporation of this newly developed set of integrated nutrition messages into textbooks. To this end, it is expected to foster good food habits, promote healthy food behavior and improve diets and nutrition and other associated practices for a healthy, brighter and productive future in Bangladesh.



## 5. Policy Recommendations

Based on the findings some recommendations are provided for creating and strengthening the environment on food knowledge and behavior for children, parents and teachers in order to improve nutritional status of school children.

1. **Incorporating integrated nutrition messages into the school textbooks:** All the messages were generated using the existing resources in the national textbooks/curriculum and nutrition related policies. These messages were easily understood by the students and their mothers, being essentially practical for use in their daily lives. Thus, reinforcing the messages on the visible pages of the textbooks by the NCTB might prove to be an effective tool to bring changes in knowledge and practices among the students.
2. **Using multiple platforms:** The integrated messages could also be communicated in school premises through digital media, posters, cartoons and other platforms
3. **Engaging different ministries and organizations:** We developed the same integrated messages for all age groups of school students, which are easily understandable and feasible to be implemented by the different ministries of the government, nongovernmental organizations (NGOs) and UN-bodies through various platform to reach out the same populations
4. **Engaging National Nutrition Services:** Since these messages were developed to foster both health and nutritional status of the students, National Nutrition Services under the Ministry of health and Family Welfare may adopt the messages in promoting health and nutrition of the same age cohort of children and parents.

# Chapter 1

## Introduction

### 1.1 Context of the study

Childhood and adolescence are the critical periods of human lifecycle in terms of nutritional standpoint (Crusick& Georgie, 2016; Das *et al.*, 2017; Das *et al.*, 2018). Health of the children and adolescents depends on food intake that provides sufficient energy and nutrients to promote optimal physical, cognitive, social growth and development (Myszkowska-Ryciak *et al.*, 2019). Dramatic physical growth and development during puberty significantly increases requirements for energy, protein, and others nutrients of the children. In Bangladesh, a significant proportion of children live with various forms of malnutrition and micronutrient deficiencies (Ahmed *et al.*, 2017; icddr;b *et al.*, 2013; Mridha 2021). One in five school-age children suffer from vitamin A deficiency and anaemia. Around 40 percent of school-age children are living with vitamin D and about 20 per cent with calcium deficiency. The prevalence of iodine deficiency among school-age children is also around 40 percent. The various forms of micronutrient deficiencies among children lead them to poor school performance, increase their probability of dropping out, hinder their future productivity, and ultimately affect the country's socioeconomic development (Khanam *et al.*, nd; Themane *et al.*, 2003). Childhood obesity is an emerging public health crisis, which increased the risk of cardio-metabolic disorders such as, hypertension, dyslipidaemia, insulin resistance, diabetes and reduced life expectancy (Baker *et al.*, 2007; Reilly 2005; St-Onge& Heymsfield, 2003; Gunnell; 1998). Optimal nutritional status not only depends on having access to foods that are conducive to a healthy diet and meet dietary needs (e.g. sufficient, safe and nutritious), but also on other underlying factors such as, healthcare practices; adequate health services; and a healthy environment, including safe water, sanitation and good hygiene practices and physical activity (Saha *et al.*, 2018; WHO, 2015).

In Bangladesh, the Government has prioritized implementing multiple policies to provide more diverse and nutritious diets and production of variety of foods. However, nutritional status of Bangladeshi population does not reflect that they are having an appropriate diet to improve it. Nutrition education is recognized as an essential catalyst intervention to improve people's knowledge towards better attitudes and practices for achieving optimal nutrition outcomes (Contento 1995; Contento *et al.*, 2007). Therefore, development of integrated nutrition messages for schoolchildren is a policy priority in Bangladesh to reinforce their nutrition knowledge, foster their dietary intake, knowledge and hygienic practices and, help them in achieving better nutritional outcome and better school performance (Asmare *et al.*, 2018). Schools provide the best opportunity to convey such messages through their academic curriculum, textbooks and class lessons. They need to be conveyed evidence based, culturally appropriate messages and

practice oriented behaviors that are feasible to be implemented in real lives. In the context of Bangladesh, a range of evidences are available that provides direction on how to design materials to educate the communities on various aspects of nutrition in improving nutrition sensitive healthy behaviors. However, they have been mostly targeted focusing on thousand days approach and a few have been applied in schools to improve children's nutrition skills. Through this study, we intend to generate feasible and practical intervention for school-aged children to promote their nutrition and health.

## **1.2 Rationale of the study**

In Bangladesh, the National Curriculum and Textbook Board (NCTB) has already incorporated information on diet, hygiene and sanitation, healthy lifestyle, environment and climate change in the national textbooks of schoolchildren. The current nutritional status of children and adolescents points out that only textbook information would not be able to address their nutrition related problem. Integrated nutrition messages that are positive, practical and pictorial are needed on issues related to nutritional well-being and daily lifestyle. Topics dealing with healthy diets, nutrition, and other underlying factors of malnutrition could be a holistic approach to the essential measures required to sensitize school age children to maintain a healthy lifestyle. Therefore, it was necessary to generate evidence for development of integrated and impactful nutrition messages for school-aged children.

## **1.3 Objective**

### **General Objective**

The general objective of this study is to develop and propose a set of impactful messages encompassing thematic issues on healthy diets, nutrition and immunity, hygiene and sanitary practices, physical activity and lifestyle, and environment including a COVID-19 context to be incorporated into children's school text book covers across different grade levels encompassing primary, middle and high-school children.

### **Specific Objectives**

The specific objectives of this study are as follows:

1. Develop and propose a set of impactful messages encompassing thematic issues of healthy diets, nutrition and immunity, hygiene and sanitary practices, physical activity and lifestyle, and environment
2. Improve the understanding of messages through trials of improved practices (TIPs) in selected schools and finalization of materials
3. Group the messages into three categories in accordance with grade levels

## **1.4 Organization of the Chapters**

The report is divided into eleven chapters, which are preceded by an introduction. This first chapter has set the context, rationale and objectives of the study for developing integrated nutrition messages for the schoolchildren in Bangladesh. Chapter-2 represents literature review supporting the background of the study. Chapter-3 illustrates details of methodology including study design, data collection and analysis and ethical review. Chapter-4 presents findings of content analysis of the national textbooks of school, curricula and relevant policies where existing nutrition and other relevant issues have been described. Chapter-5 is consisting of description of the voice of key informants providing their views and suggestions on the content and communications of integrated nutrition messages. Chapter-6 presents knowledge assessment of school students and their mothers. Chapter-7 is showing preliminary integrated nutrition messages that were tested in the field for finalizing messages, while in chapter-8 the findings of comprehension and aesthetics of preliminary messages has been given. In chapter-9, the modified final messages have been included. In chapter-10 findings of trials of improved practices (TIPs) that carried out to test the feasibility of the newly framed integrated nutrition messages has been included. Finally, Chapter-11 covers conclusion and recommendations where we briefly outline the key features of study in relation to the strengths and challenges and recommendations for consideration on incorporating integrated nutrition messages into the school textbooks.

## **Chapter 2**

### **Literature review**

In this chapter, we discuss information from different literatures on why the nutrition of older children (5–9 years) and adolescents (10–19 years) is important, and the consequences of malnutrition that it can have over generations. In addition, we will also discuss the underlying factors of malnutrition that need to be addressed for achieving optimal nutritional status of these two age groups. Furthermore, we also review the effective and feasible medium to convey integrated nutrition messages to these age groups of populations.

#### **2.1 Nutritional needs during childhood and adolescent periods**

Childhood and adolescence are critical periods of the human lifecycle in terms of nutritional needs (Crusick and Georgie, 2016; Das *et al.*, 2017; Das *et al.*, 2018). The health of children and adolescents is dependent upon food intake that provides sufficient energy and nutrients to promote optimal physical, cognitive, social growth and development (Myszkowska-Rycki *et al.*, 2019). Dramatic physical growth and development during puberty significantly increases the requirements for energy, protein, and micronutrients. Biological changes related to puberty might significantly affect psychosocial development. Rapid changes in body size and shape in girls often leads to feelings of poor body image and development of eating disorders (Kakhi and McCann, 2016). Likewise, a delay in biological development could lower self-esteem and increase the risk of eating disorders among male teenagers (Lavender *et al.*, 2017). However, in practice, the implementation of proper nutrition recommendations in these population groups is extremely difficult due to the existing barriers, e.g., availability of healthy food, inadequate nutrition knowledge of caregivers and children and personal food preferences (Myszkowska-Rycki *et al.*, 2019) as well as media influences.

#### **2.2 Overweight and obesity during childhood and adolescent period**

Childhood obesity is one of the emerging public health crises in many developed and developing countries. Globally, in 2010 out of 43 million obese children, approximately 81% were from developing countries, half of which (18 million) were from Asia alongside the huge burden of under-nutrition (de onis *et al.*, 2010). By 2020, it is estimated that the global prevalence of childhood obesity will reach approximately 60 million (de onis *et al.*, 2010). Socio-economic development, rapid urbanization, changes in lifestyle characterized by physical inactivity and unhealthy diets (deep fried chips, sugary soft drinks, juice, ice-cream, burger, chocolate, etc.), uncontrolled consumption of sweet and salty snacks, living patterns, as well as rapid epidemiological and demographic transition are some of the contributing factors attributed to the increasing levels of childhood obesity in developing countries (Satoko and Masahiro, 2017;

Davidson and Brich, 2011). An earlier study showed an increasing trend in childhood obesity in Bangladesh, which ranged from <1% to 17% and its prevalence was higher in urban area compared to rural areas (Rahman *et al.*, 2014). Childhood obesity has also become an emerging urban health problem in urban cities of Bangladesh, particularly in affluent families (Bhuiyan *et al.*, 2013). In rural areas across Bangladesh, the risk of obesity was found to be higher among adolescent girls compared to boys (Saha *et al.*, 2018).

### **2.3 Cause and effect of obesity during childhood and adolescence**

Socio-economic development, rapid urbanization, changes in lifestyle characterized by physical inactivity and unhealthy, uncontrolled consumption of sweet and salty snacks, living pattern, as well as rapid epidemiological and demographic transition are the contributing factors to the rising levels of childhood obesity in developing countries (Satoko and Masahiro, 2017; Davidson & Brich, 2001). De Onis predicted that by 2020 the global prevalence of childhood obesity would reach approximately 60 million (de onis *et al.*, 2010). During 2010, globally out of 43 million obese children, approximately 81% were from developing countries, half of which (18 million) were reported to be living in Asia despite the huge burden of under-nutrition (de onis *et al.*, 2010). An earlier study showed an increasing trend in childhood obesity in Bangladesh, which ranged from <1% to 17% and its prevalence was higher in urban areas compared to rural areas (Rahman *et al.*, 2014). Evidence showed that, overweight and obesity during childhood and adolescent periods increased the risk of future cardio-metabolic disorder such as hypertension, dyslipidemia, insulin resistance, and reduced life expectancy (Baker *et al.*, 2007; Reilly 2005; St-Onge & Heymsfield, 2003; Gunnell; 1998). Furthermore, an association between obesity in young girls with potential menstrual disorders, hypertension in pregnancy and sub-fertility was also found (Power *et al.*, 1997; Bond *et al.*, 2020). In urban Bangladesh, having an overweight parent along with limited exercise and high levels of sedentary lifestyle led to obesity among school children (Bhuiyan *et al.*, 2013). On the other hand, girls in rural areas with less physical activity were mainly associated with overweight and obesity, while food habits, television watching, computer gaming and duration of sleep were not found as significant predictors of obesity (Saha *et al.*, 2018). It appears that physical activity plays a more important role in the prevention of overweight and obesity in childhood and adolescence. Puberty and the following adolescent periods are acknowledged as particularly vulnerable for the development of obesity due to sexual maturation and, in many individuals, a concomitant reduction in physical activity (Hills *et al.*, 2011). A study in Bangladesh found that more than 30 minutes physical activity could reduce the risk of being overweight and obesity (Rahman *et al.*, 2014).

## **2.4 Underlying factors of improved nutritional status of school going children**

Optimal nutritional status not only depends on having access to safe and diversified foods and a healthy diet to meet nutritional needs, but also on other underlying factors such as, healthcare practices, adequate health services, a healthy environment, including safe water, sanitation and good hygiene practices (WHO, 2015). Infections are also associated with poor nutrient absorption, impaired transfer of nutrients to target tissues and increased catabolic losses (Scrimshaw *et al.*, 1959; Mata *et al.*, 1977; Bhutta, 2006). If such acute self-limiting infections occur repetitively, their net effect on feeding, nutrient absorption, utilization and ultimately growth could be significant (Bhutta, 2006). Evidence showed that access to improved WASH could prevent 361,000 diarrhoeal deaths per year among children under five years of age (Pruss-Ustun *et al.*, 2014). Furthermore, a meta-analysis found that improving a range of WASH services and practices in households could reduce the incidence of soil-transmitted helminth infections by one-third (Strunz *et al.*, 2014; Ziegelbauer *et al.*, 2012). Another analysis of 171 surveys in 70 low- and middle-income countries found that increasing access to and use of improved sanitation and improved water sources reduced the risk of stunting (Fink & Hill, 2011). Furthermore, integrated nutrition and WASH interventions were found to be effective in reducing common morbidities and stunting among young children in poor resource settings like Africa (Head *et al.*, 2019). Therefore, targeted interventions for reducing morbidity can in turn improve the nutritional status of children. Hand washing with soap and water is an effective way to prevent transmission of infection from hand to mouth (Luby & Curtis; 2008; Dangour *et al.*, 2013). Morbidity pattern of school-going children is different from under-five children. In addition to common morbidity they also suffer commonly from the oral cavity and anemia followed by vitamin A deficiency and worm infestation (Shinde *et al.*, 2021). Thus, their hygiene practices warrant to be corrected for improving health and cognitive development and drop out from schools. It was found in Bandung, Indonesia that proper hand washing techniques with soap at appropriate times could reduce fecal contamination among children of elementary school (Otsuka *et al.*, 2019). Improvement of hand washing with soap was more effective when the schoolteachers promoted the practices among the children (Tidwell *et al.*, 2020). A Multi-country study conducted in Cambodia, Indonesia and Lao PDR found that school based interventions including daily group hand washing with soap and brushing teeth with fluoride toothpaste, biannual school-based deworming; as well as construction of group hand washing facilities could prevent dental caries (Duijster *et al.*, 2017). All these studies created programmes can transform school settings to a healthy learning environment for students.

## **2.5 Nutrition policies in Bangladesh and gaps in implementation**

Bangladesh has been implementing national policies to promote safe and diversified diets to the population. These have been evolving and are reflected in the in the second Bangladesh National Plan of Action for Nutrition (NPAN2, 2016–2025), Seventh Five Year Plan 2016-2020 (GOB, 2015), Sixth Five Year Plan 2011-2015 (GOB, 2012), Second Country Investment Plan on Nutrition Sensitive Food Systems (2016-2020) (GOB 2016), and the recent National Food and Nutrition Security Policy (2020) (GOB 2020). In the Seventh Five Year plan (2016-2020) the government has highlighted the need for more nutrition sensitive actions focused on producing nutritious, affordable and safe foods for local consumption and nutritional gain (GOB, 2015). Indeed, policies for agriculture have largely been prioritized economic productivity and poverty reduction over production diversity and increased productivity of nutritionally valuable commodities (Naher *et al*, 2014). This is one of the reasons why Bangladesh has made significant progress on food production including self-sufficiency in a variety of crop, horticulture and fish production (GOB, 2017; BBS, 2017; DI, 2018; FAO, 2018). However, this production is not commensurate with the nutritional needs and distribution of foods. High levels of food insecurity, limited dietary diversity and gender disparities persist amidst frequent natural disasters and poor sanitation all which are contributory factors of malnutrition in Bangladesh (USAID, 2017; Arsenault *et al.*, 2013). Furthermore, there are no policies to implement feasible and culturally appropriate integrated nutrition messages for the school students that might sensitize them to change their food behavior and maintain a healthy lifestyle.

## **2.6 Effective intervention for improving nutritional knowledge among children and adolescent**

With respect to food, knowledge on what should be eaten and the awareness of the importance of healthy food habits are the first steps in altering eating behavior. Nutrition knowledge may be defined as the individual cognitive process related to information on food and nutrition, and it is closely linked with healthy food selection, nutritional well being as well as prevention of overweight and obesity which are underlying conditions to be controlled in NCDs (Axelson& Brinberg, 1992; Després& Lamarche, 1994; Scagliusi *et al.*, 2006). Childhood is an important period for correction of unhealthy food behaviors through improving knowledge, which could prevent the development of health problems later in life (Sacco *et al.*, 2016; WHO, 2010). Earlier evidence of school-based nutrition education in different countries also revealed both success and failure of addressing nutrition problems (Dobbins *et al.*, 2013; Tamiru *et al.*, 2016). Evidence showed that different forms of nutrition education, such as, web-based education, lectures, and supplement provisions could improve healthy dietary patterns, healthy lifestyle and self-efficacy



of children and adolescents (Franko *et al.*, 2008; Poddar *et al.*, 2012; Wall *et al.*, 2012). These interventions were found to be effective as these focused on direct behavioral change of target population to improve nutrition (Contento *et al.*, 1995).

## **Chapter 3**

### **Methodology**

This chapter describes the methodology of the study systematically. We performed series of activities to obtain the various objectives set for the study (Figure 3.1). Initially we did literature review and content analysis. Later we undertook key informant interviews (KIIs) and a quantitative survey to develop some integrated nutrition messages. After that, we did in-depth interviews (IDIs) to know the level of understanding of the developed messages for the targeted audience. Finally, we conducted trials of improved practices (TIPs) to explore the feasibility for following the developed messages in their real life. Furthermore, a technical advisory committee (TAC) was formed to guide the research team for developing integrated nutrition messages. The members of TAC were included from different Ministries of Government of the people's republic of Bangladesh, such as Ministry of Food, Ministry of Education, Ministry of Health and Family Welfare, Ministry of Agriculture. Besides academics, researchers and Practitioners were also the part of the TAC. A detailed description of the methods used has been given below.

#### **3.1 Study design**

We employed both qualitative and quantitative methods in order to collect data on various themes and from different sources. Both methods complement and supplement the study with immense, rich data. Qualitative approach includes literature review of national textbooks/curriculum and nutrition related policies and gathering expert opinions for preparing the integrated nutrition messages and comprehension and aesthetic test of students for refining the messages. On the other hand, quantitative component of the study encompasses knowledge assessment of mothers and students and TIPs.

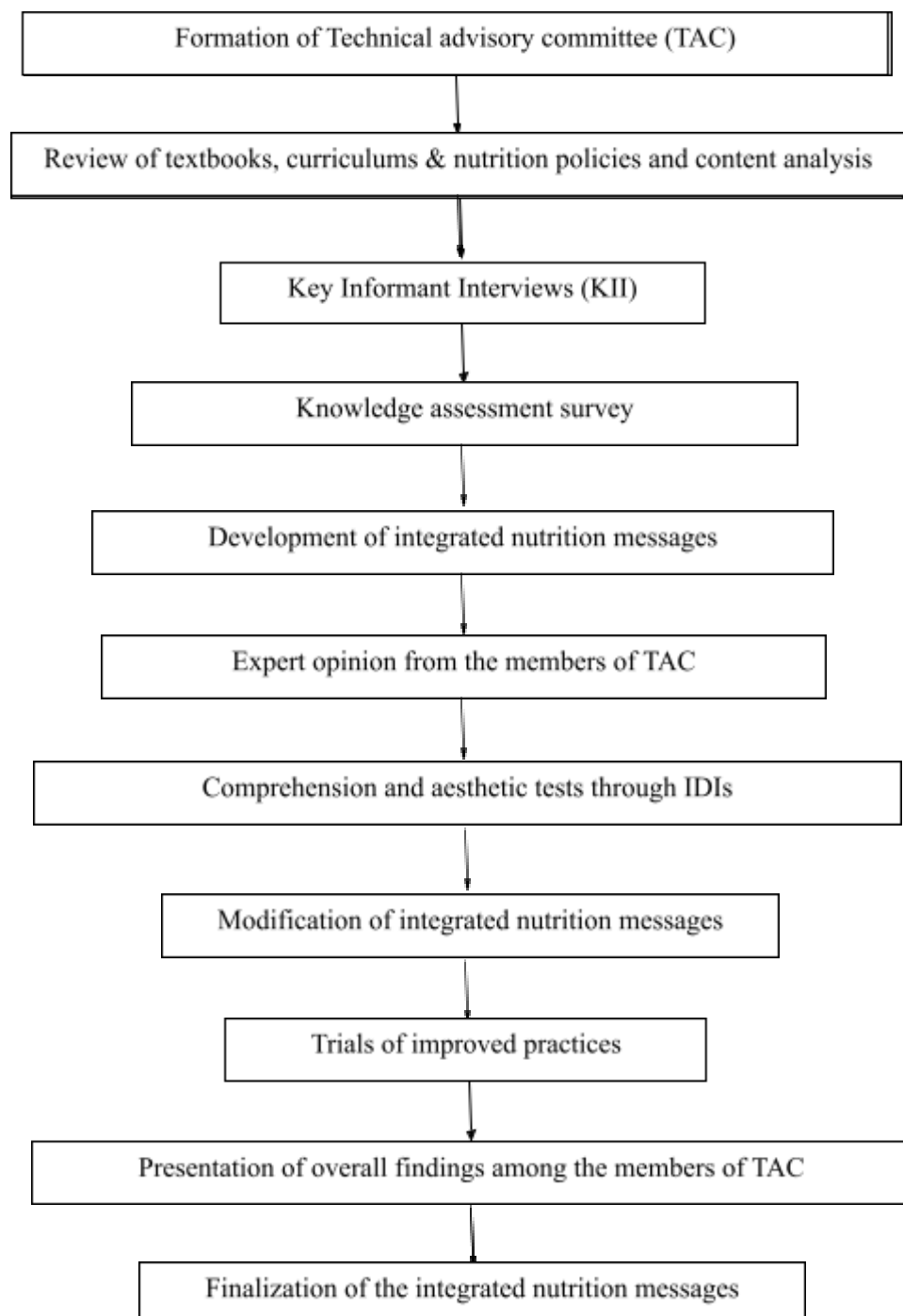
#### **3.2 Study areas**

This study was conducted in Parbotipur *upazila* of Dinajpur district and Badargonj *upazila* of Rangpur district, during August 2020 to March 2021. We have local office of BRAC JPGSPH in Dinajpur district. Considering COVID-19 pandemic situation for getting logistic support and ensuring safety of research assistants, we select Dinajpur district. Most of the people of people in this area have the socio-economic condition that representative to majority people in Bangladesh. In order to get variation on data we selected Rangpur district, which is adjacent to Dinajpur district, In addition, we carried out deskwork at the school and the experts of the different sectors were interviewed virtually.

### 3.3 Study populations

The respondents of this study were students, their mothers, schoolteachers, government, NGO, academic and UN stakeholders. All the students were divided into three groups. First group was the students who studied pre-primary to class-2, the second group studied from class-3 to 7 and the third group studied from class- 8 to 10.

Figure 3.1: Steps of activities of the study



### **3.4 Meetings of Technical Advisory Committee (TAC) and inception workshop**

A total of three TAC meetings were conducted during the study period. The first virtual meeting among members of TAC was held on September 22, 2020 from 8.30 pm to 9.30 pm via Zoom meeting platform due to the COVID-19 pandemic. The second TAC meeting was held on November 26, 2020 from 8.30pm to 9.30pm via Zoom meeting platform. The third TAC meeting was held on March 11, 2021 from 8.30pm to 9.30 pm on the same platform. The feedback of the first TAC meeting has been given in Annexure 1, 2 and 3. After the first TAC meeting, an inception workshop was held on September 30, 2020 from 2.00pm to 4.00pm via zoom virtual meeting platform among different stakeholders like teachers, parents, Government employees, NGO workers, and UN bodies to get feedback to improve the methodology of the study. Important discussion points of the workshop have been shared in Annexure 4.

### **3.5 Literature review and content analysis**

We extracted data from textbooks, curriculum, and policies. Hence, sources of data are primarily the selected textbooks of pre-primary to grade 10 students published by NCTB along with the relevant curriculum and policies (Table 1). A textbook is usually succinctly written, tightly organized, and greatly condensed (John, 2007). Textbooks were selected based on the objectives and identified themes of the current study. For this particular research, we collected data from textbooks titled '*Amar Bangla Boi*', 'Elementary Science', 'Bangladesh and Global Studies', 'English for Today' at primary education level (grade 1-5); 'Home Science', 'Science', 'Agriculture Studies', 'Physical Education and Health', 'Bangladesh and Global Studies', 'Biology', 'English for Today' at secondary education level; and for pre-primary, *Amar Boi* and also reviewed the curriculum to identify what they are expected to learn.

Meanwhile, the curriculum is the combination of instructional practices, learning experiences, and students' performance assessments that are designed to bring out and evaluate the target learning outcomes of a particular course or can be defined as a detailed plan for instruction set by policy-makers. It is the heart of education and textbooks will be written in accordance with the guidelines of curriculum and syllabus set forth (National education policy, 2010). In Bangladesh, curriculum and textbooks of compulsory courses at primary and secondary levels are uniform, and followed and taught in all types of primary and secondary schools. During data extraction, we consulted both Bangla and English versions of the selected textbooks. The policies and strategies taken into consideration during this research includes National education policy 2010, National nutrition policy 2015, National school meal policy 2019 (Bangla), National strategy for adolescent health 2017-2030, National food and nutrition security policy 2020.

**Table 3.1:** List of the documents (book, curriculum, policy) for review

Educational level	Textbooks reviewed
Pre-primary	Books and curriculums ( <i>Amar Boi</i> )
Primary (grade 1-5)	Books and curriculums [ <i>Amar Bangla Boi</i> (only for grade 1 and 2), Elementary science, Bangladesh and Global Studies, English for Today]
Secondary (grade 6-10)	Books and curriculums (Home Science, Science, Agriculture Studies, Physical Education and Health, Bangladesh and Global Studies, Biology, English for Today)
<b>Policies and strategies considered:</b>  National education policy 2010, National nutrition policy 2015, National school meal policy 2019 (Bangla), National strategy for adolescent health 2017-2030, National food and nutrition security policy 2020	

Based on the study objectives and pre-determined themes, a detail code list (Table 3.2) was developed for each theme to extract content from the textbooks and curriculum (where applicable).

**Table 3.2: Major themes and sub-themes of the code list**

Sl. No.	Major themes	Sub-themes
1	Healthy diets	<ul style="list-style-type: none"> <li>• Healthy and balanced diet</li> <li>• Unhealthy foods</li> <li>• Functions and sources of foods and nutrients</li> <li>• Food safety (throughout the food chain)</li> <li>• Meal planning, preparing and serving of foods</li> </ul>
2	Nutrition	<ul style="list-style-type: none"> <li>• Nutrition</li> <li>• Nutritional problem (macronutrient and micronutrient related problems): causes and symptoms</li> <li>• Solutions to the nutritional problem (Under and over-nutrition; micronutrient deficiency)</li> <li>• Breast feeding and complementary feeding</li> <li>• Adolescent nutrition</li> </ul>
3	Immunity	<ul style="list-style-type: none"> <li>• Immunity concept</li> <li>• Consequence of lack of immunity</li> <li>• How to boost immunity (important foods/nutrients)</li> <li>• How to prevent common infectious diseases</li> </ul>
4	Hygiene and sanitation	<ul style="list-style-type: none"> <li>• Hand washing and personal cleanliness</li> <li>• Cleanliness of surrounding</li> <li>• Sanitation (latrine use and others)</li> <li>• Menstrual hygiene</li> <li>• Safe water</li> </ul>
5	Physical activity and lifestyle	<ul style="list-style-type: none"> <li>• Physical activity concepts and types</li> <li>• Age-specific recommendations</li> <li>• Sedentary behaviour and weight management</li> <li>• First aid</li> </ul>

		<ul style="list-style-type: none"> <li>• Smoking and substance use</li> <li>• Discipline in life</li> </ul>
6	Environment	<ul style="list-style-type: none"> <li>• Environment and its components</li> <li>• Environmental pollution (causes &amp; consequences)</li> <li>• Climate change and global warming</li> <li>• Reduction of environmental pollution</li> </ul>

### 3.6 Key Informant Interviews (KIIs)

The Key Informant Interviews (KIIs) were carried out among the stakeholders of different Government, non-government organizations (NGO), UN-agencies, researchers, and experts in nutrition, WASH and environment. The respondents were selected purposively and inclusion criteria of respondents were having at least 10 years of experience of relevant field. The interviews were continued until data saturation and finally total number of interviews was 16. Respondent's categories and the number of interviews of each category is given in Table 3.3.

**Table 3.3: Respondent categories of the key informant interviews**

Sl. No.	Respondent categories	Number of Key informants
1	Government stakeholders and school textbook related experts	2
2	Representatives from UN agencies	3
3	Academicians and researchers from nutrition, education, WASH and environment sectors	6
4	Experts from NGOs	5
	<b>Total</b>	<b>16</b>

A key informant interview guideline and protocol to conduct the interview was developed consisting of questions related to all the themes along with a few opening and closing questions. The interviews were conducting mostly by mobile phone or using different platforms such as Google meet or zoom meeting platform due to the current COVID-19 pandemic situation. The duration of each interview was 30-50 minutes.

### 3.7 Knowledge assessment survey on nutrition and related issues

This was a cross-sectional study. The study was conducted in the Badargonj *upazila* of Rangpur district and Parbotipur *upazila* of Dinajpur district during November 2020. A total of 450 students and their mothers were selected for the survey. Initially the students were segregated into three groups on the basis of grades. The selection criteria of the three groups of students were,

Group 1: Students studying in pre-primary to class-2

Group 2: Students studying in class-3 to class-7

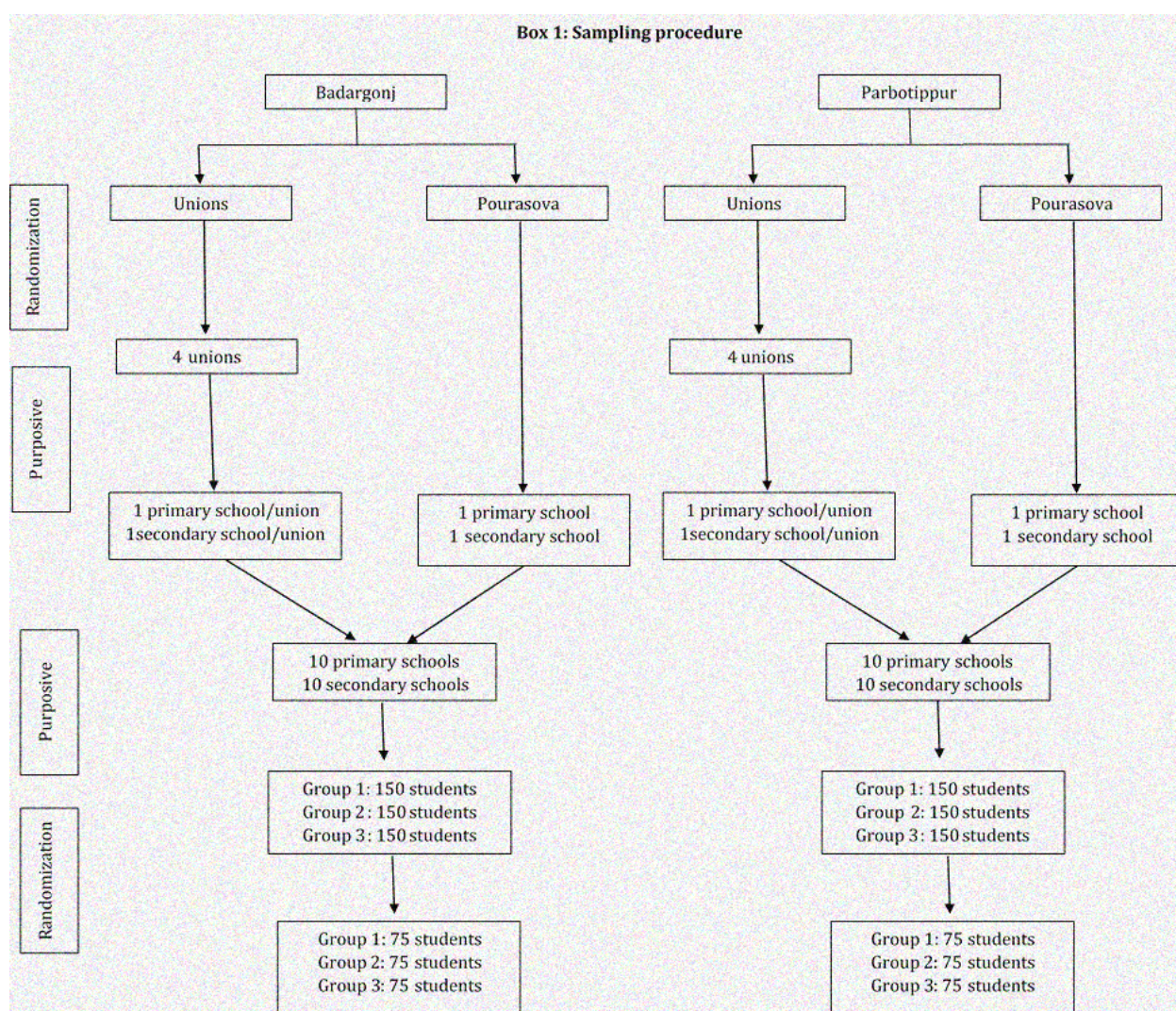
Group 3: Students studying in class-8 to class-10

In case of Group 1 only the mothers were interviewed, while for the other two groups both mothers and students were selected for the interview. Initially, a pourasova of each upazila was selected. Later four unions from each upazila were selected randomly. In total ten primary schools and ten secondary schools were selected purposively for selecting the students. We selected a primary school and a secondary school from pourasova of each Upazila and from another four unions four primary and four secondary schools were selected from each Upazila. All the twenty schools were following the books and regulation of the National Curriculum and Textbook Board (NCTB) under the Ministry of Education, of the Government of the People's Republic of Bangladesh.

After selecting the schools, the research assistants collected addresses of parents and guardians of students studying from pre-primary to class-10 from the school's authority. After visiting the households, students were included for the survey. Since mothers of the students were one of our respondent groups to get the mothers, we had to go to the household of the students. This was primarily done to seek concurrence and gain some observational insights prior to the survey. Primarily 900 students from different classes were enlisted. Finally, 450 students were selected randomly for the interview. From each group a total of 150 students were interviewed. (see in Box 1 below)

A structured questionnaire was developed for data collection, considering the existing diet, nutrition, immunity, sanitation, hygiene, climate change; physical exercise and lifestyle messages given in the books of NCTB in different grades. In addition, questions on socio-economic conditions of the households, household access to food and dietary diversity for both the mothers and students have been included. In addition, questionnaire on food processing, food preservation and food safety were also included. The questionnaire was pre-tested in different areas of Dhaka city by the researchers. Finally, data was collected by using tabloid mobile device.





### 3.8 Comprehension and aesthetic test

An exploratory study was conducted for the comprehension and aesthetic test. We performed IDIs, qualitative data collection technique for interview. Through this method, we tried to understand the opinion of the students, mothers and teachers on the developed integrated nutrition message for textbooks. This study was conducted in Badarganj and Parbatipur *upazila* of Rangpur and Dinajpur districts respectively, during December 2020. Three categories of respondents from each group were included in this study for collecting information. The first category of respondents was students from pre-primary to class-10. The second category of the respondents was the mother of the students, studying from pre-primary to class-10. The third category of the respondents were the schoolteachers. The inclusion criteria of the students was that they had to stay in the study areas for the last six months and studied in the schools of selected areas where the knowledge assessment was conducted. The selection criteria for the



mothers were that they had to stay in any of the study areas for at least six months and should know how to read and write in Bengali language. In addition, the teachers were selected from the government school of the study areas. Selection criteria of the teachers of groups 1 was that they must be either math or English language teachers, while science or social science was the selection criteria of group-2 whereas, science or social science or physical activity was the selection criteria of the teachers of group-3. The total number of interviews conducted across the respondents is given in the following Table 3.4.

**Table 3.4: Respondents' category and number of interviews**

Categories of respondents	Respondents	Number
Group 1	Students	4
	Mothers	2
	Teachers (English& Math)	3
Group 2	Students	4
	Mothers	2
	Teachers (science & Social Science)	2
Group 3	Students	4
	Mothers	2
	Teachers (Science, Social Science and Physical activity)	2

A guideline was developed prior to the interview (Annexure 5). A total of 24-IDIs were performed among different categories of respondents. A research team of two anthropologists were trained on the comprehension and aesthetic test of the developed pictorial and written messages. At first, the researchers visited the schools and contacted headmasters. With the help of them, they got the address and telephone numbers of each recommended subject's teachers. Then the researchers found the addresses of the students through teachers. Similarly, the address of other students and their parents were collected from the school authority. Here, unpaired students and parents were interviewed. The interviewing strategies were different for different groups. For example, questions were asked in three phases for students and parents. At first, pictures of messages were put in front of the study participants and interviewed. Then the written messages were presented and questions were asked accordingly. Finally, both pictures and written messages were presented together, and opinions were elicited. For teachers, only one phase was conducted. Both pictures and written messages were presented together, and opinions were recorded.

### 3.9 Trials of improved practices (TIPs)

This was a one-group pre/ post- tests experimental designed study. The study was conducted in the Badargonj *upazila* of Rangpur and Parbotipur *Upazila* of Dinajpur districts during January, 2021. This trial was conducted after modifying the developed integrated nutrition messages. Out of 450 students of three groups, those were selected in the earlier study, 150 were selected

randomly. From each group, we intended to select 50 students for the trial. The students were selected equally from each union. From each group five students were selected randomly from each school. Likewise, in an earlier study, during interviewing students of group-1 mothers were also present to respond to the questions.

We developed BCC material for each group, and these were used for interviewing the students. The mothers and students were counseled together. A total of six health workers were recruited to interview the mothers and the students. Three of them were working in Badargonj and another three were working in Parbotipur. Before going to the field, they received four days of training. A guideline was prepared in Bengali language and asked to follow the guideline during counseling. At first, the pre-test was conducted among the students. After that, the health workers visited house-to-house of the students to counsel the students and the mothers on the food plate, ten food groups, function of foods, quantity of water to drink, safe food, personal sanitation and hygiene, cleanliness and tree plantation.

A structured questionnaire was developed for data collection, considering the behavioral change communication (BCC) materials developed by the researchers. We collected information on both knowledge and practice of healthy diet, nutrition, immunity, sanitation, hygiene, climate change, physical exercise, and lifestyle. In addition, we also collected data on the dietary diversity of mothers and the students by using the FAO questionnaire developed for measuring quality of diet during the last 24-hours of interview (FAO& FHI 360, 2016). The questionnaire was pre-tested in different areas of Dhaka city by the researchers.

### **3.10 Data collection, field management, and quality control**

For the qualitative study, one researcher along with a research associate and two research assistants carried out literature review of the textbooks and curriculum available on the website of the NCTB and several documents of the government. All the information gathered were systemically organized and stored in documents only accessible to research team. As the data of KIIs were recorded by a researcher, all the records were checked daily, and transcripts were well-stored in a safe and secured place. The interview guides of comprehension and aesthetic test were pretested and accordingly fine-tuned. Data for this part of the study was collected by a trained, skilled field team but well-supervised and supported by experienced supervisors and a research team member. All the data were coded, computed and stored in a secured place maintaining anonymity.

In both the knowledge assessment survey and TIPs, face-to-face interview was carried out for collecting information by the field enumerators. We used android mobile phone for data

collection through the CommCare HQ platform. Skilled interviewers (comprising science graduates and having experience of collecting data on different aspects of nutrition and food intake) were recruited for data collection. A five day intensive training was organized, which included lectures, mock interviews, role-play, field practice at the community level and feedback session by the researchers. A training manual was developed in Bengali language to guide the interviewers in the field. In the knowledge assessment survey, two teams were formed for data collection; each team consisting of a supervisor and 11 interviewers, while in TIPs each team consisted of a supervisor and five interviewers. In addition, in the TIPs for each Upazila three field workers were recruited for counseling the mothers and children. A research team was always in the field during data collection. A 10% sample of subjects were re-interviewed within two days of the original interview by supervisors and researchers. The re-interview data was compared with the original interview.

### **3.11 Data Analysis**

#### **a. Qualitative data analysis**

The term 'content analysis' can be simply defined as 'the process of summarizing and reporting written data – the main contents of data and their messages' (Cohen, 2007). Besides, it also can be defined as 'an analysis of the written or visual contents of a document' (Wallen& Fraenkel, 2001). The design used in this research was of descriptive qualitative method, which was describing the condition of existence and classifying the information. Content of the textbooks, curriculum and nutrition related national and international policies and strategies was analyzed manually by research investigators using qualitative thematic analysis (Fereday& Muir-Cochrane, 2006), a method for identifying, analyzing and reporting themes or patterns within data to organize and describe the data in detail. Themes or patterns within data was identified in a theoretical or deductive or 'top down' way (Boyatzis, 1998; Hayes, 1997), where data analysis was driven by the researcher's theoretical or analytic interest in the area, and is thus more explicitly analyst driven. The process of coding the data was to fit into the pre-determined themes and coding frame (Table 3.2) based on research objectives. Findings were then summarized by major themes mentioned in Table 3.3.

The qualitative data from KIIs was analysed manually by research investigators using qualitative thematic analysis (Fereday and Muir-Cochrane, 2006). In case of comprehension and aesthetic test, we performed content analysis with the information obtained from the field.

#### **b. Quantitative data analysis**

A Wealth index of the current study was constructed by listing household assets, and other characteristics including household construction materials, water, sanitation, fuel supply and health situation of the respondents. We used factor analysis to assign weighting values to indicator variables. The wealth quintile was constructed using the rank procedure. The status of all categorical variables was shown as a proportion here. Data was shown as percentage (number) (% (n)). In case of non-normal variables, results were shown as Median (Inter quartile range (IQR)), while for the normal variables the results presented as Mean (Standard Deviation (SD)). In case of knowledge assessment of a particular thematic areas, such as healthy diet, functionality of ten foods, nutrient content of the foods, proper practice of food processing, food safety, food loss, nutrition & immunity, personal hygiene and sanitation, environment and climate change the following formula was used and the average knowledge score with SD shown as the result (FAO, 2014).

$$\text{Score of knowledge per question} = \frac{\text{Sum of correct responses given by all respondents}}{\text{Total number of the respondents}}$$

In case of trials of improved practices, changes in the knowledge and practices of students food intake, hygiene and sanitation, environment and tree plantation were compared between two Rounds of data collection. We presented the findings of pretest as Round-1 and the posttest as Round-2. The findings were presented as percentage (number).

Maternal dietary diversity was calculated by using the method of MDD-W (minimum dietary diversity for women)(FAO& FHI-360,, 2016). The 10 MDD-W groups, namely starchy foods; pulse; nuts and seeds; dairy; fish, meat & poultry; green leafy vegetables; yellow fruits and vegetables; other fruits and other vegetables were first summed into a score ranging from 0 to 10. Each woman's response was then coded "yes" or "no" for scoring  $\geq 5$ , followed by calculation of the proportion of women who scored between five and 10. The interpretation of the indicator is "percentage of women who achieved minimum dietary diversity, and they are more likely to have higher micronutrient adequacy than the percentage of women who did not". Dietary diversity of children was also calculated by following the same procedure.

### 3.11 Limitations of the study

Few major challenges we have encountered during the study period – time constraints, field based work and nutrition message development Covid-19 pandemic period. We tried to accomplish our tasks by working longer beyond office hours and on weekends to finish our research work. But, our concern has been to produce and accomplish quality research outcome

in such a short period. In addition, COVID-19 pandemic was a challenge for the field survey. It was difficult to recruit research assistants as they lived in different parts of the country. During training sessions, maintaining social distancing and wearing masks for the whole day was also difficult at the beginning of the training period. To address these issues, every day the training was started with a discussion on preventative measures of Covid-19 including mental health support. We maintained all precautions to prevent COVID-19 infection, such as, keeping two meters distance from each other, keeping classroom open and airy, keeping hand sanitizer in each room, cleaning toilets including hand washing facility, maintaining supply of disinfecting spray and ensuring both participants and researchers always wearing double masks. As we anticipated similar issue in the fieldwork, our research team was informed during training what measure to be taken during field work not only for own prevention but also to protect respondents from the COVID-19. Hence, for working in the field, the research assistants got sufficient surgical masks, KN-95 masks and soaps from the project. In addition, after obtaining consent of the respondents, the research assistants gave them two surgical masks and asked the mother and student to wear them before starting the interview to prevent infection. In addition, the key informants were all interviewed using mobile phone or internet based platforms instead of doing face-to-face interview. Some challenges were also faced here especially not being able to interview the key informants on the assigned day, encountering call drops and missing physical expression/body language of the key informants. To mitigate the challenges, we continuously communicated through internet-based platforms, which could have been easier and simple in face-to-face communications.

### **3.12 Ethical approval**

Ethical clearance, of the study was obtained from the Institutional Review Board of BRAC JPGSPH, BRAC University. Before the interview, field research assistants comprehensively explained to each respondent about the nature of the project, rationale of the study, questionnaire, and the risk and benefit of the study in front of a witness. Once they voluntarily agreed to participate in the trail they were then asked to sign. Informed verbal consent was also taken before each interview where necessary (i.e. where participants were unable to read). Data was kept with security in BRAC JPGSPH. None was permitted to download data from cloud of CommCare HQ platform, except the principal investigator. Furthermore, we erased all recorded versions of the data after transcription and translation.

## Chapter 4

### Exploring existing knowledge on six thematic areas

This section presents the findings from content analysis of textbooks in light of relevant curriculums of pre-primary, primary and secondary level education. At the pre-primary level, there was only one curriculum, which incorporated all aspects of learning at this level of education. Pre-primary curriculum consisted of eight learning areas, of which two were related to our study context. In the national education policy of 2010, it was mentioned that teaching at pre-primary level would be delivered through pictures, colorful attractive and simple education materials, models, rhymes, songs, games, and handicrafts. At the primary level, curricula were organised in vertical alignment (subject wise terminal competencies) and horizontal alignments (grade wise achievable competencies). At secondary level, curricula of different subjects were arranged as grade wise learning outcomes and in most cases divided as grade 6-8 and grade 9-10.

According to the curricula, the contents for one subject-wise terminal competence would become from simple and brief to complex and detail in the upper grades within same educational level such as, primary level. For example, the textbooks titled ‘Elementary Science’ at primary level, incorporate almost similar topics from grade 3 to grade 5, but the content and messages is become more comprehensive from grade 3 to grade 4 and from grade 4 to grade 5.

This current review found that among the textbooks from pre-primary to grade 9-10, most concentrated messages/contents of the study themes are incorporated in Science, Home Science, Physical Education and Health Science textbooks followed by Bangladesh and Global Studies and some other textbooks such as, English for Today, Biology and Agriculture textbooks. (Table 4.1).

**Table 4.1: List of textbooks according to the extent of themes covered**

Textbooks reviewed	Theme(s) covered	Extent of coverage
<b>Educational level: Pre-primary</b>		
• Amar Boi	Healthy diet, physical activity and lifestyle	Less covered
<b>Educational level: Primary</b>		
• Amar Boi (grade 1 & 2 only)	Healthy diet	Less covered

• Elementary Science	Healthy diet, nutrition, immunity, sanitation and hygiene, physical activity & lifestyle, environment	Very well covered
• English for Today	Healthy diet	Less covered
• Bangladesh and Global Studies	Environment only	Well covered
<b>Educational level: Secondary</b>		
• Science	Healthy diet, nutrition, immunity, sanitation and hygiene, environment	Very well covered
• Home Science	Healthy diet, nutrition, immunity, physical activity and lifestyle	Very well covered
• Agriculture	Healthy diet	Less covered
• Physical Education and Health	Immunity, physical activity, and lifestyle	Very well covered
• Bangladesh and Global Studies	Environment	Very well covered
• Biology (grade 9-10 only)	Healthy diet, nutrition, physical activity and lifestyle	Well covered
• English for Today	Healthy diet	Less covered

While going through the findings of content review, a question posed in our mind, are students equally exposed to all these messages and contents? In pre-primary and primary levels, all students are exposed to the same content (in this study context: Amar Boi, Elementary Science, Global and Bangladesh studies etc.). At secondary education level, the scenario is different. From grade 6 to grade 9-10, Home Science is the main source of content related to healthy diet, nutrition and immunity. However, Home Science is not a mandatory subject for all students. Usually, girls study this Home Science book and on the other hand, boys study Agriculture book.

From grade 9-10, students are divided into three groups: Humanities, Science and Business studies. Among the textbooks we considered in this review, Science textbooks for the students of Humanities and Business Studies groups; Biology for students of Science group; and Global Studies and Bangladesh for both Business Studies and Science groups. Therefore, this review would provide a wide range of nutrition and related information from the existing textbooks of different disciplines and grades.

#### **4.1 Theme 1: Healthy diet**

In the pre-primary curriculum matrix, 'learning outcome' 1.3.5 (will able to identify taste of different foods: sweet, hot, sour, bitter, salty) of 'learning area' 6 (physical and movement capabilities) and 'learning outcome' 8.1.3 (will identify different nutritious foods), 'learning outcome' 8.1.4 (will able to separate different foods) of 'learning area' 8 (health and security) covers healthy diet and nutrition related part. According to primary curriculum for subject named 'Elementary Science', subject wise terminal competencies 8 (choosing and consumption of right foods for healthy life) covers healthy diet related issues throughout grade 1 to grade 5 with simple to more comprehensive grade wise achievable competencies. The other curricula at primary level do not focus on healthy diet. At secondary level, curricula of Science, Home Science mostly covered issues related to this theme.

Regarding healthy diet, most of the messages are incorporated in Elementary Science textbooks at primary level and there were chapters dedicated for food such as 'Chapter 7: Food', 'Chapter 4: Food' and 'Chapter 6: Food for Good Health' in the textbook of grade 3, grade 4 and grade 5 respectively. At secondary level, Home science and Science were the major sources of information regarding healthy diet. Home Science textbooks of grades 6-8 consist of a focused section (Section C) and 4 chapters on healthy diet and nutrition along with immunity. This pattern was also true for the Home Science book of grade 9-10 (part C: Food and meal management, which consisted of 4 chapters). The Science textbooks also had dedicated chapters on these issues at secondary level: Chapter Thirteen: Food and Nutrition (grade 6); no chapter (grade 7); Chapter Thirteen: Food and Nutrition (grade 8); Chapter One: Healthy Life, Better Living (grade 9-10).

Besides, few messages were also available in English for Today, Physical education and Health, Agricultural, Supplementary Agricultural and Biology textbooks. Some messages were similarly documented in all textbooks, however, there were inconsistencies in some of the messages. In contrast, Home Science textbook includes more details with comprehensive messages while the Science textbook included the relation between food, nutrition and cleanliness, unhealthy foods and so on.

No significant messages were available in the textbooks of pre-primary, grade 1 and grade 2. It was mentioned in the curriculum of pre-primary, grade 1 and grade 2 that there were instructions to provide knowledge on the healthy diet to the students of these specific grades. However in the textbooks there was no information regarding healthy diet except few images of food items, such as, mango, jackfruits, tomato, pineapple, etc.



#### 4.1.1 Healthy and balanced diet

The concept of balanced diet was one of the major discussions related to healthy diet in the textbooks content. This review revealed that the definitions of balanced diet were consistent in the textbooks throughout the grades (Table 4.2) at primary and secondary level (from grade 3 to grade 9-10). Two points were repeatedly emphasized in all the definitions of balanced diet such as: a) the balanced diet contains all essential nutrients and b) the nutrients will be given in a required quantity according to our body needs.

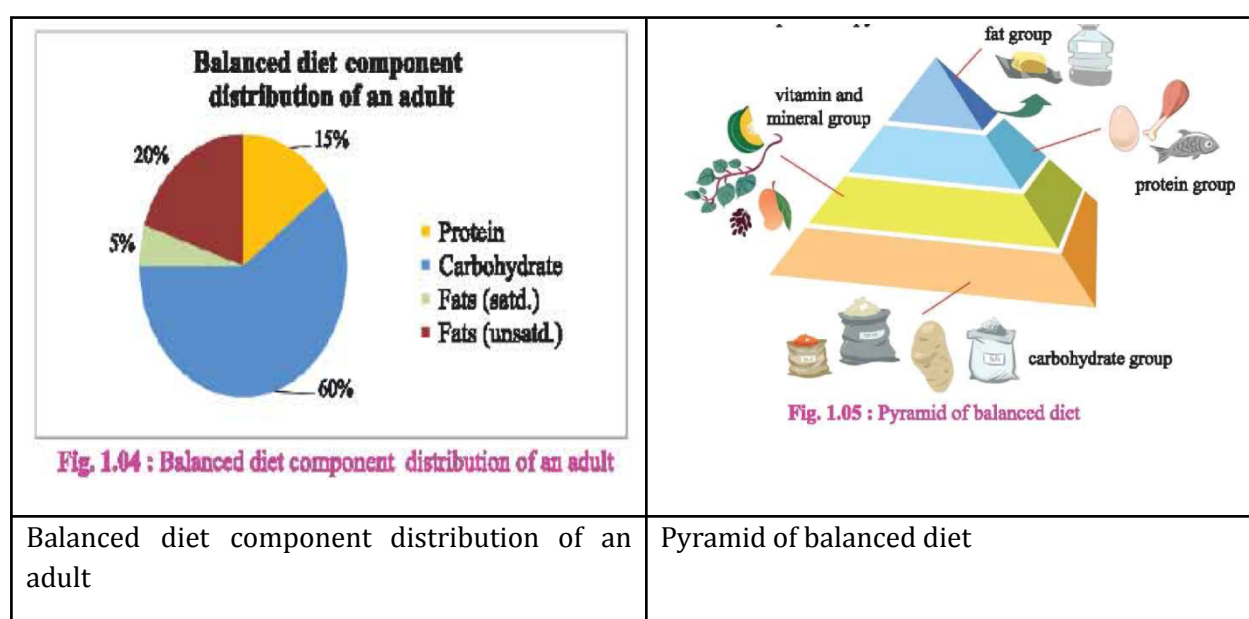
Table 4.2: Definition of balanced diet in different textbooks at primary and secondary level

Grade	Textbooks	Definition of balanced diet in different
Grade 3	Elementary Science	The food containing all the nutrients that required for our body in adequate quantity is called a balanced diet.
Grade 4	Elementary Science	A balanced diet is a diet that contains adequate amounts of all the necessary nutrients to keep our body healthy
Grade5	Elementary Science	Eating a balanced diet means that you choose the proper amount of food from each of the food groups.
Grade6	Science	A balanced diet contains all types of food in right proportion. It means that a balanced diet, contains the right amount of Carbohydrate, protein, fat or oil, vitamin, mineral salts and water depending on the desired needs of the body.
	Home Science	When the food contains adequate nutritional element according to the body's need, it is known as balanced diet.
Grade7	Home Science	A diet consisting of a variety of different types of food and providing adequate amounts of nutrients necessary for good health.
Grade8	Science	Foods, which meet the demand of calories for the body, helps maintain the growth and formation of tissue cells and controls the metabolic activities of the body is called balanced diet. Therefore, by balanced food we mean the correct amount of food and the correct proportions of each (six) type of food that meets the demands of the body of a person.
Grade9-10	Science	Balanced diet is a diet which contains all the six elements of food and eating this food we get necessary calories for our normal activities.

The textbooks of Science and Home Science added messages either on healthy food choices or preparation of balanced diet. Though the definition of balanced diet was consistent, there was

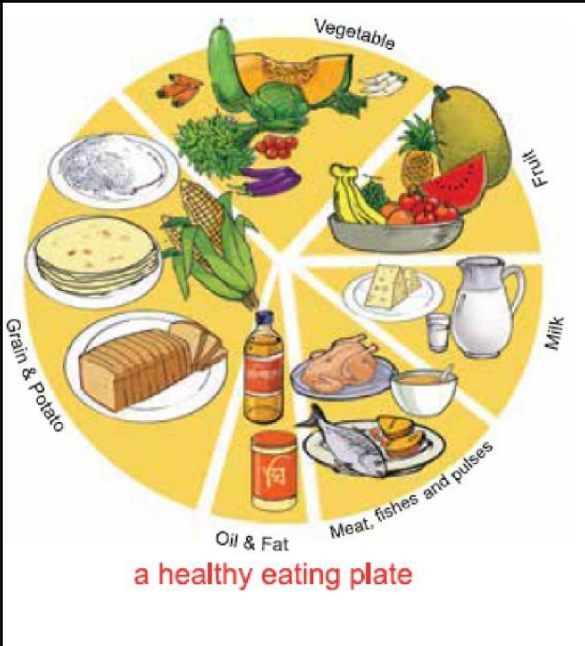
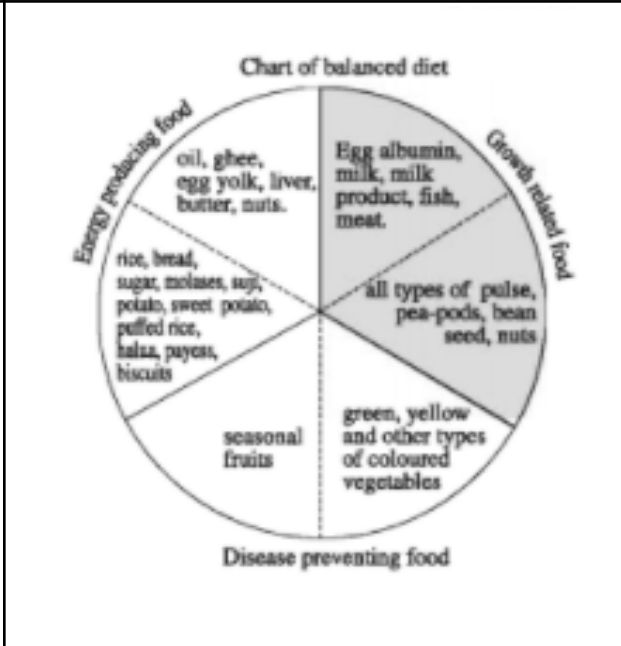
inconsistency in documentation of the ideal proportion of calories from different macronutrients. The Science textbook of grade 8 recommends on our regular diet that the required amount of calories should be 60-70% from carbohydrate, 10% from protein, 30-40% from fats and oils. The Home Science textbook of grade 6 mentioned that the required proportion of calories should be 50-60% from carbohydrate, 20-25% from protein, 20-30% from fats and oils. The Home Science textbook of the next grades also provided similar messages. In chapter one (Healthy Life, Better Living) of Science book for grade 9-10, recommendations were different from the above-mentioned proportions (Figure 4.1). This chapter also discusses low cost and high-cost foods for balanced diet.

**Figure 4.1: Balanced diet (grade 9-10, Science book, p-16, p-19)**



Images of foods were available in different textbooks, where applicable. In pre-primary and primary levels, pictures of foods were very colourful and of high quality. In textbooks though at secondary level, images found were black and white with poor quality (Figure 4.2).

**Figure 4.2: A healthy eating plate**

 <p>a healthy eating plate</p>	 <p>Chart of balanced diet</p>
Source: Grade 4, Elementary Science, p- 32	Source: Grade 8: Science, p- 150

#### 4.1.2 Sources and grouping of foods and nutrients

From grade 3 to grade 9 and 10, in Elementary Science, Science and Home Science textbooks, two main sources of foods were described, such as, 1) plant sources and 2) animal sources. In addition, food sources of specific nutrients were also discussed in the textbooks. Detailed information on food sources of different macro- and micronutrients were also described in Science textbook of grade 9 and 10.

We found dissimilarities on classification of food groups in science and home science textbooks of different grades (Table 4.3). The common patterns of inconsistencies were: (a) the number of food groups was different in different grades and also in different subjects in the same grade, and (b) the mixing of food groups with nutrients or nutrient groups. For example- according to the textbook named Elementary Science of grade 3, there were five food groups (protein, carbohydrate, dairy product group, vegetable group, and fruits groups) whereas in the textbook named Elementary Science of grade 4, there were six food groups named grain and potato; vegetables; fruits; meat, fishes and pulses; milk and dairy products; and oil and fat. Besides the dissimilarities in the number of food groups, there was mixed up between nutrient (protein and carbohydrate) and food groups (dairy, vegetable and fruits groups) in case of grade 3.

Table 4.3: Classification of food groups in Science and Home Science textbooks across different grades

Grade	Textbook of Science	Textbook of Home Science
Grade 3	<ol style="list-style-type: none"> <li>1. Protein</li> <li>2. Carbohydrate</li> <li>3. Dairy product group</li> <li>4. Vegetable group</li> <li>5. Fruit group</li> </ol>	Not applicable
Grade 4	<ol style="list-style-type: none"> <li>1. Grain and potato</li> <li>2. Vegetables</li> <li>3. Fruits</li> <li>4. Meat, fish, and pulses</li> <li>5. Milk &amp; dairy products</li> <li>6. Oil and fat</li> </ol>	Not applicable
Grade 5	<ol style="list-style-type: none"> <li>1. Grain and potato</li> <li>2. Vegetables</li> <li>3. Fruits</li> <li>4. Fish, meat, and pulses</li> <li>5. Milk group</li> <li>6. Oil and fat</li> </ol>	Not applicable
Grade 7	No data	<ol style="list-style-type: none"> <li>1. Cereal-type food</li> <li>2. Vegetable and fruit type food</li> <li>3. Fish, meat, lentil, and fish-type food</li> <li>4. Milk and milk products</li> <li>5. Food comprising of fat and sweet</li> </ol>
Grade 8	No data	<ol style="list-style-type: none"> <li>1. Crops and crops equivalent food</li> <li>2. Protein food</li> <li>3. Vegetables</li> <li>4. Fruits</li> <li>5. Milk and milk-products</li> <li>6. Oil, ghee</li> <li>7. Sweetened food item/Jam, jelly, sweets, honey, soft drinks, chocolates, biscuits, ice-creams etc.</li> </ol>
Grade 9-10	<ol style="list-style-type: none"> <li>1. Meat or fish, eggs, pulses (peanuts, chickpea&amp; nuts)</li> <li>2. Cheese and yogurt</li> <li>3. All kinds of edible vegetables and fruits</li> <li>4. Cereals and their products e.g. in bread and rice</li> </ol>	<ol style="list-style-type: none"> <li>1. Cereal and cereal products</li> <li>2. Protein foods</li> <li>3. Vegetables</li> <li>4. Fruits</li> <li>5. Milk and milk products</li> <li>6. Oil and ghee</li> </ol>

Inconsistencies and dissimilarities were observed in addressing terms and the classification of nutrients in textbooks for Science (Table 4.4). Nutrients were termed as ‘types of food’, ‘ingredients of foods’ and ‘components of food’ in Science textbook of grade 5 and grade 9-10. Besides, nutrients were classified into four types in textbooks for Science of grade 3, 5 types in textbook for Science of grade 4 and six types in Science textbooks of other grades.

**Table 4.4: Term and classification of nutrients in textbook for Science**

Grade	Termed as	Classification
Grade 3	Nutrients (4)	Proteins, Carbohydrates, Fat, Vitamins and Minerals
Grade 4	Nutrients (5)	Carbohydrates, Proteins, Fats, Vitamins, Minerals
Grade 5	Type of food (3)	Type of food: Carbohydrate, Protein, Fats, and oils
	Ingredient of food (3)	Ingredients of food: Minerals, Vitamins, Water
Grade 8	Nutrients (6)	Proteins, Carbohydrates, Lipids or fats, Vitamins, Mineral salts, Water
Grade 9-10	Components of food (3+3)	Main components: Carbohydrates, Proteins, Fats Supplementary components: Vitamins, Minerals, Waters

However, textbooks for Science of grade 9 and 10 incorporated nutrients in two sections: main components and supplementary components. In contrast, water is described as ‘not a nutrient’ in textbook for Elementary Science of grade 3 and 4. “Water is not nutrient, but adequate safe water is needed for digestion and absorption in the body” (p-45).

#### **4.1.3 Functions of foods and nutrients**

The functions of macronutrients were documented in grade 3 Science textbook; in grade 6 both Science and Home Science textbooks, in grade 7 Home Science textbook; and grade (9-10) Science textbook, Home Science textbook and Biology textbook (Table 4.5). The Science textbook of grade 4 provide messages on function of protein. However, inconsistency found on functions of proteins, carbohydrates, and fats at different textbooks of grade 9 -10 (Table 4.6).

**Table 4.5: Functions of macronutrients (protein, carbohydrate and fat) in different textbooks from pre-primary to class 8**

Grade	Name of the textbook	Findings
Grade 3	Elementary Science	Function of protein, carbohydrate and fat
Grade 4	Elementary Science	Function of protein
Grade 5	Elementary Science	No content
Grade 6	Science	Function of protein, carbohydrate and fat
	Home Science	Function of protein, carbohydrate and fat
Grade 7	Science	Function of protein, carbohydrate and fat
	Home Science	Function of protein, carbohydrate and fat
Grade 8	Science	No content
	Home Science	Function of protein, carbohydrate and fat

**Table 4.6: Functions of macronutrients (protein, carbohydrate and fat) in different textbooks for class (9 - 10)**

Sl. No.	Science	Home Science	Biology
<b>1</b>	<b>Protein</b>		
	Protein are essential for the building of animal body. Most of the parts of the body are formed by proteins. 50% of dry weight of animal cell is protein, because the structure and function of a cell is regulated by proteins.	<ol style="list-style-type: none"> <li>1. Build body and help to grow</li> <li>2. Replete decays</li> <li>3. Produce heat</li> <li>4. Give immune power against diseases</li> <li>5. Develop mental ability</li> <li>6. Control internal functions</li> <li>7. Transport important elements in our body</li> <li>8. Regulate water balance</li> </ol>	Helps in growth and repair
<b>2</b>	<b>Carbohydrate</b>		
	<ol style="list-style-type: none"> <li>1. CHO produces energy and heat in the body.</li> <li>2. During respiration, CHO is oxidized and produces energy for metabolism.</li> <li>3. Glycogen provides energy in deficiency of food or in hard labor.</li> <li>4. Cellulose is a non-digestive type CHO.</li> </ol>	<ol style="list-style-type: none"> <li>1. Supply energy or fuel for the body.</li> <li>2. Carbohydrates prevent ketosis by sparing fats from extreme burning.</li> <li>3. If carbohydrate supply is enough in the diet, protein is spared for</li> </ol>	Helps in producing energy

	<p>This is a fibrous food. It protects the body from constipation.</p> <p>5. Protein and fats are synthesized from CHO</p>	<p>important functions of it.</p> <p>4. In the presence of carbohydrate a certain kind of organism produces vitamin, 'K' and vitamin 'B' in the intestine.</p> <p>5. Cellulose prevents constipation. It has protective and detoxifying action in liver.</p> <p>6. Nervous tissues use glucose as the sole element for their energy</p>	
<b>3</b>	<b>Fat</b>		
	<p>1. Heat and energy in the body</p> <p>2. Growth and nutrition of the body</p> <p>3. Prevents the misuse of heat and works as a source of food storage for the future.</p> <p>4. Keeps the skin, soft and healthy and thus protects the skin from skin disease.</p> <p>5. Absorb the soluble vitamins e.g.- A, D, E and K.</p>	<p>1. Cholesterol and phospholipids are two general elements of cell walls</p> <p>2. Fats are the carriers of fat-soluble vitamins A, D, E and K.</p> <p>3. Adipose tissue, where fat is stored, serves as an insulation material in injury. Vital organs of the body are thus protected.</p> <p>4. Lipid keeps our bodies warm by preventing the wastage of heat.</p> <p>5. Essential fatty acids help to maintain tissues, their normal structure and efficiency.</p> <p>6. In growth period it promotes growth.</p> <p>7. Fat provides flavor and palatability to food.</p>	Produce heat and energy in the body

The functions of vitamins, minerals and water were included in Science textbooks of grade 3, grade 6, grade 8 and grade 9 to10 and Home Science textbooks of grade 6, 7 and grades 9 to10

(Table 4.7). However, the textbook for Science at grade 4 listed only the functions of vitamins. Likewise of macronutrients, the messages were not consistent in all textbooks of class 9 to 10 such as, textbooks for Science and Home Science described individual functions of vitamin A, B, C, D, E and K, whereas textbooks for Biology did not provide messages on specific functions of vitamins. Functions of iron, calcium and phosphorus were documented in both Science and Home Science textbooks of grade (9-10); however, iodine was only described in Home Science textbooks of grade (9-10).

**Table 4.7: Functions of micronutrients (vitamins and minerals) in different textbooks from pre-primary to grade 10**

Grade	Name of the textbook	Findings (just name of the vitamin or minerals, of which function was mentioned)
Grade 3	Elementary Science	Function of vitamins, minerals and water
Grade 4	Elementary Science	Vitamins: Vitamin A, B, C, D, E, K Minerals: no information
Grade 5	Elementary Science	No content
Grade 6	Science	Vitamins: Vitamin A, C, D
	Home Science	Vitamins: Vitamin A, B, C, D, E, K Minerals and water
Grade 7	Science	Vitamins: Vitamin A, B, C, D, E, K Minerals and water
	Home Science	Vitamins: Vitamin A, B, C, D, E, K Minerals and water
Grade 8	Science	Vitamins: Vitamin A, B complex, C, D, E, K Minerals and water
	Home Science	Vitamins: Vitamin A, B, C, D, E, K Minerals and water
Grade 9 to 10	Science	Vitamins: Vitamin A, B complex (Thiamin, Riboflavin, Niacin, Pyridoxin, Cobalamin), C, D, E, K Minerals: Iron, calcium and phosphorus
	Home Science	Vitamins: Vitamin A, B complex (Thiamin, Riboflavin, Niacin, Pyridoxin, Cobalamin), C, D, E, K Minerals: Iron, calcium, phosphorus and iodine
	Biology	Vitamins, mineral and water

The function or importance of water in the body is incorporated in textbooks of primary and secondary level. Water constitutes about 60-75% of human body weight and is essential for the formation of blood, muscle, teeth, bones etc. (Science textbook, grade 9-10, p-13). Moreover, function and importance of dietary fiber in the body is also covered in the Science textbook of grade 9-10 (p-14). It is introduced as 'another very important component of food is roughages or fiber-rich foods' and the main source of fiber is plant sources which includes vegetable and fruits. Intake of 20-30 grams of fiber per day is recommended in the same textbook.



#### 4.1.4 Unhealthy foods and food safety

The concept of unhealthy food is briefly introduced in different textbooks of grade 3, 5, 8 and grades 9/10 (Table 4.8). In Science textbook, there are messages regarding contaminated food, artificial color, or chemical in junk food. However, the messages regarding details of unhealthy food such as, its definition, how food become unhealthy, name of unhealthy foods and effects of consumption of unhealthy foods are incorporated only in the Home Science textbooks of grade 6.

**Table 4.8: Messages on unhealthy food in the textbooks of different grades**

Grade	Textbook	Findings
Grade 3	Science	Effect of contaminated food or water
	English	Name of unhealthy foods
Grade 5	Science	Artificial colour in food and its effect Chemicals in food and its effect Junk food and its effect
Grade 6	Home Science	<ul style="list-style-type: none"><li>• Definition and causes of food becoming unhealthy</li><li>• Name of unhealthy foods</li><li>• Effects of consuming unhealthy foods</li></ul>
	English for Today	Name of unhealthy food
Grade 8	Home Science	Effects of food adulteration and its prevention
Grade 9 to 10	Science	Conception on junk food or fast food and its effects
	Biology	Effect of using excessive chemicals and colors
	Physical Education, Health Science and Sports	Food contamination: causes, symptoms and its prevention

In addition, messages on safe foods, its characteristics, and methods to keep food safe are documented in one textbook, named as Supplementary Agricultural textbook for grade 6-10. The Science and Home Science textbooks also provide information on food preservation in details. Both the advantages of food preservation and disadvantages of preservatives are discussed. Harmful chemicals used in the purpose of preservation, to make food tasty, for better scent also have been incorporated in the textbooks (Table 4.9). Different processes of storing foods such as drying, refrigeration, freezing, preservatives etc. discussed in detail in grade 9-10 textbook named Science.

**Table 4.9: A list of harmful chemicals used in food (grade 8, Home Science textbook, p-94)**

Sl. No.	Name of foods	Name of the harmful chemicals	Purposes
1	Fish and milk	Formalin	To preserve for long time preventing rotteness

2	Vegetables	Pesticides and formalin	To control the attach of pest and keep the food fresh
3	Jilapi and chanahcur	Mobil	To make crispy and to enhance taste
4	Chips, bakery foods, soup, ice cream, noodles, sweet	Textile and leather dye, hydroze, acid	To make attractive, to whiten and to increase the scent
5	Different fruits	Formalin, carbide, ethephon	To ripe and to prevent rottenness
6	Puffed rice	Hydroze, urea	To make shiny, white, and large size through swelling

#### 4.1.5 Meal planning, healthy food preparation and serving

The demonstrations on meal planning, healthy food preparation and serving starts at pre-primary grade, where it was mentioned in the curriculum that the students would learn the practice of covering foods with clean plate and washing fruits before consumption. Hence, the findings were also available in Home Science textbooks of grade 6. Detail and comprehensive messages on preparing menu, cutting foods, making food eatable, food processing and serving foods were documented in textbooks of Home Science at grade 8 and grade 9-10. In addition, Home Science textbook also provided messages on diet in different diseases such as, cardiac diseases, diabetes, hypertension, dysentery, diarrhoea, jaundice and fever for child. Food planning for obese, underweight child, and adolescents were also included at Home Science textbooks of different grades. The analysis repeatedly found that the Home Science textbooks of different grades are exclusively enriched with different messages, which were not incorporated in Science textbooks. Lesson 7 (Food processing) in Chapter 10 of Home Science textbook (grade 8) describes food processing which includes purposes of food processing, ways of food processing particularly fruits and vegetables. Chapter eleven (Cooking food) of the same book was dedicated to contents on purposes of cooking, common system of cooking such as boiling, fried, burning or making toast, dried in heat and baking, personal cleanliness and care during preparation and cooking.

#### 4.2 Theme 2: Nutrition

Among all the reviewed textbooks, mostly Science at primary and secondary level and Home Science of secondary level consist most of the information about nutrition and nutrition related contents.

##### 4.2.1 Nutrition concept

The concept of nutrition is first introduced with students at grade 6 in Science textbook. It is available only in Science textbooks of grade 6, grade 8 and grade 9-10 (Table 4.10). Two

components of the definition that are repeatedly mentioned in all the definitions are: a) nutrition is a process and b) nutrition makes the food components absorbable to body.

**Table 4.10:** Definition of nutrition in different textbooks from pre-primary to grade 9-10

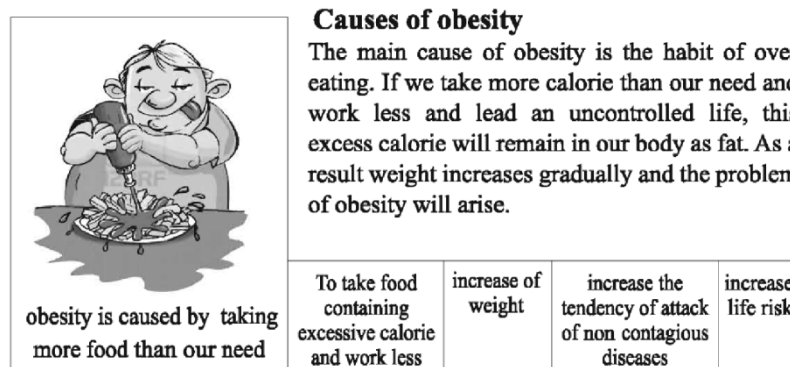
Grade	Subject	Findings
Grade 6	Science	Nutrition is a daily process which breaks the compound food substances for the body to absorb.
Grade 8	Science	Nutrition is a process. In this process, food, having eaten is digested and complex food-stuff is broken up into simple elements. All these simple elements are absorbed in human body.
Grade 9-10	Science	The process of getting necessary food items from the environment and digesting and absorbing them, then fulfillment of energy need, developing the immunity of diseases, and growth of the body is called nutrition.

#### 4.2.2 Malnutrition (macronutrient and micronutrient related problems)

The messages on malnutrition are incorporated in Science and Home Science textbooks of different grades and few information in Physical Science textbook of grade 9. An individual chapter is dedicated to malnutrition (Chapter 9, p-81) in Home Science textbooks of grade 8. In terms of deficiency of macronutrients, all messages are mainly describing the effects of deficiency of macronutrients (carbohydrate, protein and fat). However, there is a discussion on overweight on obesity in the Home Science textbooks of grade 8, though they are not defined as one type of malnutrition. Besides, effects of different micronutrients deficiency are described in Science, Home Science and Physical Education book of different grades. The dedicated chapter for malnutrition (Chapter 9, p-81) in Home Science textbook (Class- 8) also covers causes, symptoms, treatment, and prevention of different vitamin and mineral deficiency diseases such as, night blindness, anaemia, goitre, rickets, osteomalacia, pellagra, beriberi, scurvy, etc. Diseases like, beriberi and scurvy barely prevail now and require attention for removal from the textbooks.

In the Home Science textbook of grade-8 also described causes of obesity (Figure 4.3) and also the bad consequences of obesity such as increasing tendency of developing NCDs like high blood pressure, diabetes, stroke, heart diseases, gallbladder stone, etc. Besides, food planning for an obese child is also discussed in details along with how one can remain healthy with maintenance of balanced diet, regular exercise, participation in games and sports and controlled lifestyle. In contrast, conditions caused by protein-calorie malnutrition are referred to as diseases in the textbooks.

**Figure 4.3: Causes of obesity as described in Home Science textbook (grade 8, p-75)**

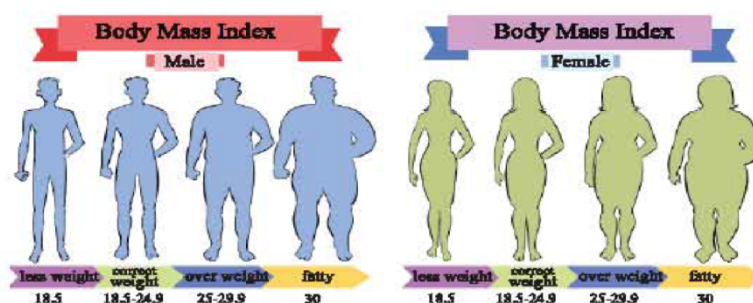


#### 4.2.3 Solutions to the nutritional problems

Solutions to nutritional problems are covered in Science books of grade 8 and grade 9, and Home Science textbooks of grade 8 and grade 9, and Physical Science textbooks of grade 9. However, the treatment of macronutrients deficiencies such as protein-calorie malnutrition and child underweight are described in Grade 8 Home Science textbooks only. The same textbooks provide messages on food planning for an obese child. In contrast, solution to micronutrients deficiency is included in all the previously mentioned textbooks.

Measurement of nutritional status using Body Mass Index (BMI) is discussed in the Science textbooks of grade 9-10 (p-15) with detailed equations and the cut-off points. But the cut-off point of BMI 25 as healthy and normal is wrongly interpreted in Figure 4.4. Moreover, *“If a person has less or more BMI than this, he/she is considered underweight and obese respectively”* is also incorrect. Such important messages should be correctly interpreted for improved knowledge and practices.

**Figure 4.4: Body Mass Index (BMI)**



**Fig. 1.02 : Body Mass Index**

BMI is the indicator of fat in our body. Fig. 1.02 shows that 25 is healthy and normal BMI. If a person has less or more BMI than this, he/she is considered under-weight and obese respectively.

#### 4.2.4 Breast feeding and complementary feeding

The messages on breast feeding and complementary feeding are only incorporated in Home Science textbooks of grade 8. The textbook provides messages on nutrition of the first 1000 days of life which consists of nutrition of 270 days in mother's womb before birth and 730 days after the birth of a child. The significance of this period of human life and the importance of proper nutrition during this time is also discussed in detail.

#### 4.2.5 Adolescent nutrition

The messages on adolescent nutrition are not included in Science textbooks of different grades, except grade 5. The messages are available in Home Science textbooks of grade 6, grade 8 and grade 9 and Physical Education textbooks of grade 6 and grade 9 (Table 4.11). Food and nutritional requirement for an adolescent and how a balanced diet can be planned is also covered in the textbook contents.

**Table 4.11:** The messages on adolescent nutrition in different textbooks

Grade	Name of textbook	Findings
Grade 5	Science	"Maintaining personal hygiene and taking nutritious food is very important at this time"
Grade 6	Home Science	Nutritional need during adolescence
	Physical Education	The purpose of six elements (Protein, carbohydrate, fat, vitamins, mineral salts and water) during puberty.
Grade 8	Home Science	Food for a child of 11-15 years (in detail)
Grade 9-10	Home Science	The nutritional requirements during adolescence
	Physical Education	The necessity of nutrition during puberty

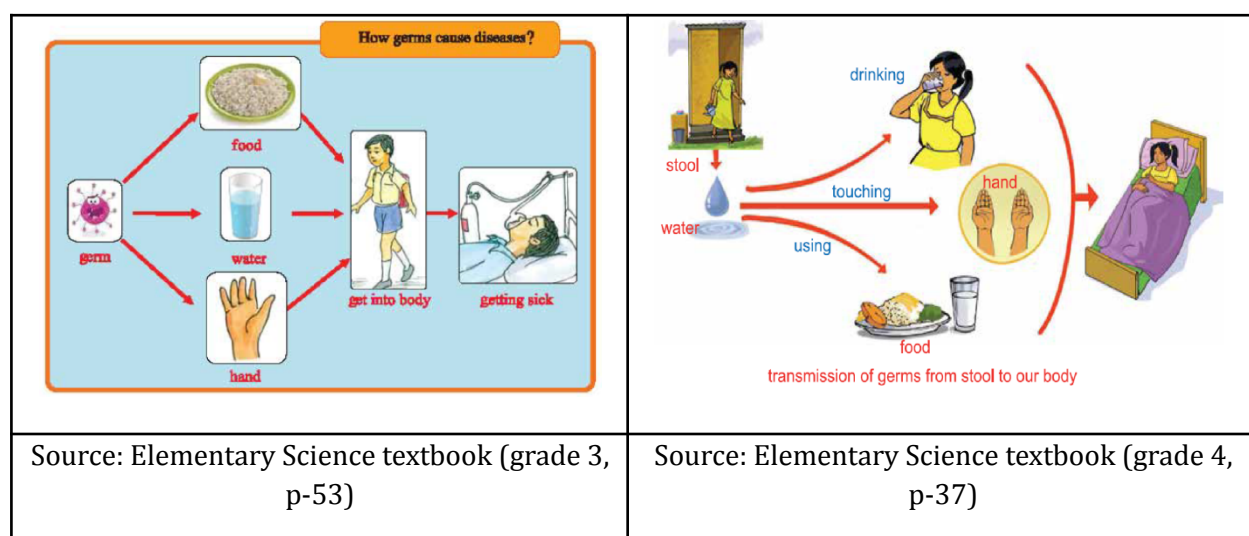
#### 4.3 Theme 3: Immunity

In the curricula of different subjects at pre-primary, primary and secondary level mentioned that students are expected to know about the different common diseases, communicable or infectious diseases and learn how they can be prevented through diet and other lifestyle modifications. According to pre-primary curriculum, students will know about the common diseases like fever, cold, abdominal pain, headache and diarrhoea from school through different learning activities and there is no content about disease or immunity in the textbooks for pre-primary level of education. In the different curricula at primary level mentioned that, students are supposed to learn causes of diseases and will be able to tell the different types of diseases name which people are usually affected and they will learn about cleanliness. At grades 2 and 3, they will know the ways of prevention of diseases and will be able to talk about why the diseases occur. Considering textbook contents, mostly Elementary Science at primary level and Science and Physical Education and Health textbooks at secondary level incorporate information regarding immunity and diseases.

### 4.3.1 Concept of immunity and diseases

The formal concept of immunity is not included in the textbooks of early grades. From this study, it is found that there are limited topics directly related to immunity in the current textbooks. In the Elementary Science textbook of grade 3, immunity concept is discussed ('natural ability to fight against diseases and destroy germs') under the heading 'Keeping our body healthy' without even mentioning the term 'immunity' (p-54). On the other hand, more emphasis has been given to familiarizing the students with the concept of diseases and the pathways how people could be affected by different germs and get disease.

**Figure 4.5: Concept of germs and diseases and the pathways how people can be affected**



### 4.3.2 How to boost immunity (important foods and nutrients)

This content review identified that when considering foods, a balanced diet with special emphasis on 'fruits and vegetables' are commonly cited to enhance immunity or in other words these foods provide ability to fight against germs and diseases along with balanced diet. When it comes to nutrients, it is the micronutrients (vitamin and minerals) that are mostly linked with immunity. The role of protein in immunity is not reflected. 'Vitamins and mineral salts are important for maintaining good health and for developing resistance against diseases' (grade 7, Science textbook, P-7). Besides healthy diet, moderate exercise and getting enough rest and sleep are also recommended to keep the body healthy.

### 4.3.3 How to prevent common infectious diseases

At grade 4, the textbook titled Elementary Science includes name of the diseases caused by deficiency of different vitamins. In addition, these textbooks incorporate the concept of infectious diseases such as chickenpox, skin diseases, measles, etc. and water-borne diseases such as dysentery, jaundice, and typhoid. Details of transmission of waterborne diseases (how contaminated water get into our body), symptoms of waterborne diseases (such as loose motion, vomiting, fever and stomach cramps etc.), and measures to prevent waterborne diseases

also discussed in detail. This chapter also mentions to drink oral saline if someone suffers from diarrhoea and includes an image showing how to make oral saline. In the Elementary Science textbook of grade 5, different ways to prevent infectious diseases have been mentioned: improve our immune system; stop the spread of germs; keep our body healthy by eating a balanced diet; using safe water and washing hands regularly; adequate ventilation in our rooms; covering face during coughs and sneezes with tissue, handkerchief or elbow; keeping our environment clean; remove any objects that hold water such as tub, tyre or canister around our house; getting vaccination and avoiding unhygienic foods. In addition, this textbook also includes types of infectious diseases, diseases spread by insects and other animals etc. In Science textbook of grade 7, prevention and remedy of health hazards caused by microbes such as virus, bacteria, fungi and entamoeba is included. Again, this textbook reiterates the importance of a joint effort including consuming balanced diet, use of sanitary latrine, cleaning and washing hands and mouth following health rules to prevent such diseases. The importance of immunization vaccine injection is incorporated as well as the idea of prevention is better than cure is encouraged in the textbook in Home Science of grade 8.

In the Physical Education textbook of grade 6, prevention of contagious diseases through vaccination; personal cleanliness; to get the habit of washing hands; carefulness during the preparation, preservation and serving of food; awareness regarding the wild and domestic animals; avoidance of insect bite; use of safe and germ free water; creating self-awareness is incorporated along with causes of the spread of contagious diseases (i. Direct contact: physical contact, droplet infection, by infected soil, animal bite, ii. Indirect contact: media borne, vector borne, air borne, unclean hand, syringe and blades in injection) and different sources of contagious diseases.

#### **4.4 Theme 4: Hygiene and sanitation**

This review found that hygiene and sanitation issue is well-covered throughout the pre-primary, primary and secondary level. In each grade, at least one textbook covers the topic in a grade appropriate way with images and messages. In grade 3, Elementary Science textbooks includes a dedicated chapter on hygiene (Chapter 7) which is the reflection of importance of learning about hygiene and sanitation from the beginning of life.

##### **4.4.1 Hand washing and personal cleanliness**

According to pre-primary curriculum, students are supposed to know and practice in real life the following hygiene and sanitation issues: brushing teeth, hand washing, covering mouth when sneezing/coughing, bathing, and hand washing with soap after using toilet. In textbook titled 'Amar Bangla Boi' for grade 1, images are available about daily personal practices such as washing hands, brushing teeth etc. (Figure 4.6). Similarly, in textbook of grade 3, it is mentioned



that brushing teeth after meals and bathe with clean water and soap every day, clean clothes regularly, care for our skin, hair, nails, eyes and ears regularly is necessary to keep our body healthy. Steps of proper hand washing is also incorporated in grade 4. Again, in different textbooks the importance of use of sanitary latrine, cleaning and washing hands and mouth following health rules is mentioned. Having regular nail cuts, brushing the tooth and taking bath using toilet soap is also very important for the prevention of diseases. Not spitting on the road, using masks or handkerchief while walking in dusty road and covering face with handkerchief while coughing and sneezing are good efforts for resisting spreading of germs. After wiping of cough with the handkerchief, it is essential to wash it on returning home. If possible, you can use tissue paper for wiping cough. One should avoid using or coming in contact with usable things of the diseased persons. It is important to drink safe water (grade 7, Science textbook, p-7).

Figure 4.6: Images regarding personal cleanliness available in different textbooks at primary level

 <p>খাওয়ার আগে ও পরে হাত ধুই।</p>	 <p>দাঁত মাজি। হাত মুখ ধুই।</p>
<p>Grade 1: Amar Bangla Boi</p>	<p>Grade 1: Amar Bangla Boi</p>
 <p>personal hygiene</p>	 <p>taking a shower</p>  <p>brushing teeth</p>  <p>clipping nails</p>



Importance of physical cleanliness during adolescence is covered in Home Science textbook for grade 6. It also discusses why physical cleanliness is even more important during adolescence. Sweat is secreted from subcutaneous glands from the armpits more during adolescence. Hence, regular bathing and putting on clean clothing is necessary. In Physical Education textbooks of grade 7, rules for maintaining physical cleanliness are discussed which includes taking bath regularly, cleaning teeth and mouth, caring for the hair (washing and combing), clipping the nails and regular defecation. In the upper grade textbooks, physical cleanliness is linked with attractive personality too.

#### **4.4.2 Cleanliness surroundings**

From pre-primary to grade 9-10, curricula and textbooks include the issue of cleanliness of the surroundings including personal room, home, school and community through both images and texts. In some grades, there are activities to clean the surroundings of the school compounds too and students are always encouraged to clean the classroom, playground, school compounds and their own home by themselves. In grade-3 curriculum of Elementary Science mentioned that students are supposed to be able to follow the rules of using latrine healthily and correctly and keep toilet clean after using it in order to prevent waterborne diseases. How to keep toilets neat and clean and why this is necessary is mentioned in grade-3 Science textbook. Germs can spread through urine and stools, so we need to use toilets properly and wash our hands with clean water and soap. wearing sandals when use toilet is also important. However, clear instructions to keep the common toilet clean and neat for the next user is not given in the current textbooks.

#### **4.4.3 Menstrual hygiene**

Menstrual hygiene is included only in 2 textbooks: Home Science of grade 6 and Physical Education, Health Science and Sports' textbooks at Grade 9-10. In Home Science textbook, girls' cleanliness during menstruation which includes a) what need to be used (napkins or pads made of clean cotton textiles); b) how those should be maintained (if textiles are used, they should be washed absolutely clean and dried in the sun; textiles and clothing should not be kept in dark, moist and damp places as contamination of diseases are apprehended; as the pads and textiles become wet, they should immediately be replaced with clean; c) dry ones and consequences of contentious use of wet pads and textiles for a long time (may result in various contaminations); and d) proper disposal of used textiles and pads (should be wrapped with paper and disposed in dustbins, buried underground or burnt) etc. In Physical Education, Health Science and Sports' textbooks at Grade 9-10, physical cleanliness during menstruation is mentioned. When menstruation happens, it is essential to be neat and clean and take regular bath/shower.

#### **4.4.4 Safe water**

Issues related to safe water is discussed in several occasions in different textbooks even in the same grades. Sources of safe water with image is available in Elementary Science textbook of grade 6. The natural sources include sea, river, lake, and rain and man-made sources includes well, tube-well, tap and pond etc. 'Water is very important and essential for life' and to avoid cholera, typhoid and bacterial diseases it is a must to take safe drinking water. We should use safe water for drinking, bathing, washing clothes and utensils, cooking, washing hands and faces, brushing teeth, cleaning, agriculture (growing crops and farming), and industries. Water from arsenic free tube well is safe. Even clear water from ponds and rivers should be boiled properly before use (grade 7, Science textbook, p-7). Savings of water is emphasized in the textbooks as water is a natural resource and there is a limit to natural resources on Earth. Some fresh water is safe for us (boiled water, well-filtered water and tube-well water) etc. some fresh water is not safe for people such as water from ponds and rivers which are polluted. Some tube-wells in Bangladesh contain harmful substances like arsenic, arsenic-contaminated water does not have a specific taste, odour or colour. Arsenic-contaminated water causes skin diseases and cancer. Identification of safe tube-well (marked green) and unsafe tube-wells (marked red).

#### **4.5 Theme 5: Physical activity and lifestyle**

In pre-primary curriculum, the 'learning outcome' of 8.1.9 (will take rest for a certain period), 'learning outcome' of 8.2.2 (will learn to swim by following rules), 8.2.4 (will identify and ask help from others in trouble) at 'learning area' 8 (health and security) address physical activity and lifestyle theme. At primary level, predominantly the primary curriculum of 'Physical health' and 'Elementary Science' focus issues regarding same theme. Afterwards, issues related to the theme are accommodated at the curriculum of Physical education, Science and Home Science in secondary level.

As there is no subject dedicated for physical activity at primary level, the messages on physical activity and lifestyle are available in 'Amar Bangla Boi' at Grade 1 and Elementary Science textbook at Grade 4. The Elementary Science textbook in Grade 4 has two chapters, such as 'Chapter 5: Healthy Lifestyle' (p: 34-39) and 'Chapter 11: Life Safety and First Aid' (p: 79-87), inclusively discussing the theme. At secondary level, an individual subject in each Grade, named as 'Physical Health and Education' at Grade (6-8) and 'Physical Education, Health Science and Sports' at Grade (9-10), is dedicated addressing to provide the messages on physical activity and lifestyle. Besides, some messages are also available in Science textbook, Home Science textbook, Biology textbook (Grade 9-10) and very few are scattered in English for Today at secondary level such as- *"Taking Regular exercise: We should take part in games and sports and take regular*

*exercise regularly” (grade 6, English for Today, p-31). “We need healthy food, proper rest and sleep” (Grade 8: English for Today, p-28).*

No message is found documented in Grade 2, Grade 3 and Grade 5, however, it is mentioned in primary curriculum of ‘Physical health’ that students of the following grade will have ideas regarding physical health and lifestyle. Hence, the teachers’ guides were not analysed in the study to find any instructions regarding the issues in the curriculum. Example of few issues addressed in the Physical education curriculum are: *“Be able to tell the requirements of moderate sports” (Physical Education curriculum, Grade 2, p- 513). “Will be able to learn and apply the first aid for various accidents” (Physical Education curriculum, Grade 5, p- 536).*

#### **4.5.1 Physical activity concepts**

The definition of physical exercise is only available in Physical Education and Health textbooks of grade 6. At secondary level, the messages on emphasizing physical exercise are available in all Physical Education and Health textbooks of grade 6 to grade 8 and Physical Education, Health science and Sports textbook at grade 9-10. Besides, similar messages are also added in Home Science textbook of grade 6 and, Science and Biology textbook of grade 9-10. Moreover, harmful effects of excessive physical activity are described in Physical Education textbook of grade 7. Exercise is defined as *“The movement of physical organ in a systematic way in order to attain physical and mental fitness and derive joy is called exercise. Sports are also included in exercise” (grade 6: Physical Education and Health, p-4).* In addition, importance of physical exercise to remain healthy is also incorporated in the textbooks at the pre-primary level.

#### **4.5.2 Types of physical exercises**

The physical exercises are classified according to requirement of equipment in Physical Education and Health textbook at grade 6, grade 7 and grade 8. Besides, name of different exercises is mentioned in Home Science textbook of grade 6, Science textbook and Biology textbook of grade 9-10. In addition, description of different sports is also described in all Physical Education and Health textbooks from grade 6 to grade 10.

#### **4.5.3 Age-specific recommendations**

Few messages on age specific recommendations are available at Physical Education and Health textbook in grade 6 and Physical Education, Health Science and Sports textbook at grade 9-10 though all those messages are not technically correct or not entirely based on evidence. *“The girls need a good amount of rest and sleep at puberty” (Grade 6: Physical education, p- 53)* but this message is equally applicable for boys too. Moreover *“Reminder, children and adolescents should not participate in weightlifting exercises. It causes harm to body” (Grade 9-10: Physical Education and Health, p- 17)* was not phrased rightly. Such reading materials may confuse students and teachers with long-term consequences in knowledge and practices. In addition, there was no

daily recommendation in the textbooks for the students to follow to keep the body fit and healthy. This critical learning message requires serious attention to be incorporated into the textbooks.

#### 4.5.4 Sedentary behavior

From pre-primary curriculum, it is found that student of pre-primary students will learn about taking rest for a certain period, though no message is found in the textbook. The messages on rest and its significance are documented in Physical Education and Health textbook of grade 7 and grade 8, Science book of grade 9-10 and Biology book of grade 9-10. The suggested requirement for sleeping is little inconsistent in different textbooks (Table 4.12).

**Table 4.12: Duration of sleep required for a healthy life**

Grade	Textbook	Findings
Grade 7	Physical Health and Education	7-8 hours
Grade 8	Physical Health and Education	1. Age between 5-7: years requires sleep for 10-11 hours 2. Age between 8-11 years requires sleep for 9-10 hours. 3. Age between 12-14 years requires sleep for 8-9 hours 4. Age above 15 years requires sleep for 6-8 hours.
Grade 9	Science	Boys/girls: 8-9 hours Children: 10-12 hours Adults: 6 hours

#### 4.5.5 Weight management

Along with the causes and harmful effects of obesity and underweight in children, diet planning for both of them are discussed in the Home Science textbooks in Grade 8.

#### 4.5.6 First aid

Students are introduced with the concept on first aid at Elementary Science textbook in grade 4. Afterwards, concept on first aid and description of first aid for various accidents and injuries are documented in the Elementary Science textbook of grade 4 and Home Science textbook of grade 8, Physical Education and Health textbook of grade 6 to 8 and Physical Education, Health Science and Sports textbook of grade 9-10 (Table 4.13). However, the type of first aid to be administered is not detailed.

**Table 4.13: Name of the accidents for which first aid is recommended in the textbooks**

Grade	Textbook	First aid for the following accidents
Grade 4	Elementary Science	Burn, drowning, electric shock, snake bites
Grade 6	Physical Education and Health	Cut, burn, abrasion
Grade 7	Physical Education and Health	Bleeding, electric shock, biting/stinging, foreign objects in eyes and ears

Grade 8	Physical Education and Health	Different kind of bandages
	Home Science	<ol style="list-style-type: none"> <li>1. Minor injury, cuts, insect bite, thermal wound, foreign object in the throat, eye problems and ear problems</li> <li>2. Loss of sensation, fainting, snakebite, bone fracture, drowning and electric shock</li> </ol>
Grade 9	Physical Education and Health	<ol style="list-style-type: none"> <li>1. Skin bruises, tense muscle and tendons and swelling, bone displacement, wounds, bruises, fractures, and ligament tears</li> <li>2. Various type of wounds</li> <li>3. Nose bleeding, methods to rescue from drowning and provide artificial respiration</li> </ol>

#### 4.5.7 Smoking and substance use

The concepts on smoking and addiction of drugs are first introduced at Physical Education and Health textbook in grade 6. Then grade 7, the Physical Education and Health textbook provides messages on drug addiction and its consequence and preventive measures against it. An individual chapter, named as 'Drug Addiction and AIDS' is available at Physical Education and Health textbook in grade 9-10 describing the causes, harmful effects and suggestions to resist against smoking tobacco or drug addiction (p: 58-74). Besides, the harmful effects of drug addiction are also described in Home Science textbook of grade 8 and Science textbooks of grade 9-10. Along with harmful effects of drug addiction, Science textbooks of grade 9 also provides messages on smoking tobacco.

#### 4.5.8 Healthy lifestyle

Few images are available emphasizing healthy life at Amar Bangla Boi at Grade 1. The measures and significance of disciplined are described in Elementary Science textbook at grade 4 and Home Science textbook of grade 9-10. In addition, impact of non-disciplined or uncontrolled living is also mentioned at Home Science textbook of grade 9-10.

#### 4.6 Theme 6: Environment

In pre-primary curriculum, 'learning outcome' 6.1.1 (will identify different element in the environment) , 'learning outcome' 6.1.3 (will say about different incidents in the environment such as storm, flood), 'learning outcome' 6.1.4 ( will take care of different elements at home and school), 'learning outcome' 6.1.7 (will differentiate different season), 'learning outcome' 6.2.1 (will keep the environment of home and school clean), 'learning outcome' 6.2.2 (will participate in reduction of environment pollution) are occupied in 'learning area' 6 (environment), which discusses issues related to environment theme. The curriculum for the subject of 'Elementary Science' and 'Bangladesh and Global Studies' are providing issues related to Environment for the students of primary level. At secondary level, curriculum of Science, Bangladesh and global studies textbook and Agricultural studies address issues related to environment.

The Amar Bangla Boi textbook at grade 1 and grade 2; and Elementary Science textbook and Bangladesh and Global Studies textbook at grade 3 to grade 5 in primary level provide messages on environment in primary level. The messages for secondary level are available in Science textbook, Bangladesh and Global Studies textbook and Agricultural Studies textbook and few messages are also scattered in English for today textbook.

From grade 3 to grade 8, one or more chapters addressing environment theme are available at Elementary Science textbook in grade 3 to grade 5, Science textbook in grade 6 to grade 8 and Bangladesh and Global Studies in grade 3 to grade 8 such as three chapters of Elementary Science textbooks and Bangladesh and Global Studies textbook at Grade 3 are focusing on the theme.

#### **4.6.1 Environment and its components**

The concept of environment is introduced from the very beginning of school system and almost each grade has a dedicated chapter on this issue. Definition of environment and the main components of it (air, soil, water) discussed elaborately in different textbooks of same grade and also multiple chapters of same textbooks. The concepts are well explained with the help of texts and also images.

#### **4.6.2 Environmental pollution (causes, consequences & prevention/reduction)**

Environmental pollution particularly air, soil and water pollution along with sound pollution is discussed comprehensively in the current textbooks. This content review found that the causes of pollutions, negative consequences of these pollutions for human and overall ecosystem, and how we can prevent or reduce these pollutions and restore the mother earth, all these issues are addressed in detail.

Tree plantation is introduced from the primary level, as a measure to protect and to conserve the environment. In grade 1: Amar Bangla Boi, tree plantation and it's, importance (give us flower, fruits and shadow to protect from sun, happiness from seeing growing plants) is discussed in a very simple and easy way (Figure 4.7). "You can also save the environment by reducing, reusing and recycling the things you use" (Grade 7: English for Today, p- 108). Different ways to prevent water, soil, air pollution is also included in the contents.

Figure 4.7: Tree plantation (Grade 1, Amar Bangla Boi, p-51)



#### 4.6.3 Climate change and global warming

Weather and climate are introduced in the Elementary Science textbook of grade 4 (Chapter 10: Weather and Climate). Science and Bangladesh and Global Studies textbooks mostly covered climate changes and its consequences like global warming and other events in details (Figure 4.8).

Figure 4.8: Effect of global warming (Grade 5: Elementary Science, p-10)



## Chapter 5

### Expert's opinions on developing integrated nutrition messages

In this chapter, we will present the expert opinions on the integrated nutrition messages for school children. The purpose of conducting the key informant interviews (KIIs) was three-fold. Firstly, to gather expert opinions on how to deliver integrated nutrition messages through textbooks for the students of pre-primary to grade-10 in a more eloquent way. Secondly, to map and to identify the messages or contents regarding all six themes i. e. healthy diets, nutrition, immunity, hygiene and sanitary practices, physical activity and life style, and environment that need to be included in textbooks from pre-primary to grade-10. Thirdly, to get the ideas how we can deliver integrated nutrition messages in textbooks from pre-primary to grade-10.

#### 5.1 Grouping of the students as per their grades for effective delivery of messages

The key informants emphasized the importance of keeping the existing division of education as pre-primary, primary, secondary and incorporating the messages within the current curriculum.

Considering grade wise intellectual capabilities and internalizing capacity of the students were also highlighted by them. The key points noted by the participants on the content presentation for the textbooks of different grades are as follows:

- For pre-primary to grade 2: only picture (+instruction in teacher's guide)
- For grade 3-7: More picture and less texts (big font size for the lower grades)
- For grade 8-10: The proportion of text and picture could be equal or more text and less picture

Table 5.1: Grouping of the students as per their grades for effective delivery of messages

Sl. No.	Grouping	Rationale	Content and presentation of the content
Option 1	Group 1: Pre-primary – grade 2 Group 2: Grade 3-7 Group 3: Grade 8-10	The current study proposed these categories	Same content for all grades (or may differ) within the group
Option 2	Group 1: Pre-primary – grade 2 Group 2: Grade 3-5 Group 3: Grade 6-8 Group 4: Grade 9-10	This grouping will serve both the existing categories (pre-primary, primary, junior secondary and secondary) and also the similar range in terms of intellectual capability to understand the messages	Same for all grades within the group
Option 3	Group 1: Pre-primary – grade 5 Group 2: Grade 6-10	The existing category of education and curriculum (pre-primary, primary and secondary). For pre-primary, only picture in the textbook and text/instruction on the teacher's guide.	Content should be same for a particular group but presentation (such as ratio of text & content may vary within the grades of a group

## 5.2 Views on integration of six themes

Almost all key informants were very positive about integrating six themes with stating different rationales for this action. One expert stated, *'If children are exposed to integrated nutrition messages from their childhood, it will create more impact compared to those who learn to relate/connect among these themes in adulthood'*.

## 5.3 Considerations for developing messages for textbooks

Almost all key informants came to the consensus about the following points while they were requested to provide suggestions regarding incorporating messages on six themes in a more understandable way. The Important points to consider during incorporating any message in textbook:



- Must follow the instructions in the national education policy and curriculum for the respective grades and subjects. (For example, at pre-primary level, messages should be delivered through pictures, colours, attractive and simple education materials, models, rhymes, songs, games and handwork or handicraft; and at primary level, textbooks must be flawless and written in easy and lucid language, directed towards creating an interest in the students; textbook contents must be attractive, reflect the indigenous realities of life etc.)
- Maintain consistency with the existing contents (text or image) in the textbooks regarding the same topic
- Prepare and distribute a manual on the newly developed messages for the teachers (separate one or can be incorporated within the existing teacher's guide) for more effective communication with the students on that message
- Linkage among students, teachers and parents is important to transform the textbook messages into practice/implementation in real life. So, beside teachers, inform parents about the messages too (through practical homework and other activities related to messages).

#### 5.4 Ideas to integrate six themes in the textbooks

While key informants were commenting on the idea of incorporating messages on six themes on textbook cover page, they also suggested other alternative ideas to incorporate the messages developed by this research project (Table 5.2). These include: a) comic book: two or more characters (conversation plus relevant pictures); b) rhyme: short and simple rhyme integrating six themes in order for children to easily read, memorize and practice; c) cartoon: Meena cartoon can be taken as an example to interlink all six themes; d) story line: Focus on connection to the healthy life and well-being with pictures of role models (covering both gender as well as physical and intellectual aspects, for example, showing successful sportsman or scientist etc.) and motivational description on how all these themes helped in leading a healthy and successful life; and e) daily schedule/life activities (24 hours): if we carefully consider every day schedule, it represents all six themes perfectly in an integrated manner.

**Table 5.2: Ideas to integrate six themes (suggested by key informants)**

Sl no	Ideas
1	Comic book: Two or more characters (conversation with relevant pictures)
2	Rhyme: Short and simple rhyme integrating 6 themes; so that children can easily read, memorize and practice them
3	Cartoon: The idea of Meena cartoon can be one way to interlink all 6 themes
4	Story line: Connection to the healthy life and well-being:

	<p>Give a picture of role model (cover both genders and both physical and intellectual aspects: for example, successful sportsman or scientist etc.)</p> <p>Provide a description on how all these 6 themes helped him/her to lead a healthy and successful life.</p> <p>Or can present two comparative scenarios: unhealthy and healthy person</p>
5	<p>Interrelation of the themes:</p> <p>Consumption of healthy diet in a hygienic way and practicing proper sanitation will improve nutrition along with immunity. Sufficient physical activity helps proper digestion, absorption and utilization of healthy diet by the body. And of course, we need healthy environment to properly complete all these activities.</p>
6	<p>Every day schedule/life activities (24 hours)</p> <p>If we carefully consider every day schedule, it represents all six themes perfectly in an integrated way.</p> <ul style="list-style-type: none"> <li>• Early to bed and early to rise</li> <li>• Washing mouth, hand, brushing teeth</li> <li>• Healthy breakfast at home (homemade foods)</li> <li>• Bathing and cleaning</li> <li>• Tiffin/lunch (homemade foods, snacks, seasonal fruits etc.)</li> <li>• Back to home and taking rest</li> <li>• Outdoor games/sports/physical activities</li> <li>• Washing and cleaning body</li> <li>• Healthy dinner (a glass of milk before go to bed)</li> <li>• Sleep for sufficient time</li> <li>• In between snacks eating and using toilets in a hygienic way</li> <li>• A clean environment (personal room, home, class room, school and surroundings)</li> </ul> <p>When it comes about integration, then, for children we need to set a comprehensive health goal. It should be goal oriented, not knocking door effect.</p>

### 5.5 Cover page as an entry point of integrated message

All respondents welcomed the idea of incorporating the integrated message in cover page and mentioned that incorporating integrated message on the cover page would be effective. However, they indicated that a cover page incorporating all six themes may become too clumsy/wordy/dense and therefore may look unattractive and get less attention. To address this, they suggested including only 1-2 focused important and clear messages from each of the theme to make the information easy and understandable. Some also mentioned about other platforms in addition to textbook cover page to disseminate messages: a) poster in classrooms, canteens, libraries, and playgrounds; b) educational materials - geometry boxes, maps, and calendars acting as a continuous reminder; and c) inner back cover etc.

**Table 5.3: Other platform in addition to textbook cover page to incorporate the integrated messages**

Ideas
Poster: Posters in classrooms, canteens, libraries, and playgrounds.
Educational materials: Educational materials such as geometry boxes, maps, and calendars etc. (will act as a continuous reminder)
Back cover (inner):

Indirect learning from own curiosity sometimes more effective than direct learning. Students will just look at the pictures/text and will get familiar with the contents. No need to burden the main textbook content further.

## 5.6 Appropriate textbooks for the integrated messages

All key informant came to a consensus that this integrated message should be incorporated in a common (and mandatory for all) textbook. According to one key informant:

*‘These six themes are equally important to me. No need to think about a specific or related textbook to incorporate these messages. These issues are as urgent as like breathing, we need to know and practice these issues to live a healthy life. Hence, it could be added in Bangla or English for Today textbooks as like our national anthem is incorporated. Moreover, these two textbooks are common from pre-primary to grade 12’.*

## 5.7 Potential messages on six themes

Based on the suggestion from key informants, this study came up with a number of proposed messages on six themes (Table 5.4). Since only one cover page is available to incorporate all messages from all six themes, we need to prioritize from the wish list. Another important consideration is that when we will develop message for a group (such as group 1: pre-primary to grade 2), we need to consider (in terms of intellectual capabilities) the lowest grade of each group as a base grade (like for group 1, base grade is pre-primary). We also need to come up with the criteria for prioritizing the messages.

**Table 5.4: Potential messages on six themes (based on KIIs)**

Sl. No.	Themes (potential messages)
1	<b>Healthy diet</b> [what to eat and what to avoid; good tiffin or school time eating] <ul style="list-style-type: none"> <li>a. Balance diet (along with dietary diversity): definition, healthy plate (and/or food pyramid) concept (home-made foods) and its importance with real life examples (with pictures) [what to eat and what to avoid]</li> <li>b. Food grouping: according to the function of foods in the body (with pictures)</li> <li>c. Nutrients: main nutrients and food sources of nutrients (with picture)</li> <li>d. Example of unhealthy foods (such as: available in school canteen and school catchment areas) and consequences of eating those (picture of context specific foods)</li> <li>e. Example of good Tiffin or school time eating</li> <li>f. Role of school canteen</li> </ul>
2	<b>Nutrition</b> [picture of nutritionally sound child and a malnourished child] <ul style="list-style-type: none"> <li>a. Macronutrients: functions and consequences of eating excess amount (overweight, obesity and in later life NCDs) and consequences of deficiency disorders</li> <li>b. Micronutrients: functions and consequences of eating excess amount and consequences of deficiency disorders</li> <li>c. Triple (double) burden of malnutrition: coexistence of overnutrition, undernutrition and micronutrient deficiencies (with pictures) [picture of a nutritionally sound child and a malnourished child] [BMI classification]</li> <li>d. Emphasize on the nutrition related public health issues</li> </ul>

3	<p><b>Immunity</b> [role of nutrition, particularly micronutrients in enhancing immunity, positive impact of strong immunity]</p> <ol style="list-style-type: none"> <li>Foods and other practices that enhance immunity against different diseases</li> <li>Importance of nutrition for immunity [micronutrient enhance immunity]</li> <li>Consequences of lack of immunity (going to hospital frequently, being sick all the time, impact on reading and playing etc.)</li> <li>Positive impact of strong immunity</li> </ol>
4	<p><b>Sanitation and hygiene</b> (picture could be more effective for hygiene and sanitation theme)</p> <ol style="list-style-type: none"> <li>Personal cleanliness: brushing the teeth, bathing, combing hair, wearing neat and clean clothes</li> <li>Hand washing: when to wash hand, how to wash hands properly, consequence of not washing hands when need to wash</li> <li>Coughing and sneezing manners (with pictures)</li> <li>Proper toilet use: personal (at home) and common toilet use (at school and other places), wearing sandal etc.</li> <li>Menstrual hygiene [make it more explicit; prioritize]</li> </ol>
5	<p><b>Physical activity and lifestyle</b> [cut-off point for sufficient physical activity, negative consequences of sedentary activities like screen time]</p> <ol style="list-style-type: none"> <li>Importance of regular/enough sleep and rest</li> <li>Minimum requirement of physical activity: and how they can achieve the target (WHO cut-off point)</li> <li>Importance of being physically active</li> <li>Example of how they can perform physical activity even in indoor spaces (as outdoor space is becoming very limited day by day, particularly in urban areas)</li> <li>Negative consequences of sedentary activities (such as screen time etc.)</li> </ol>
6	<p><b>Environment</b> [Tree plantation, not throwing plastic or other waste here and there etc.]</p> <ol style="list-style-type: none"> <li>Home and school environment: how can we keep healthy</li> <li>Prevention of soil, air, water pollution</li> <li>Responsibility at individual level to make the environment healthy [tree plantation, not throwing plastic or other waste here and there]</li> <li>Climate change and negative consequences of it</li> <li>Relationship between nutrition and climate change</li> <li>Plastic throwing here and there and how it affects nutrition (use bin)</li> <li>Tree plantation (go green)</li> </ol>

## Chapter 6

### Knowledge of the mothers and students on nutrition and related factors

This chapter contains knowledge of the mothers and the students on healthy diet, balanced diet, preparing safe food, safety measures of preparing food, nutrition, immunity, prevention of food food and water borne diseases, contagious diseases, environment and climate change and lifestyle. They were asked question on different issues and all the correct answers were cumulated and the average value presented as the knowledge score of the respondents .the formula has been described in the methodology sections. In addition, the socio-demographic conditions of the respondents and their 24-hour dietary diversity also have been presented in this chapter. Findings of this chapter are described below.

#### 6.1 Socio-economic condition of the households

Table 1 depicts the socio-economic condition of the households (HHs) selected in the study. Majority of the HHs were headed by males and were following Islam (Table 6.1). Most of the HH heads were married and their average age was 38, 43, and 46 years in group-1, 2 and 3 respectively. The average number of persons per HH was five. Literacy was comparable across the three groups. However, only about 20%, 11% and 19% of them completed primary education. Their occupations did not vary across the groups and in all groups, the highest proportion of the HH-heads were farmers. In group-1, the proportion of poor HHs was higher than the HHs of the groups-2 and group-3. On the other hand, in the group-3 proportion of the rich people were higher compared to the other two groups. Their monthly HH income was BDT 11,000, 13,000 and 15,000 in group-1, 2 and 3 respectively. Their average monthly expenditure was BDT 9,000/-, 10,000/- and 12,000/- in group-1, 2 and 3 respectively. We observed that the highest part of their expenditure were for purchasing foods. Interestingly, difference between total expenditure and expenditure for purchasing foods was lesser in the groups with poorer HHs (group-1 &2), while in the group-3 this difference was higher (Table 6.1).

**Table 6.1: Percentage distribution of households by sex, marital status, education of household-head and household size**

Study variable	Group 1 n=154	Group 2 n=152	Group 3 n=155	All n=461
Sex of household head, % (n)				
Male	98.0(149)	97.4(148)	94.1 (143)	96.5(440)
Female	2.0(3)	2.6(4)	5.9(9)	3.5 (16)
Religion, % (n)				
Islam	94.1(144)	90.8(139)	88.9(136)	91.3(419)
Hindu	5.9(9)	8.5(13)	11.1(17)	8.5(3.9)
Age of HH-head, Mean (SD)	37.61(8.91)	43.36(8.86)	46.04(8.96)	42.33(9.57)

Household size, Mean (SD)	4.74(1.3)	4.88(1.2)	4.77(1.4)	4.80(1.3)
Marital status of household head, % (n)				
Married	98 (149)	98.7 (150)	95.5(145)	97.4(444)
HH head can read and write, % (n)	58.6(89)	55.9(85)	58.6(89)	57.7(263)
Education of household head, % (n)				
None	25.7(39)	30.9 (47)	27.0(41)	27.9(127)
Primary incomplete	19.1(29)	18.4(28)	13.8(21)	17.1(78)
Primary complete	20.4(31)	11.2 (17)	19.1(29)	16.9(77)
Secondary incomplete	17.8 (27)	23.0(35)	23.0(35)	21.3(97)
Secondary +	17.1(26)	16.4(25)	17.1(26)	16.9(77)
Main occupation, % (n)				
Farmer	16.4(25)	19.1 (29)	23.0(35)	19.5(89)
Small business	15.1 (23)	18.4(28)	20.4(31)	18.0(82)
Day laborer (agri)	11.2(17)	10.5(16)	9.2(14)	10.3(47)
Day laborer (non-agri)	17.8(27)	9.2(14)	6.6(10)	11.2(51)
Rickshaw puller	12.5(19)	12.5(19)	6.6(10)	10.5(48)
Other <sup>a</sup>				
Wealth index, % (n)				
Poorest quintile	29.4(45)	20.3(31)	9.8(15)	19.8 (91)
Second quintile	22.9(35)	23.5(36)	13.7(21)	20.0(92)
Middle quintile	19.0(29)	17.0(26)	24.2(37)	20.0(92)
Fourth quintile	15.7 (24)	19.0(29)	25.5(39)	20.0(92)
Richest quintile	13.1(20)	20.3(31)	26.8(41)	20.0(92)
Monthly income of the HH, Median (IQR)	11000 (9000-1500 0)	13000 (10000-2000 0)	15000 (12000- 20500)	12000 (10000 -20000)
Monthly expenditure of the HH, Median (IQR)	9000 (7000- 12000)	10000 (8000- 15000)	12000 (9000-1850 0)	10000 (8000-1500 0)
Monthly expenditure for food of the HH, Median (IQR)	6000 (4500- 8000)	7000(5500-9 500)	8000 (6000-1000 0)	7000 (5000- 9000)

## 6.2 Socio-demographic condition of the mothers of the selected students

The average age of mothers in survey was 30, 36 and 39 years in group-1, 2, and 3 respectively (Table 6.2). More than 95% of them were married and most of them were house makers. In group-1, 70% of mothers could read and write while in group-2 and 3 this proportion was 61%. In all groups, the proportion of mothers with incomplete secondary education was higher than other categories of students.

**Table 6.2: Socio-demographic characteristics of the mothers by the group of students**

Study variable	Group 1 n=154	Group 2 n=152	Group 3 n=155	All n=461
Mean Age, in year, Mean (SD)	30.0(6.3)	35.9(6.0)	38.8(6.7)	34.9(7.3)

Marital status, % (n)				
Married	96.1(148)	98.7(150)	95.5(148)	96.7(446)
Others	3.9 (6)	1.3(2)	4.5 (7)	3.3 (15)
Can read and write, % (n)	70.1(108)	61.2(93)	61.9(96)	64.4(297)
Educational status, % (n)				
No education	14.9(23)	18.4(28)	20.6(32)	18.0(83)
Primary incomplete	16.9(26)	24.3(37)	20.6 (32)	20.6(95)
Primary complete	19.5(30)	11.8(18)	16.0(25)	15.8(73)
Secondary incomplete	37.0(57)	34.9(53)	29.7 (46)	33.8(156)
Secondary complete or Higher	11.7(18)	10.5(16)	12.9(20)	11.7 (54)
Main occupation, % (n)				
Home maker	92.2(142)	96.1 (146)	91.6 (142)	93.3 (426)
Others	7.8(12)	3.9 (6)	8.4(13)	6.7(25)

### 6.3 Availability of the ten food groups in the households

We collected data on availability of ten food groups of foods to know the household food security of the students. Findings revealed that grain, cereal, roots and tubers were available in all households during the last seven days before interview (Table 6.3). More than 60% of respondents reported about the availability of pulse and legume at their households. Nuts and seeds were available in about one-fifth, one-fourth and one-third of the households reported by respondents. Half of the respondents in group-2 and 3 reported that they had milk or milk products at their home while in group-1 43% of the respondents reported the same. More than 93% of respondents across all three groups reported that fish, meat and poultry were available at their home preceding last seven days of interview. Meanwhile 65%, 70% and 82% of the respondents of group-1, 2, and 3 reported about the availability of eggs during last seven days before interview. About half of all respondents of across all groups reported that they had yellow and orange fruits and vegetables at their home while 72%, 94% and 93% of respondents reported that they had green leafy vegetables at home during the last seven days of interview. Similarly other fruits were available in 40%, 48% and 50% of the households whereas other vegetables were available in 96%, 60% and 70% of the households of group-1, 2 and 3.

**Table 6.3: Availability of ten food groups at household during last seven days of interview**

Food groups	Group 1 n=153	Group 2 n=153	Group 3 n=153	All n=459
<b>Food groups % (n)</b>				
Starchy foods	100(153)	100 (153)	100 (153)	100 (459)
Pulse and legume	62.7 (96)	64.1 (98)	70.6 (108)	65.8(302)
Nuts and seeds	20.3(31)	24.2(37)	32.0(49)	25.5(117)
Dairy	43.1(66)	51.6(79)	51.0(78)	48.6(223)
Fish, meat and poultry	93.5(143)	96.7(148)	96.1(147)	95.4(438)
Eggs	65.4(100)	70.4(108)	81.7(125)	72.5(333)
Yellow fruits and vegetables	47.1(72)	45.8(70)	54.1(83)	49.0(225)
Green leafy vegetables	71.9(110)	94.1(144)	93.5(143)	76.5(397)

Other fruits	40.5(62)	48.4(74)	50.3(77)	46.4(213)
Other vegetables	96.1(147)	60.1(92)	70.6(108)	75.6(347)

#### 6.4 Intake of ten food groups by the women, students and other household members

Table 6.4 illustrates the intake of ten food groups by mothers, students and other family members during 24 hours preceding the interview. Mothers were respondents of the dietary intake of the students (their children) of group-1 along with that of other family members and their own during the last 24 hours. We observed a variation in food intake among mothers and their children. All mothers and students consumed energy producing grains, cereals, roots, and tubers. The students consumed some types of foods, while mothers did not consume during last 24 hours. Some of them reported that the intake of other food groups by students were better in all groups. For instance, in group-1 more students ate fish, meat and poultry during 24 hours of interview compared to their mothers. Intake of pulse and legume; nuts & seeds; milk & milk products; eggs; green leafy vegetables and other fruits varied between mothers and students of groups-1. On the other hand, we did not observe much difference in intake of other food groups except pulse & legume and nuts & seeds between mothers and students of group-2 and 3. Furthermore, intake of ten food groups by other family members was slightly higher than those of mothers, but, was lower than the intake by students (Table 6.4).

**Table 6.4: Percentage of mothers, children and any other family members who consumed 10 food groups on a single recall day, by groups of the student**

Study variable	Group 1 n=153	Group 2 n=153	Group 3 n=153	All n=459
<b>Mothers, % (n)</b>				
Starchy foods	100 (153)	100 (153)	100 (153)	100(153)
Pulse and legume	15.7(24)	22.2(34)	21.6(33)	19.8(91)
Nuts and seeds	7.8(12)	5.9(9)	5.9(9)	6.5(30)
Dairy	26.1(40)	29.4(45)	36.6(56)	30.7(141)
Fish, meat and poultry	59.5(91)	71.9(110)	71.2(109)	67.5(310)
Eggs	26.8(41)	32.7(50)	36.6(56)	32.0(147)
Yellow fruits and vegetables	22.2(34)	19.0(29)	24.8(38)	22.0(101)
Green leafy vegetables	38.6(59)	45.8(70)	47.7(73)	44.0(202)
Other fruits	11.8(18)	24.2(37)	27.5(42)	21.1(97)
Other vegetables	83.7(128)	83.6(128)	61.4(94)	64.5(296)
<b>Students, % (n)(reported by mother)</b>				
Starchy foods	100 (153)	100 (153)	100 (153)	
Pulse legumes	26.1(40)	36.2 (55)	32.6(49)	
Nuts and seeds	17.6(27)	11.8(18)	15.9(24)	
Dairy	31.4(48)	30.9(47)	33.1(50)	
Fish, meat and poultry	73.2(112)	73.0 (111)	77.5(117)	
Eggs	32.7(50)	37.5(57)	47.0(71)	
Yellow fruits and vegetables	28.8(44)	24.3(37)	24.5(37)	
Green leafy vegetables	52.7(81)	52.0(79)	62.3(94)	
Other fruits	25.5(39)	27.0(41)	33.1(50)	
Other vegetables	81.0(124)	78.0(120)	82.9(125)	

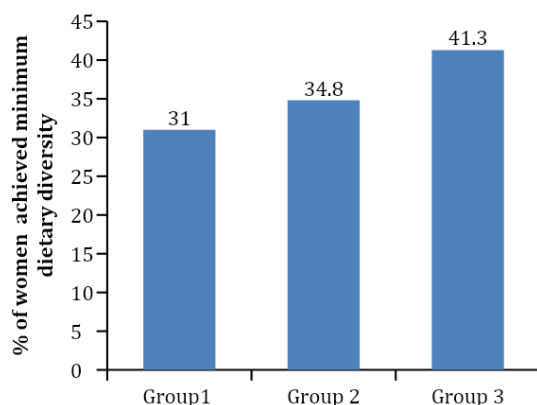


Any other family members , % (n)(reported by mother)				
Starchy foods	100(153)	100 (153)	100 (153)	100 (459)
Pulse and legume	15.7(24)	22.2(34)	21.6(33)	19.8(91)
Nuts and seeds	8.5 (15)	5.2(8)	7.5(15)	7.4(34)
Dairy	30.1 (48)	31.4(48)	39.2(60)	33.6(154)
Fish, meat and poultry	61.4(94)	71.2(109)	70.6(108)	67.8(311)
Eggs	27.5(42)	34.5(53)	37.3(57)	33.3(153)
Yellow fruits and vegetables	20.3(31)	19.6(30)	22.9(35)	20.9(96)
Green leafy vegetables	39.2(66)	46.4(71)	48.4(74)	44.7(205)
Other fruits	17.0(26)	25.5(39)	32.0(49)	24.8(114)
Other vegetables	82.4(126)	49.7(76)	62.7(96)	64.9(298)

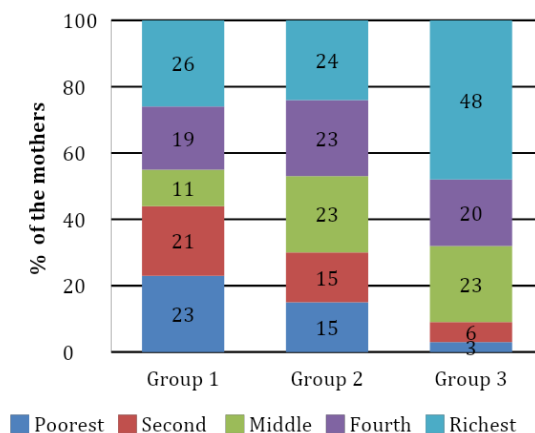
## 6.5 Minimum dietary diversity of the mothers

Figure 6.1 depicts the proportion of mothers in three groups who achieved the minimum dietary diversity during 24 hours of interview. We found that 31%, 35% and 41% of the mothers in group-1, 2 and 3 ate at least five food groups during last 24 hours of interview. We found that the minimum dietary diversity of the richest quintile of each group was the highest compared to other quintiles (Figure 6.2).

**Figure 6. 1:** Minimum Dietary Diversity ( $\geq 5$  food groups) achieved by the mothers during last 24 hours of interview, by group of students



**Figure 6. 2:** Minimum Dietary Diversity ( $\geq 5$  food groups) achieved by the mothers during last 24 hours of interview, by wealth quintile



Group 1 P=0.018

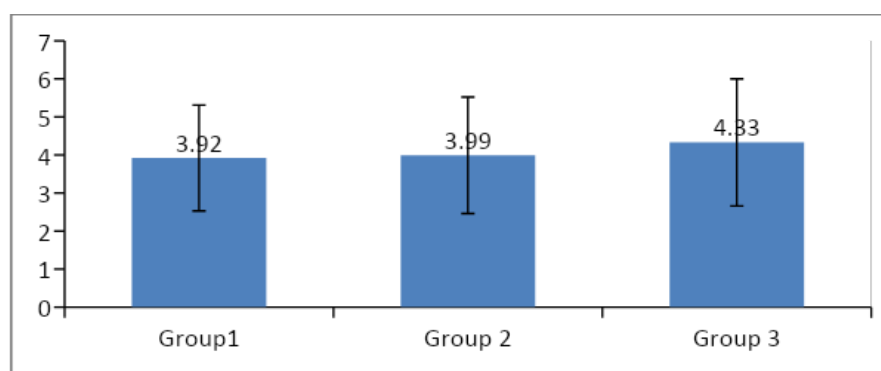
Group 2 P<0.000

Additionally, we observed that the diversity score of most of the women ranged between 3-5 (Annexure 5) and mean dietary diversity score of women four across all the three groups (Figure 6.3).

Dietary diversity of mothers is an important predictor of nutritional status of children (Hasan *et al.*, 2019). It was assumed that family members were eating from the same pot and mothers had the principal responsibility of selecting, preparing, and serving nutritious foods to their children (Hasan *et al.*, 2019). In the present study, we found that only one-third mothers of group-1 and 2

and 41% of mothers of group-3 could only achieve the minimum dietary diversity(had at least five food groups during last 24-hours). However, an early nationwide survey in Bangladesh found that about 60% achieved the minimum dietary diversity during 2014 (HKI & JPGSPH, 2014). The COVID-19 pandemic might have had an effect on the socio-economic condition of households of respondents, which might have adversely impacted their purchasing capacity of variety of foods and reduced household food security and the minimum dietary diversity of mothers (Kundu *et al.*, 2020; Pakravan-Charvadeh *et al.*, 2021). Additionally, household dietary diversity was also related to human capital, natural capital and capital (Huluka& Wondimagegnhu, 2019). Besides, dietary diversity was also affected by the utilization of livelihood assets, social relations, institutions, organizations, shocks and seasonality and directly influenced by livelihood strategies such as farm production diversity and non-farm income (Huluka& Wondimagegnhu, 2019). Since, the study did not have this information the study was unable to explain the causes of low dietary diversity among respondents.

**Figure 6.3: Mean number of food groups taken yesterday by the mother**



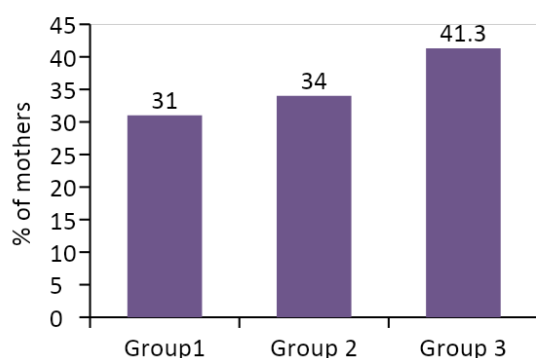
Error bar represents standard deviation

## 6.6 Dietary diversity of the students

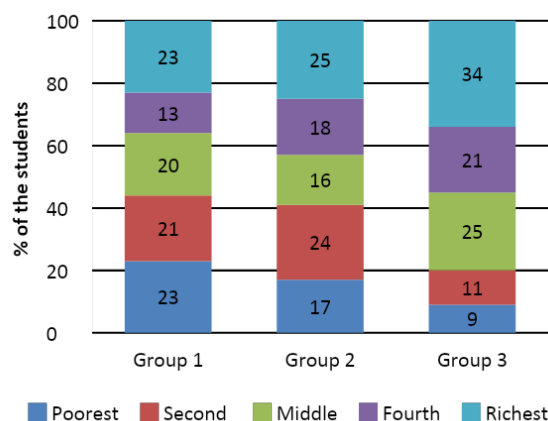
We found that during the last 24 hours of interview, 31%, 34% and 41% of the students of group-1, group-2 and group-3 respectively, had consumed at least five food groups (Figure 6.4). Likewise, mothers, children's minimum dietary diversity of the different groups was higher in the richest quintile category of group-1 and group-2 (Figure 6.5). Affluent women and children had higher dietary diversity compared to women from poor households. Furthermore, we found that families tended to spend more money to purchase foods. An earlier study in Bangladesh found that the dietary diversity score was significantly associated with monthly per capita food and total expenditures (Andrew *et al.*, 2010). Both increase of food price and scarcity of foods indicated the potential risk of worsening of micronutrient deficiency and child malnutrition (Andrew *et al.*, 2010). Since we did not undertake nutritional assessment of mothers and

children, we could not predict whether members of affluent families had better nutritional status compared to poor families.

**Figure 6. 4 :** Minimum Dietary Diversity ( $\geq 5$  food groups) achieved by the students during last 24 hours of interview, by students groups



**Figure 6. 5:** Minimum Dietary Diversity ( $\geq 5$  food groups) achieved by the students during last 24 hours of interview, by wealth quintile

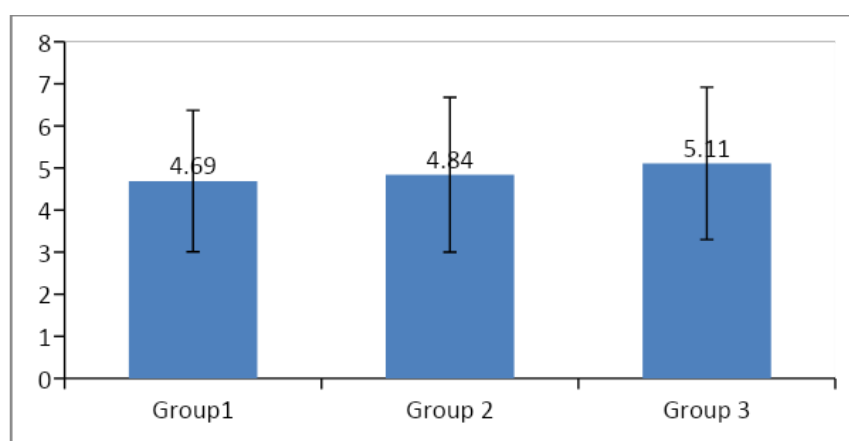


Group 1 P=0.016

Group3, P= 0.075

Their average dietary diversity score was 4.69(1.68), 4.84(1.84) and 5.11(1.81) in group-1, group-2 and group-3 respectively (Figure 6.6) while most their diversity score ranged from three to six (Annexure 7).

**Figure 6.6: Mean number of food intake by the students of three different groups preceding last 24 hrs of interview**



Error bar represents standard deviation

Consumption of some food groups such as, dairy products, eggs, meat and poultry and green leafy vegetables were better among students compared to mothers (Annexure 6& 7). It signifies that mothers first ensured nutritious foods for their children and then later consumed food themselves. We also found that the average number of food group intake was four among

mothers while it was higher at five among students. Moreover, there is also a gender norm in Bangladesh that females receive and consume small meal portions and make sacrifices in food consumption so that male family members can eat more (Lauren *et al.*, 2019). However, this study found that women were also concerned for the health of their children and fed nutritious food to them more than that they themselves had.

## **6.7 Knowledge score of the mothers and the students on different thematic areas relevant to nutrition**

### **6.7.1 Knowledge score of the mothers**

We observed that mothers had better knowledge on purchasing healthy food items for their children, food preparation procedures and food waste loss (Table 6.5). However, they had less knowledge on functions of different foods, balanced diet and had moderate knowledge on healthy diet and safe foods. We found that they had better knowledge on prevention of contagious diseases and prevention of food and water borne diseases such as diarrhoea, dysentery, typhoid and Jaundice. In addition, we found that their knowledge on hygiene and sanitation was also very good. However, they had a poor knowledge on environment and climate change.

**Table 6.5: Knowledge score of mothers on healthy diet, nutrition & immunity, sanitation& hygiene and environment& climate change**

Theme	Number of question asked	Knowledge score			% of correct response		
		Group 1	Group 2	Group 3	Group 1	Group 2	Group 3
		n=153	n=153	n=153	n=153	n=153	n=153
Healthy diet	17	9.2	9.5	9.5	54	56	56
Purchasing healthy foods for children	17	13	13.6	13.6	76	80	80
Function of foods	16	5	4.9	5	31	31	31
Balanced diet	5	0.95	0.95	0.95	19	19	19
Nutrient content of foods	14	5	4.9	5	36	35	36
Safety measures of food preparation	21	10.3	11.2	11.6	49	53	55
Appropriate food preparation methods	8	6.1	6.2	6.3	76	78	79
Food waste and loss	14	12.7	12.5	12.6	91	89	90
Prevention of contagious disease	7	5.2	5.2	5.3	74	74	76
Prevention of food & water borne disease	9	5.6	5.6	5.6	62	62	62
Personal hygiene and sanitation	11	9.7	10.3	10.4	88	94	95
Environment and climate change	9	2.3	2.8	2	26	31	22

### 6.7.2 Knowledge score of the children

Knowledge of students of group-2 and 3, on different thematic areas relevant to nutrition was assessed. However, students of group-2 were not asked all questions on topics such as, safety measures during preparation of foods, appropriate food preparation methods, nutrition, immunity and nutrition deficiency diseases as these areas were less covered or almost not covered in textbooks of students who studied from class-3 to class-7.

Students had good knowledge on healthy diet, purchasing of healthy foods for themselves and safety measures required for food preparation (Table 6.6). Additionally, they had better knowledge on food waste, food loss and cleanliness around the kitchen. However, their knowledge on balanced diet, function of foods and nutrient content of food was very poor.

Student of group-3 had very good knowledge on nutrition and immunity. But, they had poor knowledge on diseases that occur due to nutritional deficiency. Students of both group-2 and 3 had better knowledge on prevention of disease, prevention of food and water borne diseases. They also had very good knowledge on personal hygiene and sanitation. Students of group -2 had poor knowledge on environment and climate change. However, this knowledge was improved among students of group-3. But this group also had better knowledge on physical exercise and lifestyle (Table 6.6).

**Table 6.6: Knowledge score of students on healthy diet, nutrition & immunity, sanitation & hygiene, environment & climate change and physical exercise & life style**

Theme	Number of question asked	Knowledge score		% of correct response	
		Group 2	Group 3	Group 2	Group 3
		n=153	n=153	n=153	n=153
Healthy diet	17	11.0	11.3	64.7	66.5
Purchasing healthy foods	17	12.8	12.9	75.3	75.9
Function of foods	16	4.4	5.8	27.5	36.3
Balanced diet	5	0.6	0.7	12.0	14.0
Nutrient content of foods	14	4.6	6.2	32.9	44.3
Safety measures of food preparation	21	-	12.0	---	57.1
Appropriate food preparation methods	8	-	6.2	---	77.5
Food waste and loss	14	12.8	13.1	91.4	93.6
Cleanliness around the kitchen	3	2.5	2.6	83.3	86.7
Nutrition and immunity	6	-	5.6	-	93.3
Nutritional deficiency of disease	4	-	1.2	-	30.0
Prevention disease	7	5.2	5.4	74.3	77.1
Prevention of food & water borne disease	9	5.5	6.0	61.1	66.7
Personal hygiene and sanitation	11	9.0	10.8	81.8	98.2

Environment and climate change	9	3.4	5.4	37.8	60.0
Physical exercise and life style	10	1.9	6.9	19.0	69.0

Knowledge on different domains was similar between mothers and student groups. It signified that we tended to follow traditional norms and values regarding food, nutrition, water, sanitation, and hygiene practices. Regarding environment and climate change people had more or less academic knowledge or thorough exposure to mass media. Knowledge on all other domains also varied by levels of education (de Vriendt *et al.*, 2009). In our study, mothers of group-1 had better education levels compared to the other two groups; however, their knowledge level of different domains of the mothers was similar irrespective of groups. Knowledge on food handling, processing and hygiene sanitation was high among mothers of group-3. A higher age of mothers of this group could be one of the factors for their increased knowledge of these two particular areas (de Vriendt *et al.*, 2009). Perhaps these women, were informed from other sources or exposed to textbooks of their children as students of this group also possessed better knowledge on these areas.

## Chapter 7

### Development of integrated nutrition messages

Both pictorial and written integrated nutrition messages had been developed for different grade of students. The major messages were on different thematic areas, such as, healthy diet, hygiene and sanitation, physical activity and healthy lifestyle and environment. Some of the written messages are given below (Table 7.1),

**Table 7.1:** Integrated Nutrition Messages (written only) developed by the research team for different groups of students

Thematic areas	Group 1	Group 2	Group 3
Healthy diet	To keep the body healthy and strong all kinds of nutritious food on this plate should be eaten every day.	There are 10 types of food in the picture above. To keep the body healthy and strong, you should eat as much as possible from these types of food every day. If you are healthy you will be intelligent, stronger & able to fight diseases and infection	For a healthy and strong body and to be intelligent you should eat at least 5 foods/food groups from these 10 food groups in the plate every day. This will ensure micronutrient adequacy and help to raise your immune system to fight against diseases. Different types of food have different nutritional properties, each of which is very important.
	Homemade food is good for health. Fruits should be washed well before eating.	Homemade food is good for health. Fruits should be washed well before eating.	To stay healthy, it is necessary to eat homemade food. Fruits should be washed well before eating.
	Drink at least 5 glasses of water throughout the day	Drink at least 7-8 glasses of water throughout the day	Drink at least 8-11 glasses of water every day
Hygiene and sanitation	Wash both hands thoroughly with soap before eating. After defecation, you must wash both hands thoroughly with soap	Wash both hands thoroughly with soap before eating and using toilet	Help others to keep the toilet clean. Wash both hands thoroughly with soap before eating food and always after using the toilet
	Take a bath every day. Wash your clothes regularly	Take a bath every day. Wash your clothes regularly	Take a bath every day. Wash your clothes regularly
	Do not spit here and there	Do not spit here and there	Do not spit here and there
	Always wear shoes or sandals	Wear shoes or sandals all the time	Always wear shoes or sandals
	Hair should be combed	Comb hair	Comb hair
	Nails of finger and toes should be cut regularly	Cut nails of finger and toes regularly	Cut/trim nails of finger and toes
	Brush your teeth two to three times in a day (upon rising, after a meal and before going to sleep)	Wash your cloths regularly	Wash your cloths regularly



	During coughing and sneezing, your mouth and nose should be covered with a handkerchief/tissue	Brush your teeth two-three times throughout the day	Help younger members of the family to stay neat and clean
		Cover nose and mouth with handkerchief/tissue during sneezing and coughing	Brush your teeth two-three times throughout the day
			Cover nose and mouth with handkerchief/tissue during sneezing and coughing
Environment	The house and surroundings should be kept clean. Flowers, vegetables and fruit trees should be planted in empty places surrounding the house or in tubs.	We may eat fresh vegetables if we plant vegetables in the open space around the house or in a tub garden. It contains many nutrients. Plants are very necessary for the environment.	Houses and surroundings should be kept clean. Vegetables and flowering plants should be planted in empty places surrounding home or in tubs. Clean and pollution free environment helps to stay physically and mentally healthy.
Physical activity	Regular sports keep healthy	Regular sports and physical activity keep healthy	Regular sports and physical activity keep healthy

## **Chapter 8**

### **Understanding of narratives and pictorial messages by the students, parents and teachers**

This chapter contains the findings of the level of understanding of the narrative and pictorial integrated nutrition messages developed by the researchers. For this purpose, we performed comprehension and aesthetic tests among the students, mothers and the teachers. Both tests were conducted by following qualitative method. We used IDI data collection technique to obtain information of the level of understanding of the respondents. Of the developed messages, findings of the comprehension and aesthetic are given below.

#### **8.1 Healthy diet and Food groups**

The students and mothers considered the image as a Round object with some foods, whereas the teachers considered it a food chart. The mothers of Group-1 provided less recommendation for modification of pictures compared to other categories of participants. The confusion on images of grains and beef were common among all categories of participants. Some of them recommended changing the background color of the plate. Students of Group-1 and Group-2 had problems reading the written messages and relating those messages with the pictures. Some of the teachers suggested using simple language and easily readable words instead of complex words.

#### **8.2 Hand washing**

Though some confusion was still observed, the shape, color and expression of the image was mostly accepted in all categories of students. One of them stated, *“It is not clear in the picture that the hands are being washed with safe water” (IDI 12, student, Group2).*

However, the students replied that hands were washed with either a hand wash or savlon. The image of soap, a whole tube well (indicated through green colour) and a person were suggested to be added. Meanwhile, it was exhibited that participants had ideas regarding the significance of hand washing. One of the students said, *“If hands are not properly washed, we may be attacked by pathogens or coronavirus” (IDI 1, student, Group1).*

In addition, when the hands should be washed, it should be included in the written message. The teachers demanded four steps of hand washing pictures as a poster in the classroom that would help the students in learning the hand washing method. Both teachers and students wanted images of hand washing to be presented with basin and running tap water in a washroom with walls.

### 8.3 Coughing or sneezing

Participants had no issues to disagree regarding the shape, colour and expression of the image. However, a mother from Group 1 demanded modification of the image. she suggested adding an image covering face with tissue or handkerchief while coughing and sneezing. She said, *"If handkerchief or tissue is given to the children to use, they lose them. So, instead of handkerchiefs or tissues, training on how to use the elbow during coughing or sneezing, should be given"*(IDI 5, mother, Group1).

The size of the picture was asked to be enlarged by the respondents. The teachers recommended drawing the image of children according to their age. The students of Group-2 were quiet and looked nervous when they were asked to read the messages as they might have had found difficult to read it. In another instance, while reading the narrative of not spitting here and there, the students of Group-2, Group-3 and teachers of Group-3 recommended adding an image to understand an appropriate place for spitting.

### 8.4 Wearing Sandals

The images were mostly liked by participants of all categories. A few modifications were asked though. In terms of written messages, the teachers agreed with the messages, however, mothers and students expressed their confusion. For example, students did not agree to wear shoes, as they felt uncomfortable, whereas the parents thought that always wearing sandals was not possible as children were restless in nature. We identified that misconception existed among mothers about wearing sandals . They told us that always wearing sandals might increase the temperature of the head or cause gastritis among children. Teachers suggested modifying the legs and sandals according to ages of different groups. A teacher said, *"The color of the legs and nails should be different"*(IDI 15, teacher, Group-2).

### 8.5 Brushing teeth

All participants positively accepted the images. However, they demanded a few changes like- adding toothpaste in the picture and when teeth need to be brushed should be written in the messages. Teachers of Group-3 were asked to include pictures of appropriate brushing technique in the image. Students were aware about brushing teeth twice in a day; however, they expressed their laziness in brushing teeth before sleeping. One of them said, *"I know tooth brushing should be done at night, but I didn't follow because of my laziness"*(IDI 18, student, Group3).

### 8.6 Taking shower

Though the image and message of taking shower was good in color, shape and expression, the participants added to improve it by coloring the tube well with green color as green color tube well represented arsenic free safe water. One of the students cited, *"It seems like the water of this tube well contains arsenic, as it is not colored with green color"* (IDI 18, student, Group-3). Most of the respondents also have to improve the image by adding soap, a wall of washroom or changing

the color of water. They thought that if the image was modified according to their feedback it would be more realistic and acceptable to the audience.

### **8.7 Participation in sport**

The students of Group-1 did not get all elements of the picture like ball, shoes or dresses. That is why they remained silent while the pictorial messages of participation of the sport were shown to them, which meant that the image was not culturally appropriate. Teachers were also confused regarding the image of Group-1, as one teacher said, *“Children are playing with balls” (IDI 6, teacher, Group-1)*. The teacher also suggested making the field greener and the face of the children livelier. They demanded that photos be made for each message of physical activity.

All participants of Group-2 agreed with the picture of playing sports, which was prepared for them. Participants from different categories suggested for a picture of sleeping, some also asked for a picture of physical activities. The students of Group 3 discussed the reasons behind not playing on field. *“Though we have a desire to participate in sports in the playground, we can’t manage time for it. We need to go for tuition during afternoon ”(IDI 19, student, Group-3)*.

### **8.8 Tree plantation**

The participants of group1 agreed with the images, however, the teacher suggested adding a name of the school so that the image might seem like a school. In Group-3, the image of tree plantation was well accepted by all respondents of all groups. However, the teacher advised to add an image of rooftop gardening to show the current scarcity of land due to rapid urbanization. One of them cited, *“As there is less space for planting trees in urban areas, students may be encouraged for tree plantation”(IDI 24, teacher, Group-3)*.

## **Chapter 9**

### **Modification of pictorial and written integrated nutrition messages**

Based on the feedback of students, parents and teachers integrated nutrition messages were modified by the research team to make it easily understandable for students and their mothers. During modification we also considered that the audience might easily follow the messages in their daily lives. All groups received the same messages however the narratives were different for the three different groups. In addition, duration of the sleeping time and quantity of drinking water was different in three different groups. The modified and final images along with messages for the three different groups are given below.

## 9.1 Integrated nutrition messages for Group-1

### সমন্বিত পুষ্টি বার্তা

স্বাস্থ্যকর খাদ্য, পুষ্টি এবং রোগ প্রতিরোধক ক্ষমতা

- আমি পুষ্টিকর খাবার খাই
- ১০ রকমের খাবার থেকে রোজ কমপক্ষে ৫ রকমের খাই
- আমি বাসায় রান্না করা খাবার খাই
- সারাদিনে কমপক্ষে ৫ গ্লাস পানি খাই
- আমি সুস্থ ও সবল থাকব



### নিরাপদ খাদ্য ও পরিষ্কার-পরিচ্ছন্নতা

- আমি ফল ও সবজি খাওয়ার আগে ধুয়ে খাই
- আমি জাক্ক ফুড খাই না
- খাওয়ার আগে হাত সাবান দিয়ে ধুই
- ল্যান্ড্রিন থেকে এসে ভালভাবে সাবান দিয়ে হাত ধুই
- রোজ সকালে খাওয়ার পরে ও রাতে ঘুমাতে যাওয়ার আগে দাঁত মার্জি
- আমি সবসময় জুতো বা স্যান্ডেল পরে থাকি
- হাটিকাশির সময় নাক ও মুখ রুমাল বা টিস্যু দিয়ে ঢেকে ফেলি
- আমি যেখানে সেখানে থুথু বা কাশি ফেলি না



### শরীরচর্চা এবং জীবনযাত্রা

- আমি রোজ খেলাধুলা করি
- রোজ একই সময়ে ঘুমাতে যাই
- রাতে ৯-১০ ঘণ্টা ঘুমাই

### পরিবেশ

- আমি ঘরবাড়ি ও আশপাশ পরিষ্কার রাখি
- আমি বাগান করি



## 9.2 Integrated nutrition messages for Group-2

### সমন্বিত পুষ্টি বার্তা

স্বাস্থ্যকর খাদ্য, পুষ্টি এবং রোগ প্রতিরোধক ক্ষমতা

- আমি পুষ্টির খাবার খাই
- ১০ ধরনের খাবার থেকে রোজ কমপক্ষে ৫ ধরনের খাবার খাই
- বাসায় রান্না করা খাবার খাই
- সারাদিনে ৭-৮ গ্লাস পানি খাই



- আমি যদি সুস্থ ও সবল থাকি তাহলে আমার -
  - ▶ কাজ করার শক্তি বাড়বে
  - ▶ পড়াশোনা মনোযোগ বাড়বে
  - ▶ আমার অসুখ-বিসুখ হবে না



নিরাপদ খাদ্য ও পরিষ্কার-পরিচ্ছন্নতা

- আমি ফল ও সবজি খাওয়ার আগে ধুয়ে খাই
- আমি জীবাণু ফুড খাই না
- খাওয়ার আগে হাত সাবান দিয়ে ধুই
- ল্যাট্রিন থেকে এসে ভালভাবে সাবান দিয়ে হাত ধুই
- প্রতিদিন সকালে নাশ্ব খাবার পরে ও রাতে ঘুমাতে যাবার আগে দাঁত মাজি
- সবসময় জুতো বা স্যান্ডেল পরে থাকি
- আমি প্রতিদিন গোসল করি
- নিয়মিত নখ কাটি
- আমার পরনের কাপড় প্রতিদিন ধোয়া হয়
- হাটিকাশির সময় নাক ও মুখ রুমাল বা টিস্যু দিয়ে ঢেকে ফেলি
- আমি যেখানে সেখানে থুথু বা কাশি ফেলি না



শরীরচর্চা এবং জীবনযাত্রা

- আমি নিয়মিত খেলাধুলা করি
- প্রতিদিন একই সময় ঘুমাতে যাই
- রাতে কমপক্ষে ৮-৯ ঘণ্টা ঘুমাই

পরিবেশ

- আমি আমার ঘরবাড়ি ও আশপাশ পরিষ্কার পরিচ্ছন্ন রাখি
- বাড়ির আশেপাশের খালি জায়গায় বা টবে সবজি ও ফুলের বাগান করি





### 9.3 Integrated nutrition messages for Group-3

**সমন্বিত পুষ্টি বার্তা**

**স্বাস্থ্যকর খাদ্য, পুষ্টি এবং রোগ প্রতিরোধক ক্ষমতা**

- শরীরকে সুস্থ ও সবল রাখতে, মেধাবৃদ্ধিতে ও রোগ জীবাণুর আক্রমণ থেকে বাঁচতে আমি প্রতিদিন ১০ ধরনের খাবার থেকে ৫ ধরনের খাবার খাই
- রোজ শক্তিদায়ক খাবারের সাথে দুই ধরনের দেহ বৃদ্ধি ও ক্ষয়পূরণকারী এবং দুই ধরনের রোগ প্রতিরোধকারী খাবার খাই
- প্রতিদিন ৮-১১ গ্রাস পানি খাই




#### নিরাপদ খাদ্য ও পরিষ্কার-পরিচ্ছন্নতা

- আমি ফল ও সবজি খাওয়ার আগে ধুয়ে খাই
- আমি জাক্ক ফুড খাই না
- খাওয়ার আগে হাত সাবান দিয়ে ধুই
- ল্যাট্রিন থেকে এসে ভালভাবে সাবান দিয়ে হাত ধুই
- প্রতিদিন সকালে নাছ খাবার পরে ও রাতে ঘুমাতে যাবার আগে দাঁত মার্জি
- সবসময় জুতো বা স্যান্ডেল পরে থাকি
- আমি প্রতিদিন গোসল করি
- নিয়মিত নখ কাটি
- আমার পরনের কাপড় প্রতিদিন ধুই
- হাঁচিকাশির সময় নাক ও মুখ কুমাল বা টিস্যু দিয়ে ঢেকে ফেলি
- যেখানে সেখানে খুঁত বা কালি ফেলি না



#### শরীরচর্চা এবং জীবনযাত্রা

- আমি শারিরিক ও মানসিকভাবে সুস্থ থাকার জন্য পুষ্টি-কর খাবার খাওয়ার পাশাপাশি
  - নিয়মিত খেলাধুলা করি
  - প্রতিদিন একই সময়ে ঘুমাতে যাই
  - রোজ রাতে ৭-৮ ঘণ্টা ঘুমাই

#### পরিবেশ

- আমি আমার ঘরবাড়ি ও আশপাশ পরিষ্কার পরিচ্ছন্ন রাখি
- আমরা বাড়ির আশেপাশে বাগানে ও টবে ফুল ও সবজি গাছ লাগাই



## Chapter 10

### Trials of improved practices



### 10.1 Socio-demographic characteristic of the children

Table 10.1 shows the socio-demographic characteristics of children in the survey. Average age of the students in Group-1, 2 and 3 was 7, 11 and 15 years respectively. In terms of gender, male was the major proportion in Group-1, while female was the major proportion in group-2 and 3. Islam is the main religion across the groups of students. Likewise, knowledge assessment survey, wealth quintile index shows that the poorest children were in group-1, while the richest were in group-3.

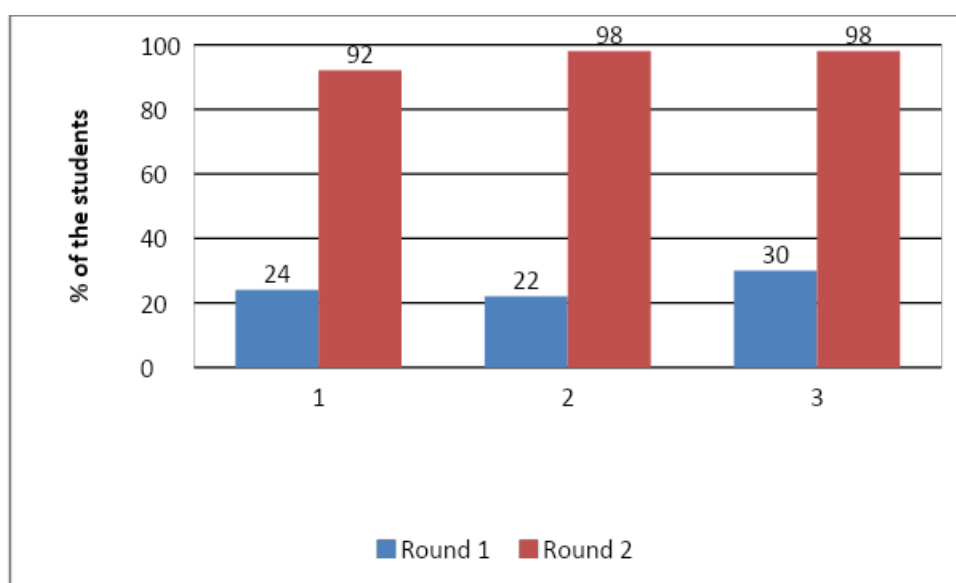
**Table 10.1: Socio-demographic characteristics of children**

Variables	Group 1 n=50	Group 2 n=50	Group 3 n=50
Age in year, Mean (SD)	6.6(1.2)	10.9(1.59)	14.9(1.16)
Gender, %(n)			
Male	54.0(27)	34.0(17)	38.0(19)
Female	46.0(23)	66.0(33)	62.0(31)
Religion, % (n)			
Islam	96.0(48)	90.0(45)	90.0(45)
Hindu	4.0 (2)	10.0(5)	10.0(5)
Wealth quintile, % (n)			
Poorest	30.0 (15)	26.0(13)	2.0(1)
Second	24.0(12)	18.0(9)	16.0(8)
Middle	24.0(12)	2.0(1)	24.0(12)
Fourth	12.0(6)	26.0(13)	24.0(12)
Richest	10.0(5)	28.0(14)	26.0(13)

### 10.2 Change in knowledge on diet among three groups of students

Figure 10.1 shows the Knowledge of the students on classification of foods according to the functions in the body (energy producing, bodybuilding and maintenance and prevention of disease). A look at the table indicates that students of all groups showed an almost improved universal knowledge (>90%) in Round 2 compared to Round 1(P<0.001).

**Figure 10.1: Knowledge of the students on classification of foods according to the functions in the body (energy producing, bodybuilding and maintenance and prevention of disease)**



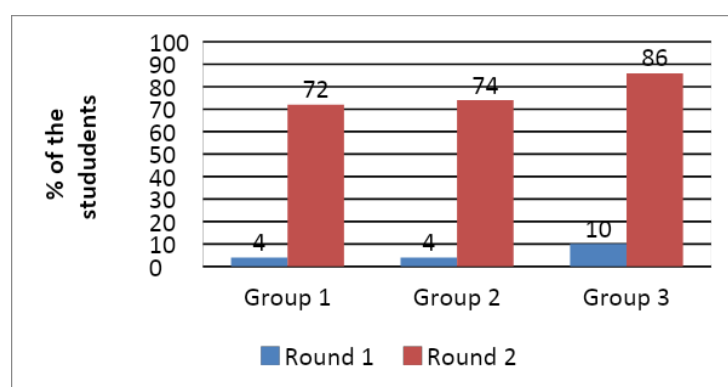
Group 1: Round 1vs Round 2  $p < 0.001$

Group 2: Round 1vs Round 2  $p < 0.001$

Group 3: Round 1vs Round 2  $p < 0.001$

Figure 10.2 shows the proportion of students that could say names of three types of foods, such as, energy producing, body building and maintenance and prevention of disease. Students of all groups showed an improved knowledge in Round 2 compared to Round 1, with Group-3, Round 2 students having the highest knowledge retention (86%) ( $P < 0.001$ ).

**Figure 10.2: Proportion of students could say names of three types of foods, such as, energy producing, body building and maintenance and prevention of disease**



Group 1: Round 1vs Round 2  $P < 0.001$

Group 2: Round 1vs Round 2  $P < 0.001$

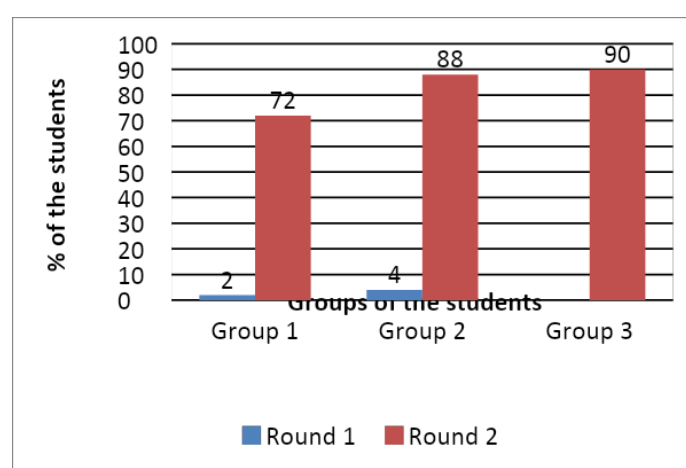
Group 3: Round 1vs Round 2  $P < 0.001$

Moreover, their knowledge on function of different foods improved significantly between Round 1 and Round 2. We found they could mention more about rice, roti, noodles, potato, and sweet potato as energy producing foods during Round-2 (Annexure 8). Furthermore, their knowledge on the food groups that act in the body as growth and repair also increase significantly (Annexure 8). Particularly, more students of all groups knew that meat, poultry, fish, egg and

milk were helpful in body building and repair during Round-2 compared to Round-1. In addition, their knowledge on the foods that can improve immunity in the body and prevent disease also increased significantly. They could mention the food groups of green leafy vegetables, yellow & orange fruits and vegetables, other vegetables and fruits (Annexure 10). They mentioned that they received vital information on food and nutrition from the health workers of BRAC University from Round-1 to Round-2 ( $P < 0.001$ ; Annexure 13).

Figure 10.3 shows the Knowledge on classification of ten food groups (by FAO) for consumption of adequate nutrients by students. Nearly all students showed an improved knowledge in Round 2 across all groups 1, 2 and 3 with Group-3 students having (90%) knowledge ( $P < 0.001$ ).

**Figure 10.3: Knowledge on classification of ten food groups for consuming adequate nutrients**



Group 1: Round 1 vs Round 2  $P < 0.001$

Group 2: Round 1 vs Round 2  $P < 0.001$

Group 3: Round 1 vs Round 2  $P < 0.001$

It is noted in the figure 10.4 that the proportion of students who had knowledge on consuming five food groups out of ten for getting adequate nutrients. Almost all of the students across groups 1, 2 and 3 have improved knowledge in Round 2 than Round 1 ( $> 80\%$ ).

**Figure 10.4: Had knowledge on having five food groups out of ten for getting adequate nutrients**

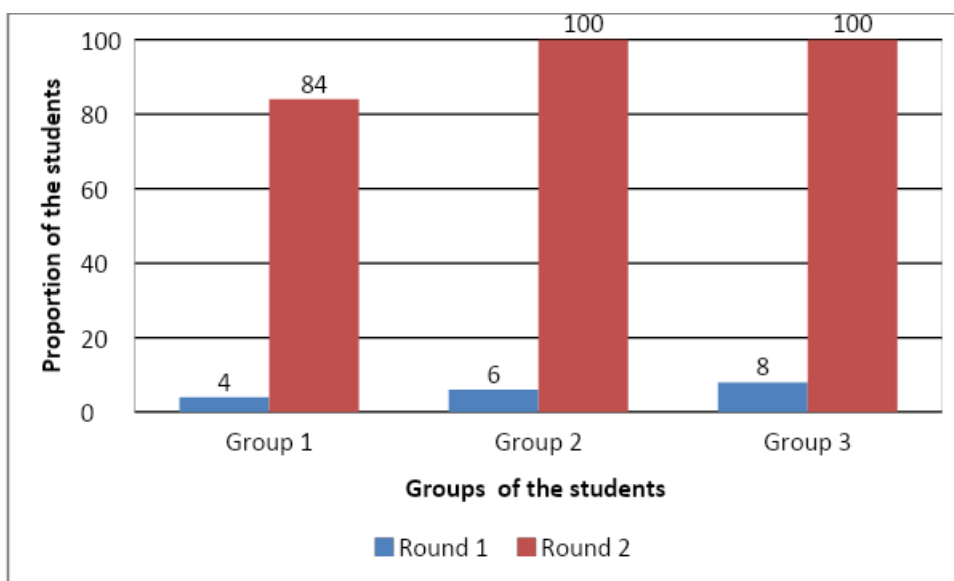
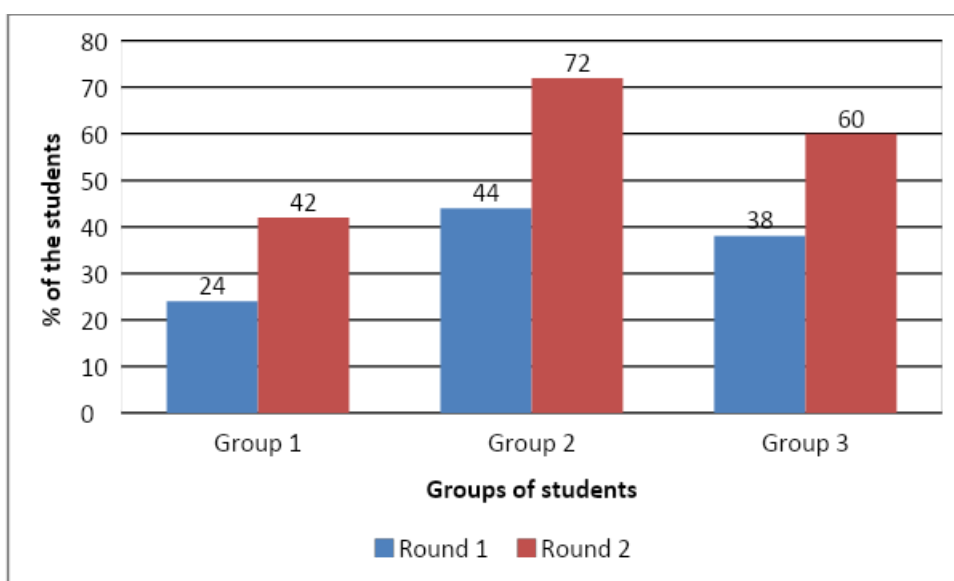


Figure 10.5 shows the possibility of students eating five food groups daily. Here in group 2 Round 2 student nearly had (72%) possibility and all groups 1,2 and 3 showed an improved trend from Round 1 to 2 ( $P < 0.001$ ).

**Figure 10.5: Possible to eat five food groups daily**



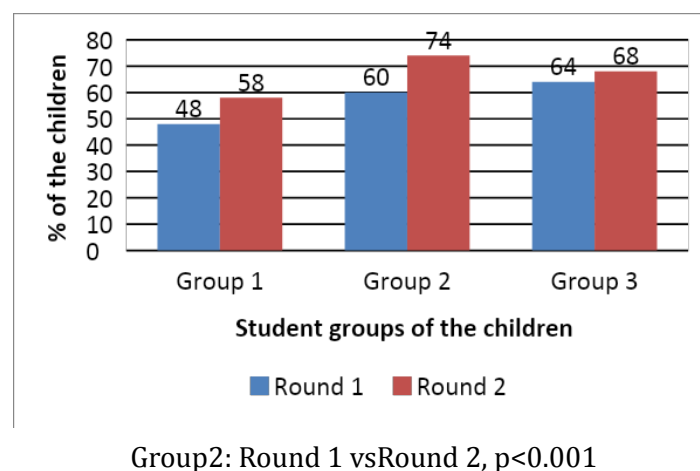
Group 2: Round 1 vs Round 2  $P < 0.00$

### 10.3 Minimum Dietary Diversity achieved by the students

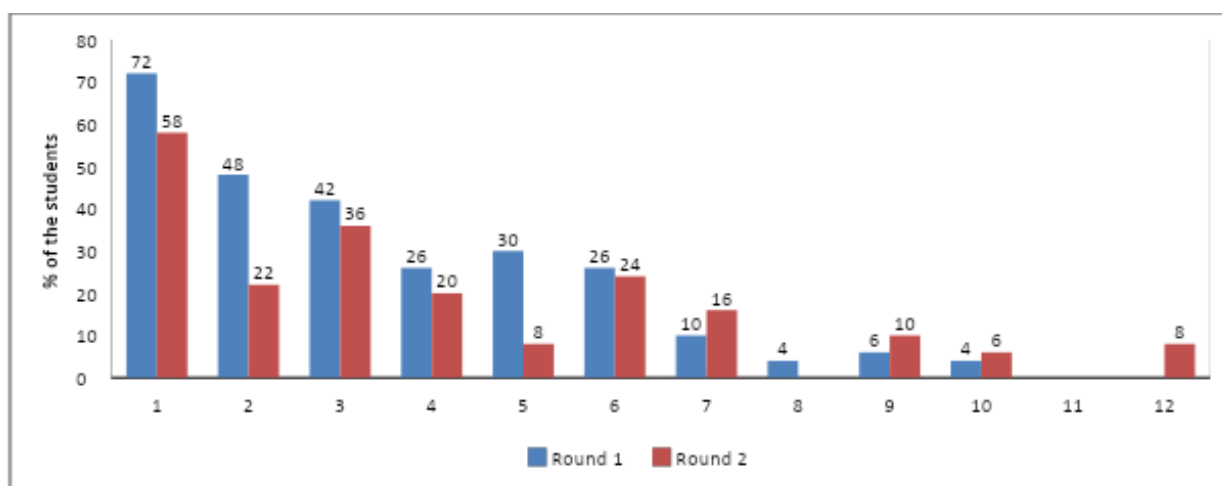
The FAO has recommended having ten food groups to achieve dietary diversity that has been included in the integrated nutrition messages in this study (FAO and FHI 360, 2016). This

classification of foods represents the quality of dietary intake, however, not the quantity of the dietary intake. This is used widely to measure women, adolescent girls, infant and household dietary diversity. According to this classification, it is easy to assume micronutrients intake of the respondents. However, we found a gap between knowledge and achieving minimum dietary diversity among the mothers and the students except intake of green leafy vegetables to some extent, which was also found in another school based intervention conducted in the USA (Fahlman *et al.*, 2008). Intake of most of the food groups, during last 24 hours of interview, was comparable across group-1,2 and 3 from Round-1 to 2 except intake of green leafy vegetable and yellow and orange fruits and vegetables (Annexure 12).

**Figure 10.6: Consumption of five or more food groups (out of ten groups) by the children during last 24 hours of interview**



**Figure 10.7: Reason for inability to consume five food groups of food daily**



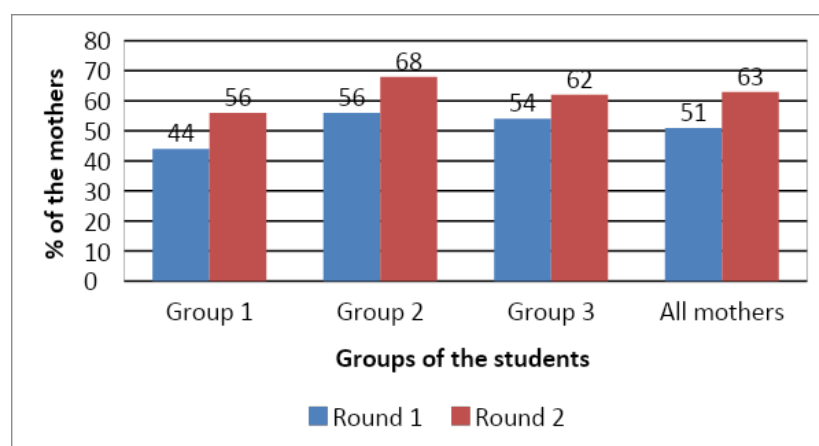
Financial crisis: Group 1: Round 1 vs Round 2,  $p < 0.001$   
 Group 2: Round 1 vs Round 2,  $p < 0.001$   
 Group 3: Round 1 vs Round 2,  $p < 0.001$

Figure 10.7 shows the major reasons for inability to intake five food groups daily. In Round 1 majority of students ( $>40\%$ ) across Groups 1,2 and 3 stated financial crisis as being the primary reason for not able to take five food groups daily. However, this reason was reported less by students during Round-2 ( $p < 0.001$ ). This was followed by not used to eating variety of foods ( $>25\%$ ) in Round-1. Also across all groups a higher proportion of students in Round-1 stated the reasons than those in Round-2.

#### 10.4 Minimum dietary diversity achieved by the mothers

Figure 10.8 depicts minimum dietary diversity achieved by the mothers of the students during last 24 hours of interview over the Round 1 and Round 2. Like in case of students, their mothers were also the highest in Round 2 of Group 2 (68%). All groups of mothers in Groups 1, 2 and 3 showed an improved trend from Round-1 to Round-2. Table 3 shows intake of different food groups by the mothers of different groups of children during last 24 hours of interview. Most of the parameters are comparable across groups 1,2 and 3 and mothers had common knowledge on Dietary diversity from Round-1 to 2.

**Figure 10.8: Intake of five or more food groups (out of ten groups) by the mothers of the students during last 24 hours of interview**



Dietary diversity of the mothers is an important predictor of nutritional status of the children (Hasan *et al.*, 2019). It was assumed that family members were eating from the same pot and mothers had the principal responsibility of selecting, preparing, and serving nutritious foods to their children (Hasan *et al.*, 2019). Likewise, earlier knowledge assessment survey in this trial we found that dietary diversity was better among the students compared to their mothers, which meant that mothers sacrificed for their children to achieve their minimum dietary diversity. Furthermore, this was a short trial and significant change in socio-economic condition was impossible within this period, which had direct influence of dietary diversity of a family (Huluka& Wondimagegnhu, 2019). A long term intervention linking to agriculture or food production might help to achieve minimum dietary diversity of the students (Blakstad *et al.*, 2019; Reinbott *et al.*, 2016; Tamiru *et al.*, 2016; Waswa *et al.*, 2015).

### 10.5 Knowledge on healthy and safe foods

All students across all Groups in both Round-1 and 2 had knowledge that homemade food is good for health (Figure 10.9).

**Figure 10.9: Had knowledge on homemade food is good for health**

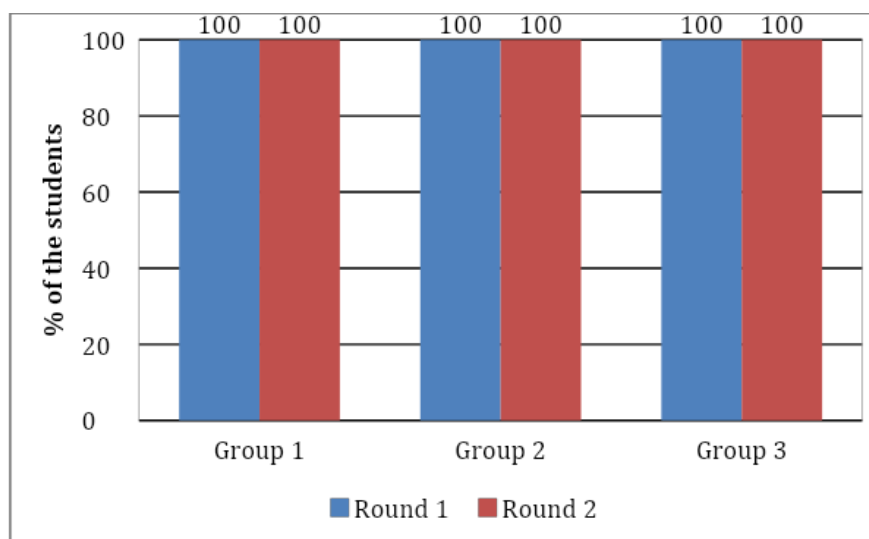
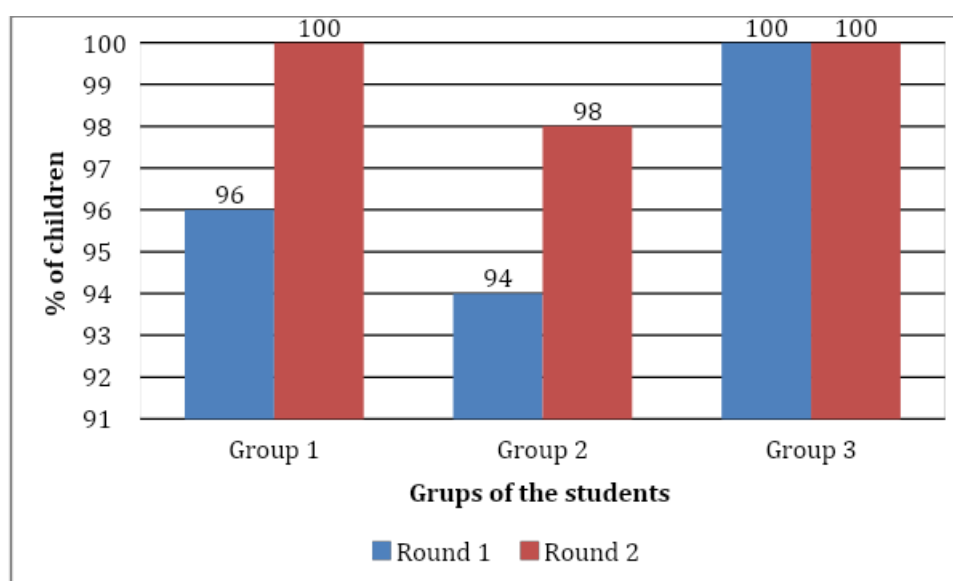


Figure 10.10 shows proportion of students who had knowledge on washing raw fruits and vegetables with safe water before eating. It might be noted that almost all (universal) children across all groups had knowledge that raw fruit and vegetables had to wash with water before eating during Round-1 and Round-2.

**Figure 10.10: Had knowledge on washing raw fruits and vegetables with safe water before eating**

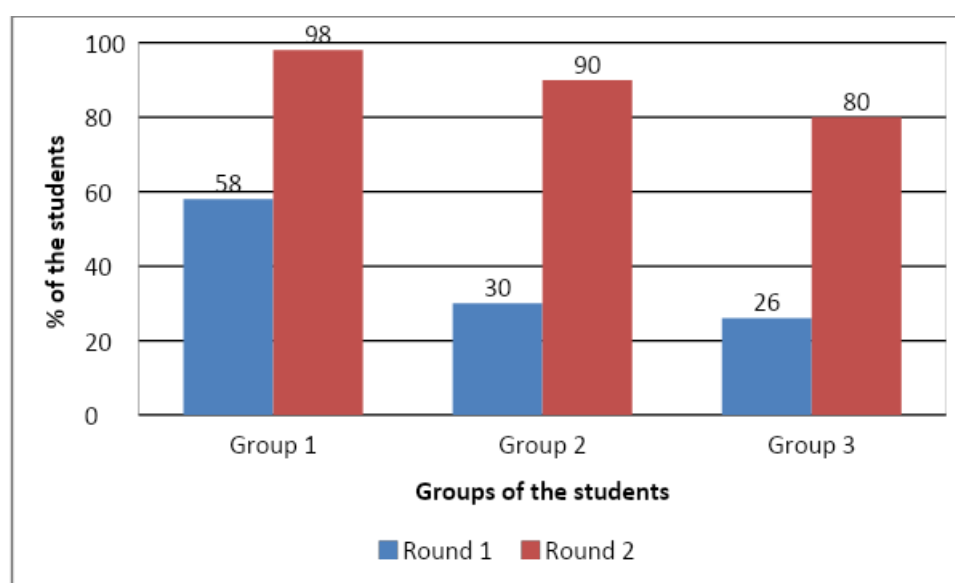




### 10.6 Knowledge on daily drinking of water

Figure 10.11 shows the percentage of students of different groups who had knowledge on daily drinking of adequate glasses of water. Findings show that there was significant improvement of knowledge among the students on daily drinking of adequate glasses of water across Group-1, Group2 and Group 3 between Round-1 and Round-2 ( $P<0.001$ ).

**Figure 10.11: Had knowledge on daily drinking of adequate glass of water\***



\*Group 1: At least 5 glasses of water/day; Group 2: 7-8 glasses of water/day; Group 3: 8-11 glasses of water/day

Group 1: Round 1vs Round 2, $p<0.001$

Group 2: Round 1vs Round 2, $p<0.001$

Group 3: Round 1vs Round 2, $p<0.001$

### 10.7 Knowledge and practice of hand washing soap among the students

Figure10.12 shows students who had knowledge on critical points of hand washing. Both in Round1 and Round2 above 90% of students of three groups had knowledge on hand washing with soap both before eating and after coming from latrine. Others point of time they mentioned that they washed their hands after playing , before cutting vegetable , before cooking, after coming from outside, after eating, after completion of work, after touching dirt, after working, after cleaning dirt (Figure 10.12).

**Figure 10.12: Had knowledge on critical points of time of hand washing**

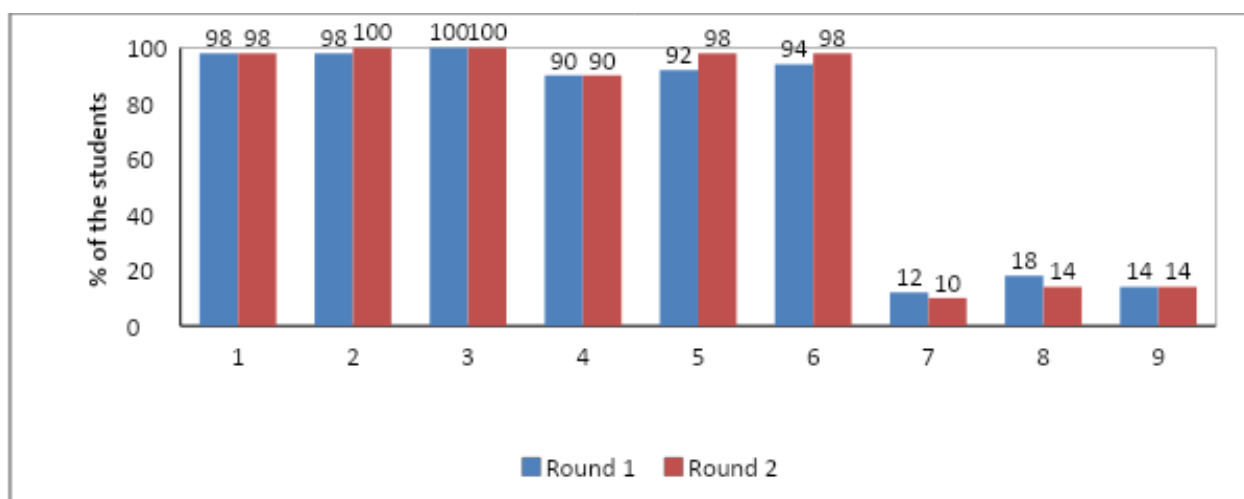
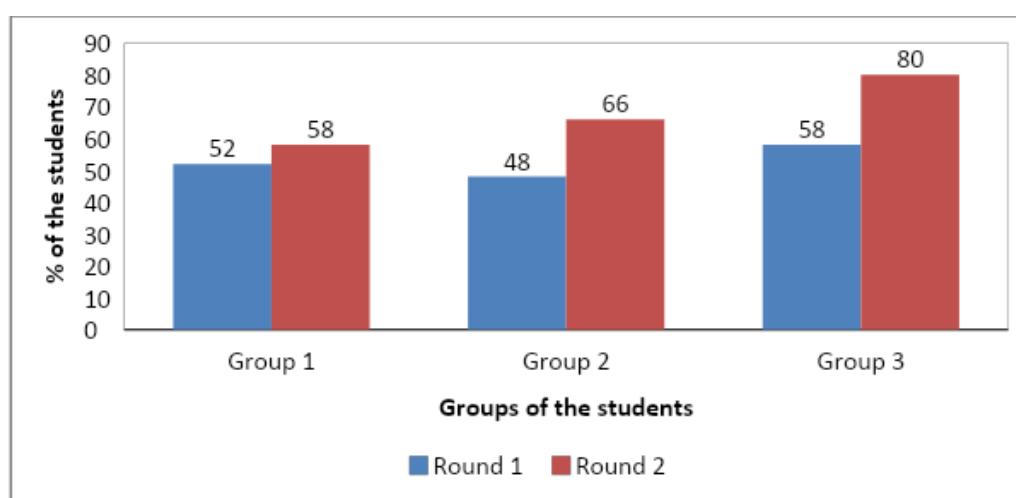


Figure10.13 shows the practice of hand washing with soap before having meals among students where the students showed an improved trend across the Group-1, Group-2 and Group-3 from Round-1 to Round-2. However, hand washing practice with soap increased significantly among the students of Group-3 between Round-1 and Round-2 ( $p=0.017$ ).

**Figure 10.13: Practice of hand washing with soap before eating among the students**



Group 3: Round 1vs Round 2;  $p=0.017$

Figure10.14 depicts reasons for not practicing hand washing with soap before eating. Main reason for not washing their hands with soap having meal was they were not habituated to wash their hands before having meal, followed by they forgot to wash their hands and unavailability of soap. However, during Round-2 most of them reported that they were not washing hands with

soap before eating as they forgot to do that. Though proportion of this response reduced from Round-1 to Round-2 (Figure 10.14).

**Figure 10.14: Reason for not practicing hand washing before eating**

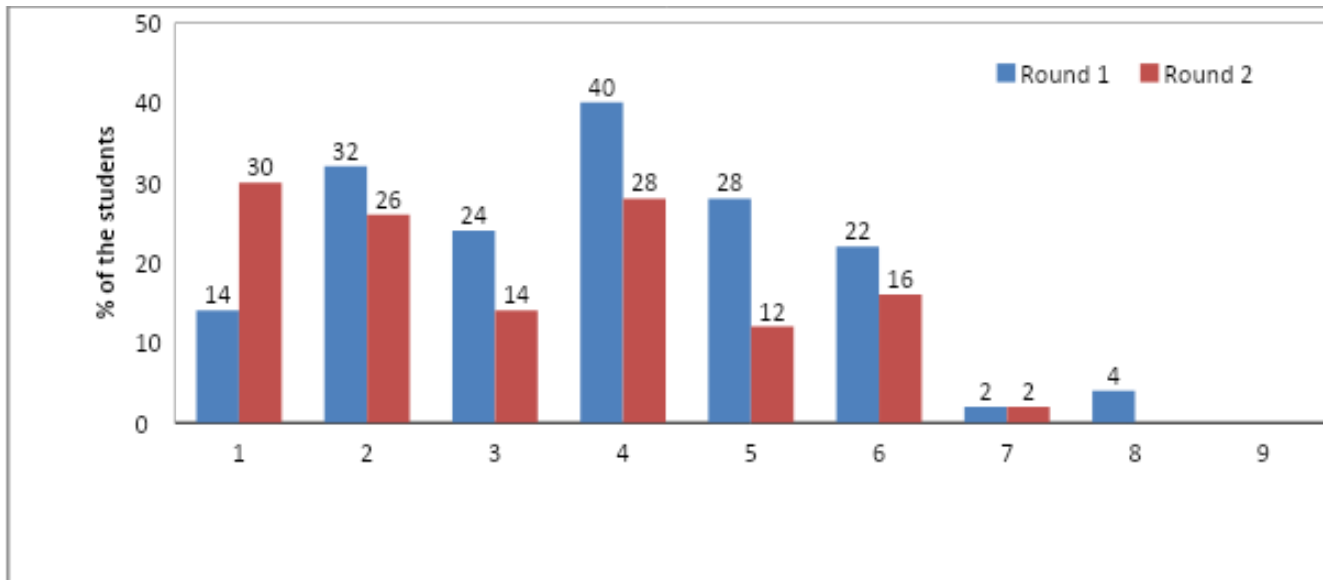


Figure10.15 shows the practice of hand washing with soap after defecation among students. This was a common practice in both Round-1 and Round-2 among the students of Group 1, Group-2 and Group-3.

**Figure 10.15: Practice of hand washing with soap after defecation**

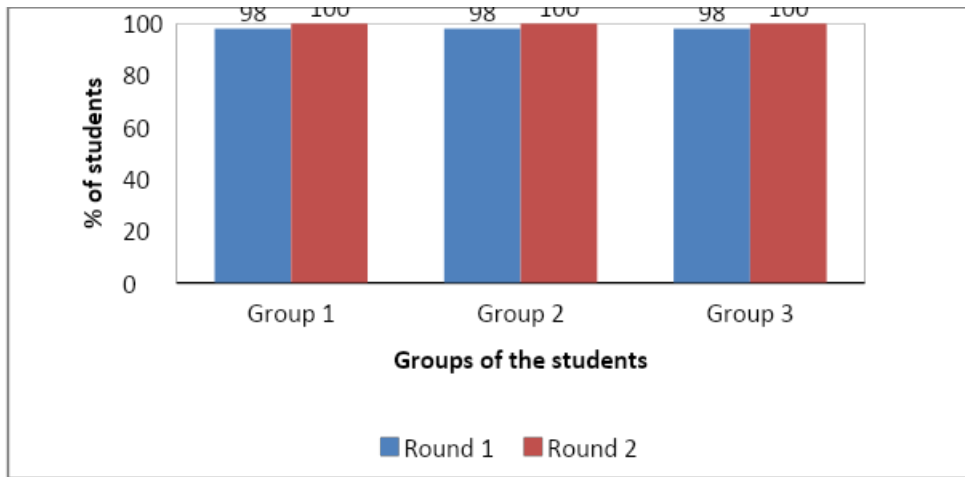
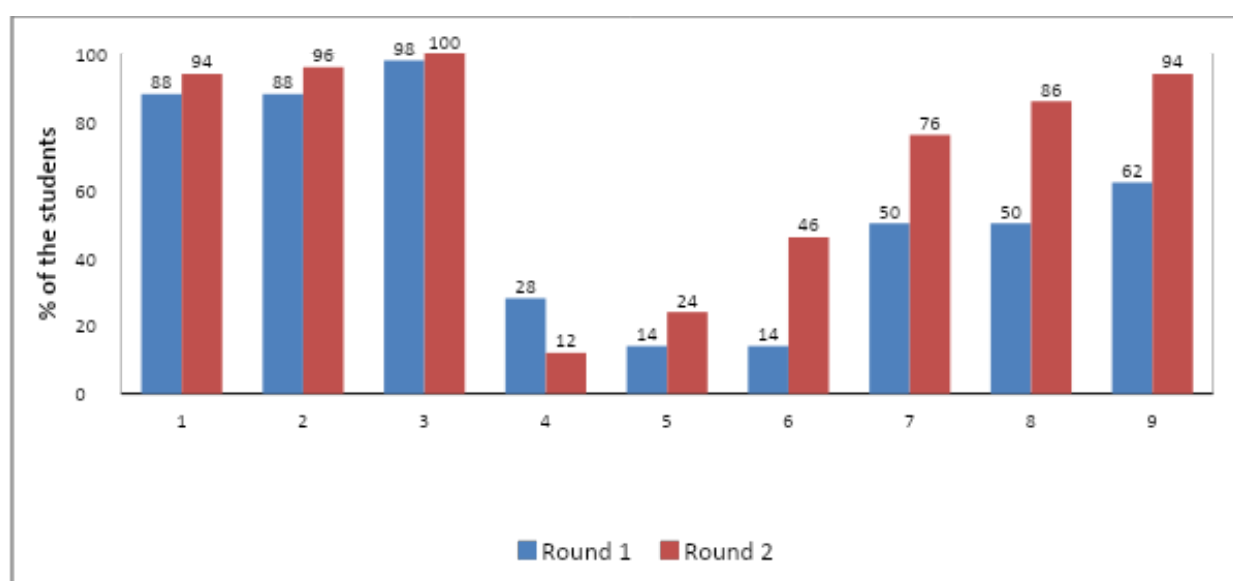


Figure10.16 shows the knowledge on benefits of hand washing with soap among students. They reported frequently that due to hand washing hands might be germ free during Round-1 and Round-2. We observed that beneficial effect of hand washing for preventing diarrhoea was significantly higher in Group-3 during Round-2 compared to Round-1 ( $p<0.001$ ). However, their knowledge improved significantly that hand washing might prevent contagious disease from Round-1 to Round-2 ( $p<0.001$ ).

**Figure 10.16: Knowledge on benefits of hand washing with soap**



Prevent Diarrhoea, Group 2: Round 1vs Round 2,  $p < 0.001$

Prevent contagious disease, Group 1: Round 1vs Round 2,  $p < 0.001$

Group 2: Round 1vs Round 2,  $p < 0.001$

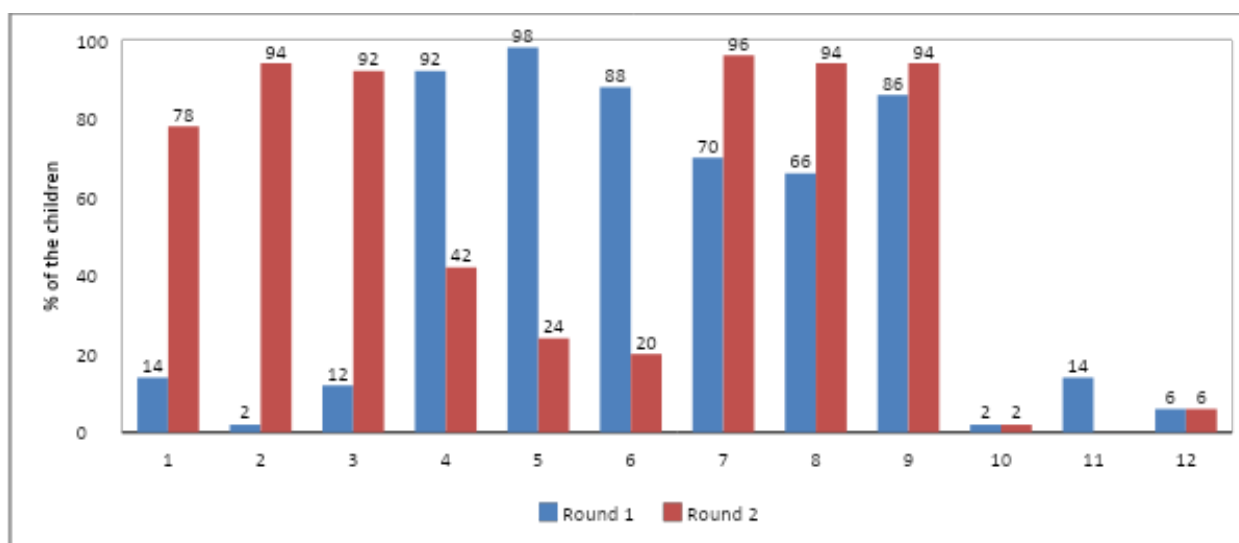
Group 3: Round 1vs Round 2,  $p < 0.001$

Almost all students washed their hands with soap after defecation however, knowledge and practice gap revealed in hand washing with soap before having meals. Earlier study conducted in Africa also observed most of the school-going students washed their hand with only water and few washed both hands with soap (Vivash *et al.*, 2010). Lack of resources like safe water and soap and inadequate sanitation facility hindered hand washing in African countries (Oswald *et al.*, 2008; O'Loughlin 2006; WHO, 2009). However, lack of resources was not a problem in the study population of this study. Their problem was they were not habituated washing hands with soap before eating meals. Intervention including sensitization of the beneficiaries could promote the students hand washing before having meals in the current study (Vivash *et al.*, 2010). End of the intervention their knowledge on the benefits of hand washing for preventing the diseases, diarrhoea and germ free hands increased significantly, which might have promoted them to wash hands with soap before having meal and after defecation.

### 10.8 Knowledge and practice of brushing teeth

Figure 10.17 shows the proportion of students who had knowledge on the appropriate time of brushing teeth. The proportion of students across Group-1, Group-2 and Group-3 showed an improved knowledge among those after taking breakfast from Round-1 to Round-2 ( $P < 0.001$ ), but in case of after waking up children showed a decrease in knowledge from Round-1 to Round-2 across all student groups.

**Figure 10.17: Had knowledge on appropriate time of brushing teeth**



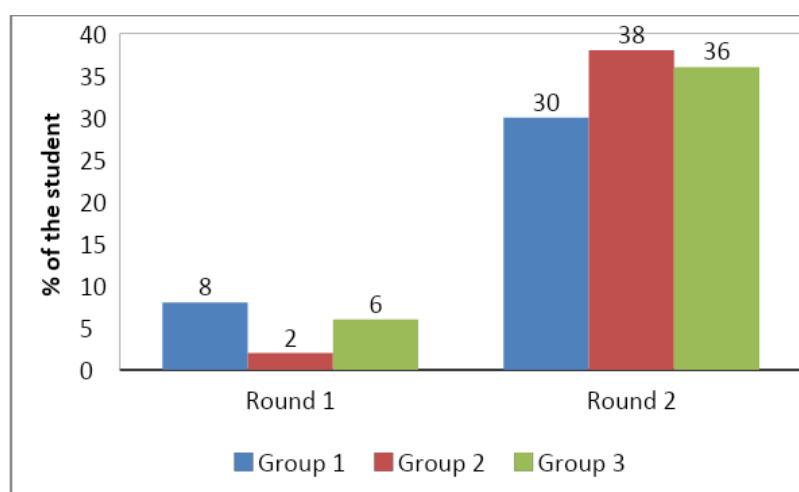
Group 1: Round1 vs Round 2,  $p < 0.001$

Group 2: Round 1 vs Round 2,  $p < 0.001$

Group 3: Round 1 vs Round 2,  $p < 0.001$

Figure 10.18 shows the practice of brushing teeth after taking breakfast by the students. Findings show that across all groups of students' practice of brushing teeth after breakfast increased significantly from Round-1 to Round-2 ( $p < 0.001$ ).

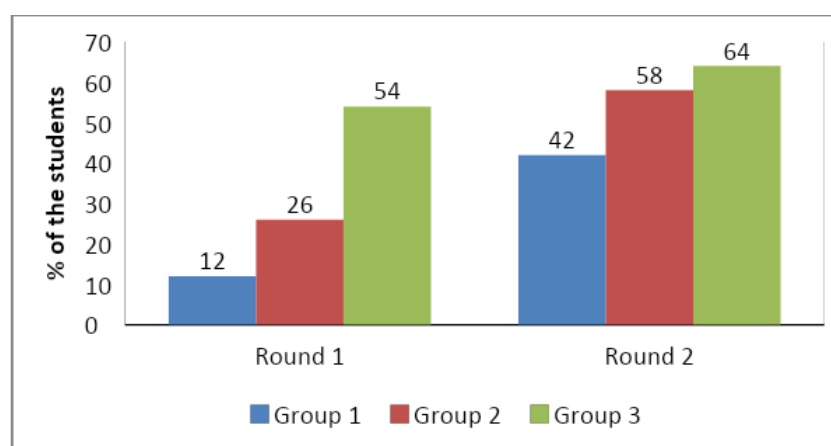
**Figure 10.18: Practice of brushing teeth after taking breakfast by the students**



Group 1: Round 1vs Round 2,  $p<0.001$   
 Group 2: Round 1vs Round 2,  $p<0.001$   
 Group 3: Round 1vs Round 2,  $p<0.001$

Students explained causes of not brushing teeth after having breakfast. Students of only Group-2 who indicated not brushing teeth after breakfast in Round 1 were found to have a decreasing trend in Round-2 ( $p<0.001$ ; Annexure 21). All the other reasons seemed similar while having responses. Figure10.19 shows the practice of brushing teeth before going to sleep. We observed that there was a marked improvement in Group-1 and Group-2 from Round-1 to Round-2 ( $p<0.001$ ). In addition, proportion of students dropped significantly between Round-1 and Round-2 who reported that they were not used to brush teeth before sleeping ( $p<0.001$ ; Annexure 22).

**Figure 10.19: Practice of brushing teeth before going to sleep**



Group 1: Round1 vs Round 2.  $p<0.001$   
 Group 2: Round 1 vs Round 2,  $p<0.001$

Their knowledge on the benefits of brushing teeth also increased significantly (Annexure 16). We found that higher proportion of the students in group 1 and group 3 reported that brushing teeth would reduce bad smell of mouth increased from Round 1 to Round 2 ( $p<0.001$ ). In addition, students of group 2 and group 3 who responded “food particles would be cleaned” also showed a marked improvement from Round 1 to Round 2 ( $p<0.001$ ).

### 10. 9 Wearing Sandal or Shoes

Figure10.20 shows the practice of wearing sandal or shoe by the students. Students across all groups who had always worn sandal or shoe showed an increased practice from Round-1 to 2. The pictorial messages along with written messages and intervention with the beneficial effect of the wearing shoe for prevention of the soil-transmitted helminthes improve the practice (Paige *et al.*, 2017). Besides, intervention that affixed directly to shoe could improve the practice effectively (Paige *et al.*, 2017). However, low perception of health benefits, financial constraints,

and limited availability of shoes could hinder the shoe wearing practice of the students (Ayode *et al.*, 2013). The financial condition of the Bangladeshi population improved enough that they could afford purchasing footwear while their problem was that they did not want to wear sandal always specially the youngest group of the students. Thus including this information in the national curriculum and textbook would be a cost-effective approach for Bangladesh to reach mass population rapidly.

**Figure 10.20: Practice of wearing sandal or shoe by the students**

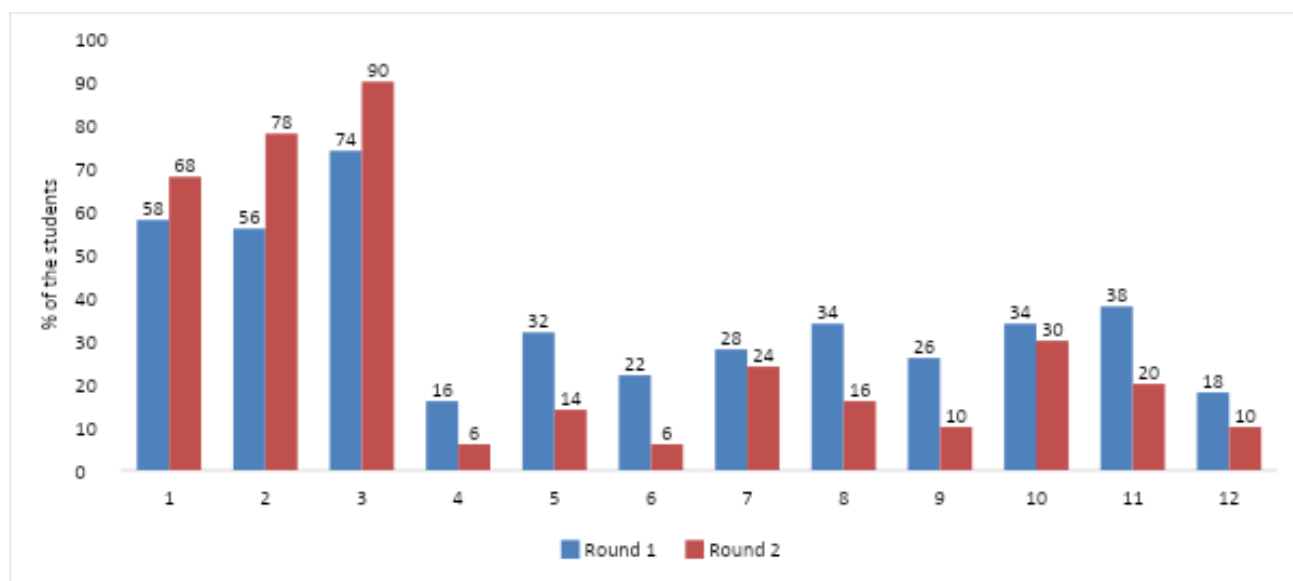
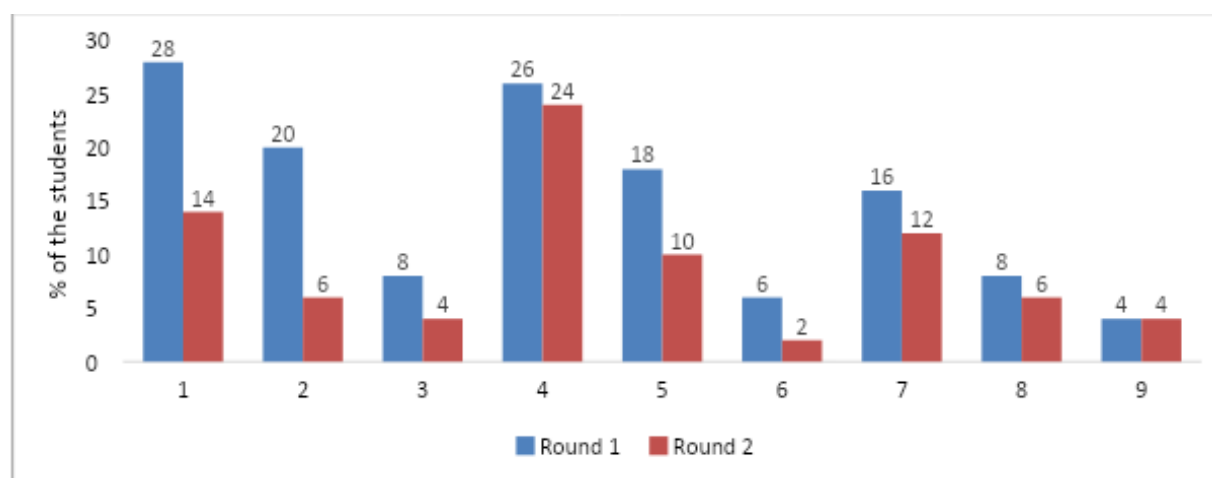


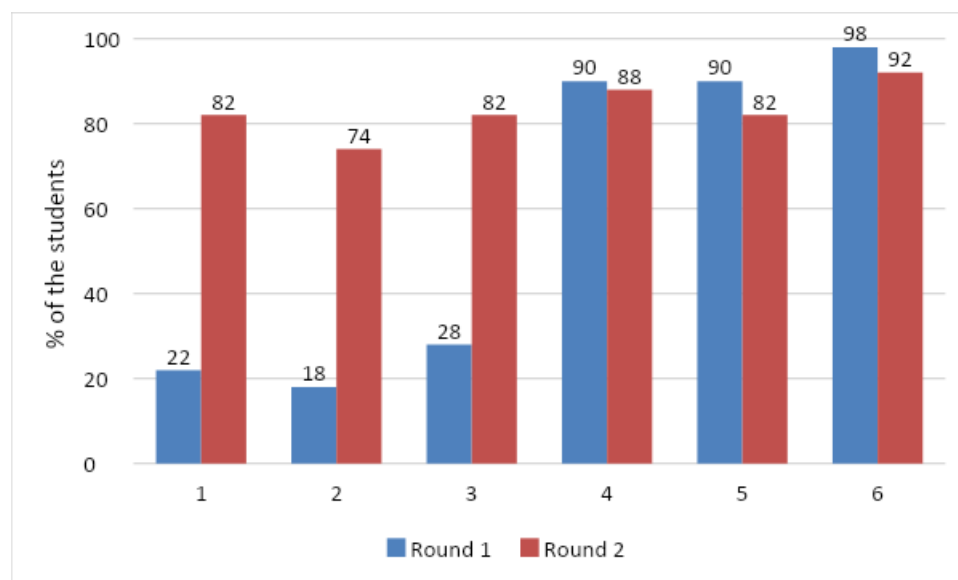
Figure 10.21 shows the reasons for not always wearing sandal and shoes by the students of all groups. We found that their causes of not wearing sandals and shoes reduced drastically between Round-1 and Round-2 as they had started to wear sandal or shoes regularly (Figure 10.21).

**Figure 10.21: Reasons for not always wearing sandal and shoe**



Furthermore, their knowledge on beneficial effects of wearing sandals and shoes also increased significantly (Figure 10.22). Findings revealed that students across Groups 1, 2 and 3 felt that wearing shoe and sandals prevented worm infestation and there was an improved knowledge from Round-1 to 2 ( $p<0.001$ ).

**Figure 10.22: Knowledge on the benefit of always wearing shoe and sandal the students**



Prevent worm infestation: Group 1: Round 1vs Round 2,  $p<0.001$ ; Group 2: Round 1vs Round 2,  $p<0.001$ ; Group 3: Round 1vs Round 2,  $p<0.001$

### 10.10 Practice and benefits of regular bathing

Table 10.2 shows the practice on regular bathing among students. Students of Group-3 showed an improved response in regards to sleeping well from Round 1(14%) to 2(42%) as being the benefits of bathing daily and the difference was significant ( $p<0.001$ ).

**Table 10.2: Practice and knowledge on regular bathing**

Food groups	Student group	Round 1, % (n)	Round 2, %(n)	p-value *
Interval of bathing, daily	Group 1 (n=50)	100.0(50)	100.0(50)	-
	Group 2 (n=50)	98.0(49)	98.0(49)	1.000
	Group 3(n=50)	100.0(50)	100.0(50)	-
<b>Reason for not bathing daily</b>				
For cold weather	Group 1 (n=50)	-	-	-
	Group 2 (n=50)	2.0(1)	2.0(1)	1.000
	Group 3(n=50)	-	-	-
For preventing cough and cold	Group 1 (n=50)	-	-	-
	Group 2 (n=50)	2.0(1)	0.0(0)	0.315
	Group 3(n=50)	-	-	-
<b>Materials used for bathing</b>				
Safe water	Group 1 (n=50)	100.0(50)	100.0(50)	-
	Group 2 (n=50)	100.0(50)	98.0(49)	0.315
	Group 3(n=50)	100.0(50)	100.0 (50)	-
Soap	Group 1 (n=50)	100.0(50)	100.0(50)	-
	Group 2 (n=50)	98.0(49)	100.0(50)	0.315



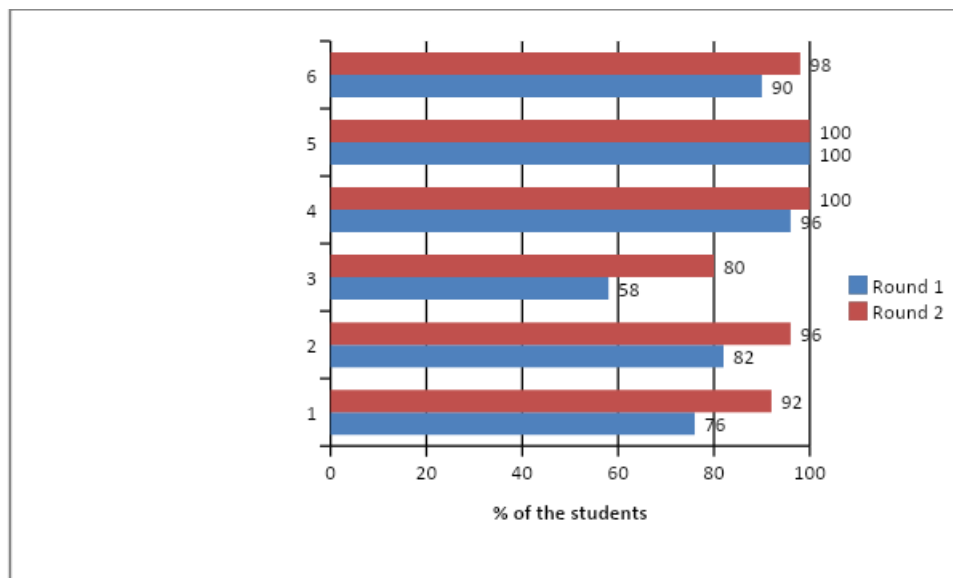
	Group 3(n=50)	100.0(50)	100.0(50)	-
Shampoo	Group 1 (n=50)	6.0(3)	12.0(6)	0.295
	Group 2 (n=50)	12.0(6)	12.0(6)	1.000
	Group 3(n=50)	26.0(13)	26.0(13)	1.000
<b>Benefits of bathing daily</b>				
Remove dirt of the body	Group 1 (n=50)	58.0(29)	60.0(30)	0.839
	Group 2 (n=50)	68.0(34)	76.0(38)	0.373
	Group 3(n=50)	80.0(40)	86.0(43)	0.424
Keep safe from disease	Group 1 (n=50)	52.0 (26)	76.0(38)	0.012
	Group 2 (n=50)	68.0(34)	72.0(36)	0.663
	Group 3(n=50)	70.0(35)	86.0(43)	0.053
Sleep well	Group 1 (n=50)	14.0(7)	22.0(11)	0.298
	Group 2 (n=50)	14.0(7)	16.0(8)	0.779
	Group 3(n=50)	14.0(7)	42.0(21)	0.002

\*chi-square test

### 10.11 Covering face during coughing and sneezing

We found that most of the students knew that face should be covered by the tissue or handkerchief during coughing and sneezing (Figure 10.23). Some of them had knowledge gap, however, end of the Round 2 this gap reduced and all the student could say what they needed to do during coughing and sneezing. Their knowledge on covering face with elbow also increased significantly from Round-1 to Round-2 (Figure10.23).

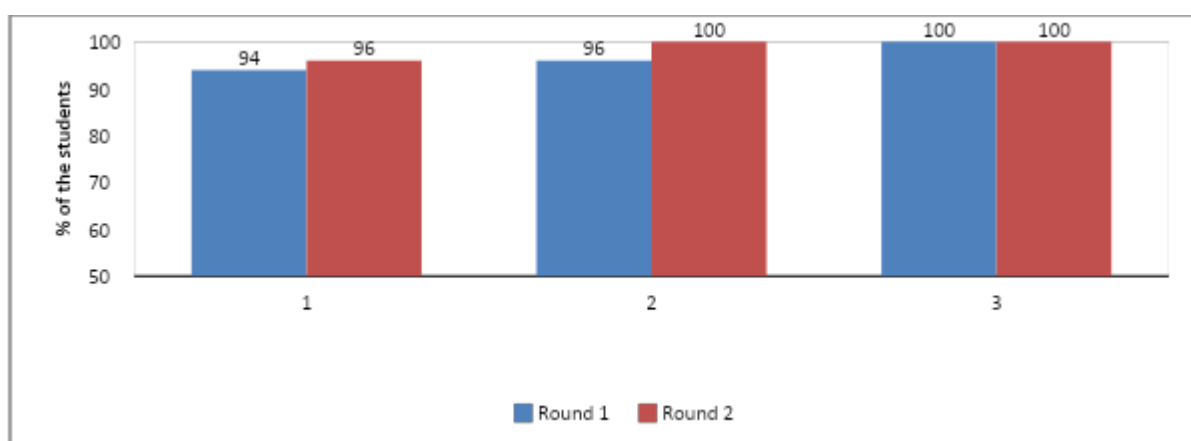
**Figure 10.23: Knowledge on the measures during coughing and sneezing among the students**



### 10.12 Practice of cutting nails by the students

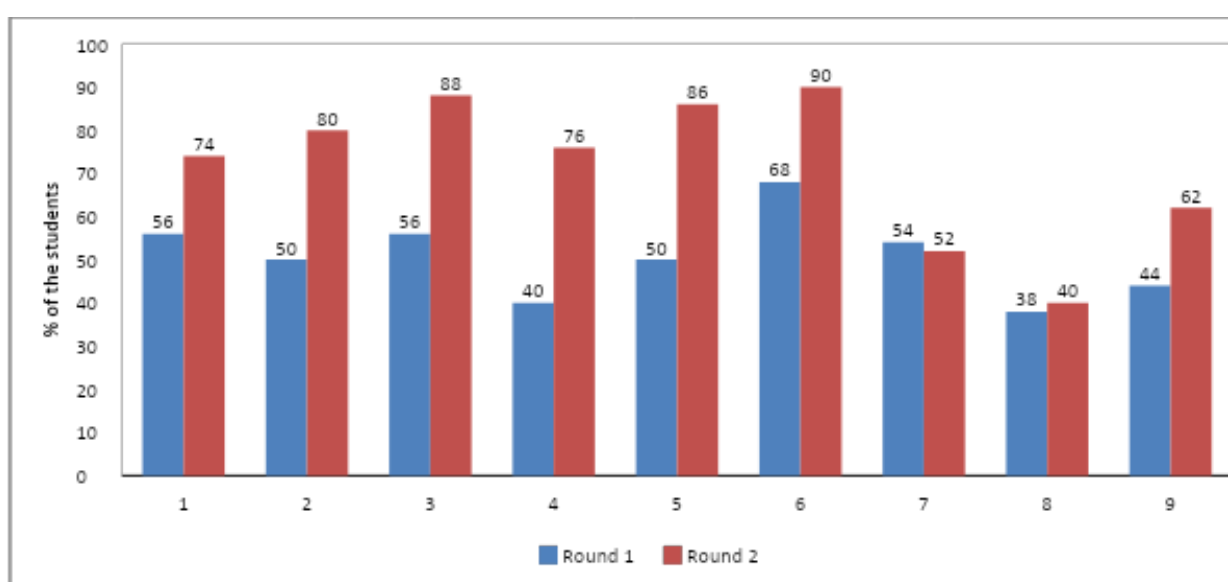
We found that almost all the students had habit to cut their nails within seven days of interval during Round-1 and Round-2 (Figure 10.24).

**Figure 10.24: Interval of nail cutting of the students of different groups**



We observed improvement of knowledge on the benefits of cutting nails regularly ( $p < 0.001$ ). Proportion of students who responded that no germ remained inside the nails and no germ would enter the intestine increased significantly from Round-1 to-2 ( $p < 0.001$ ; Figure 10.25).

**Figure 10.25: Knowledge on benefit of nail cutting among the students**



No germ remains inside the nail: Group 1, 2 and 3: Round 1vs Round 2  $P < 0.001$   
 No germ will enter the intestine: Group 1, 2 and 3: Round 1vs Round 2  $P < 0.001$

### 10.13 Physical exercise and sports

Table 10.3 shows the practice of regular physical exercise and sports, reason for not playing regularly and knowledge on benefits of regular sports among students. Their practice of regular sports did not improve over the period. However, students in Group-2 and Group-3 showed an improved knowledge on the benefits of playing as sports tended to keep mind joyful from Round-1 to Round-2 ( $p < 0.001$ ). Also students in Group-1 and 2 showed an improved knowledge on improved concentration on education from Round-1 to 2 ( $p < 0.001$ ).

**Table 10.3: Knowledge and practice of regular exercise and sports**

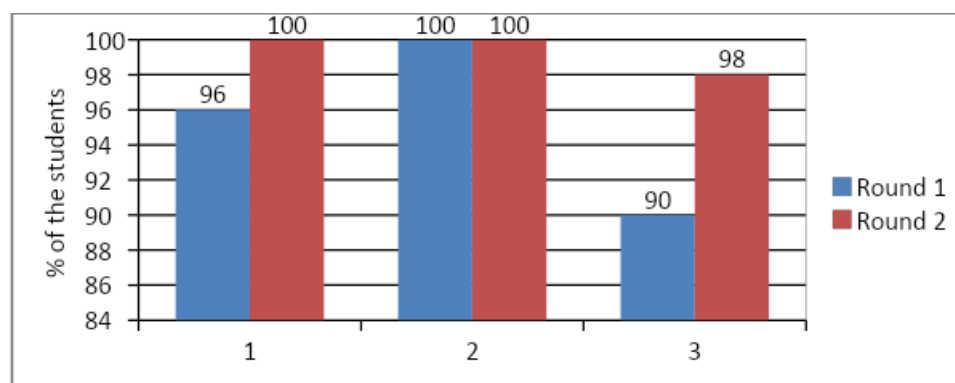
Variable	Student group	Round 1, % (n)	Round 2, % (n)	p-value*
Playing regularly	Group 1 (n=50)	100.0 (50)	100.0(5)	-
	Group 2 (n=50)	90.0(45)	96.0(46)	0.240
	Group 3(n=50)	84.0(42)	80.0(40)	0.603
<b>Reason for not playing</b>				
Forbidden by family	Group 1 (n=50)	-	-	-
	Group 2 (n=50)	4.0(2)	0.0(0)	0.153
	Group 3(n=50)	4.0(2)	12.0(6)	0.140
Do not have fried to play	Group 1 (n=50)	-	-	-
	Group 2 (n=50)	2.0(0)	2.0(1)	1.000
	Group 3(n=50)	2.0(0)	2.0(1)	1.000
Do not have place	Group 1 (n=50)	-	-	-
	Group 2 (n=50)	-	-	-
	Group 3(n=50)	2.0(1)	0.0(0)	0.090
Do not have time to play	Group 1 (n=50)	-	-	-
	Group 2 (n=50)	2.0(1)	0.0(0)	0.315
	Group 3(n=50)	10.0(5)	18.0(9)	0.249
<b>Benefits of physical exercise and sports</b>				
Physical growth and mental development	Group 1 (n=50)	32.0(16)	32.0(16)	1.000
	Group 2 (n=50)	16.0(8)	20.0(10)	0.603
	Group 3(n=50)	44.0(22)	58.0(29)	0.161
Sports keep mind joyful	Group 1 (n=50)	46.0(23)	64.0(32)	0.070
	Group 2 (n=50)	38.0(19)	60.0(30)	0.028
	Group 3(n=50)	42.0(21)	84.0(42)	0.000
Improve concentration in education	Group 1 (n=50)	2.0(1)	16.0(8)	0.014
	Group 2 (n=50)	8.0(4)	44.0(22)	0.000
	Group 3(n=50)	4.0(2)	44.0(22)	0.000
Reduce illness	Group 1 (n=50)	40.0(20)	52.0(26)	0.229
	Group 2 (n=50)	24.0(12)	40.0(20)	0.086
	Group 3(n=50)	34.0(17)	52.0(26)	0.069

\*Chi-square test

#### 10.14 Sleeping

Figure 10.26 shows the appropriate sleeping practice among the students and all students from Round-1 to Round-2 responded that they slept between 7 and 10 hours as recommended.

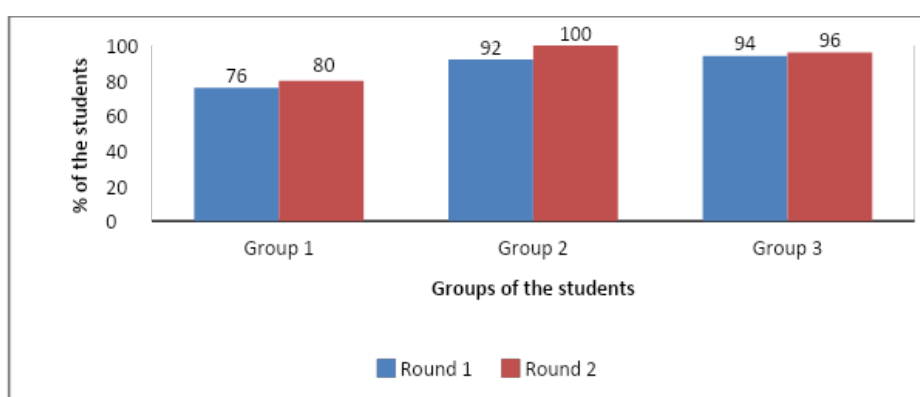
**Figure 11.1 Appropriate sleeping practice among the students**



### **10.15 Tree plantation**

Figure10.27 shows the proportion of students who had ever planted a tree. Results revealed that most of the students in all groups had planted tree during their lifetime. Even though counseling practice on tree plantation did not improve from Round-1 to Round-2.

**Figure 11.2 : Proportion of students who have ever planted tree**



Students' knowledge on the benefits of tree plantation with respect to getting fresh fruits and vegetables, produce oxygen, reduce global warming and financial benefits improved significantly from Round-1 to Round-2 ( $p < 0.001$ ; Table 10.4). According to the Intergovernmental Panel on Climate Change (IPCC), Bangladesh ranked the highest on the risk index of climate victims during 2008 (IPCC, 2008). Evidences showed that interventions on the climate change and child health had limited scope for adaptations (Akachi *et al.*, 2009; McKie, 2018; Xu *et al.*, 2012). In Bangladesh, a study reported that school manual on climate change and child health for the students of grade six to ten was effective to improve their knowledge (Kabir *et al.*, 2015). Similarly, findings of our study found an improvement of knowledge of the students on benefits of tree plantation, but, practice in terms of tree plantation was not changed within this short period. Still this study assumed that school based intervention for tree plantation would be improved to conserve the environment and to adapt to climate change in Bangladesh.

**Table 10.4: Knowledge on benefit of tree plantation among the students**

Benefits	Student group	Round 1, % (n)	Round 2, % (n)	p-value*
Source of fresh fruits	Group 1 (n=50)	74.0(37)	88.0(44)	0.074
	Group 2 (n=50)	76.0(38)	82.0(41)	0.461
	Group 3(n=50)	70.0(35)	96.0(48)	0.001
Source of fresh vegetable	Group 1 (n=50)	48.0(24)	78.0(39)	0.002
	Group 2 (n=50)	34.0(17)	70.0(35)	0.000
	Group 3(n=50)	54.0(27)	86.0(43)	0.000
Increase beauty of household	Group 1 (n=50)	38.0 (19)	28.0(14)	0.288
	Group 2 (n=50)	40.0(20)	54.0(27)	0.161
	Group 3(n=50)	50.0(25)	62.0(32)	0.227
Can get formalin free vegetables	Group 1 (n=50)	18.0(9)	30.0(15)	0.160
	Group 2 (n=50)	6.0(3)	20.0(10)	0.037
	Group 3(n=50)	22.0(11)	32.0(16)	0.260
Produce oxygen	Group 1 (n=50)	54.0(27)	76.0(38)	0.021

	Group 2 (n=50)	72.0(36)	84.0(42)	0.148
	Group 3(n=50)	86.0(43)	94.0(47)	0.182
Save the environment	Group 1 (n=50)	12.0(6)	16.0(8)	0.401
	Group 2 (n=50)	18.0(9)	14.0(7)	0.585
	Group 3(n=50)	32.0(16)	26.0(13)	0.504
Reduce global warming	Group 1 (n=50)	0.0(0)	12.0(6)	0.012
	Group 2 (n=50)	4.0(2)	12.0(6)	0.140
	Group 3(n=50)	12.0(6)	30.0(15)	0.027
Financial benefit	Group 1 (n=50)	20.0(10)	32.0(16)	0.171
	Group 2 (n=50)	26.0(13)	42.0(21)	0.091
	Group 3(n=50)	26.0(13)	62.0(31)	0.000

\*Chi-square test

## **Chapter 11**

### **Conclusion and Policy Recommendation**

This study has made an effort for generating evidences on integrated nutrition message development for schools by employing both quantitative and qualitative methods. As a result of this exercise, simple, practical, and culturally appropriate integrated nutrition-messages for school children across different grades have been developed. The qualitative approach in this context encompassed a review of school textbooks and curriculum and nutrition related policies, interviews of key stakeholders and comprehension and aesthetic tests of messages. On the other hand, the quantitative methods conducted in two sub-districts of two adjacent districts – Rangpur and Dinajpur included knowledge assessment of students and mothers and the use of TIPs among students.

The evidence based process included review of six thematic areas from the existing textbooks and curriculum of school children, review of nutrition related policies and expert opinions on how these integrated messages would be presented were analyzed. It appeared that the NCTB's books and curriculum had already incorporated enough messages on food, nutrition, hygiene, sanitation, environment and physical exercise. However, the information on immunity, healthy lifestyle and climate change were found insufficient and scattered in different books. The key informants' opinions very clearly revealed how these integrated nutrition messages would be presented in the textbooks and communicated to children and parents in an understandable manner for their effective use in the real-life. While analyzing knowledge of students and mothers, it divulged the need and practicality of integrated nutrition messages for the school-going children.

The development of integrated nutrition messages as derived from the content analysis, key informant interviews and knowledge assessment of students and mothers was quite rigorous and comprehensive. Based on the findings of the studies, preliminary pictorial and narrative messages were developed for three cohorts of school children attending different grades from preprimary to class 10. A Technical Advisory Committee (TAC) of this particular research guided research team for further refinement. Important messages such as, globally recommended 10 food groups (FAO& FHI 360, 2016); classification of foods according to functions; having at least five out of 10 food groups daily; having safe and hygienic foods; drinking adequate water; brushing teeth, wearing sandals, washing hands after defecation; keeping house clean; planting trees, were counseled to improve knowledge and practices of students and their mothers. After conducting a counseling session on the newly framed integrated nutrition messages, findings

revealed that the developed messages were reported to improve knowledge of students. Although this trial could not achieve the FAO recommended minimum dietary diversity among children, school students adopted other good recommended practices in their real-life.

Some challenges were noted especially in data collection and analysis during the COVID-19 period. However, special preventative public health measures were maintained to protect staff and prevent spread of infection during data collection. For the COVID-19, some families were reported to be living in a difficult situation where they lost their job or did not have enough income to purchase essential commodities for their families. As a result, food security was being compromised that eventually would influence nutritional status of children. In addition, both physical and mental health were challenged for the schoolchildren of higher grades as they had to sacrifice their playtime due to study pressure refraining them from doing physical exercise.

Despite limits and challenges, the strength of the study was that the same set of integrated nutrition messages using pictures and succinct narratives was developed for all the students regardless of their age. These messages would improve the knowledge and practices of children due to their simplicity, cultural appropriateness, and visibility in the textbooks. The display of messages on the visible page of the textbooks will act as a constant reminder for improved behavior and practices of children and parents. It is critical to note that a large group of populations embracing school children, parents and school teachers will simultaneously be exposed to these important messages that will likely to diffuse knowledge across the society. To augment behavior and practices in real life, inclusion of parents in the intervention seemed to be a useful and practical tool to support their children and to create an enabling environment. As this study has been conducted under the leadership of the Ministry of Food, it is therefore warranted to set formal communications with the policy-makers in the Ministry of Education especially the NCTB to incorporate this newly framed set of integrated nutrition messages into textbooks to promote good behavior and practices related to diet and nutrition and other associated issues for a healthy, brighter and productive future in Bangladesh.

## Policy Recommendations

Based on the findings some recommendations were made to create a supportive environment for children, parents, and teachers in order to improve nutritional status of school children

1. **Incorporating integrated nutrition messages into the school textbooks:** All the messages were generated using existing resources in the national textbooks/curriculum and nutrition related policies. These messages were easily understandable by the students and their mothers being essentially practiced in their daily lives. Thus,



reinforcing the messages on the visible pages of the textbooks by the NCTB might prove to be an effective tool to bring changes in knowledge and practices among the students.

2. **Using multiple platforms:** The integrated messages could also be communicated in school premises through digital media, posters, cartoons, and other popular folk lore and related platforms.
3. **Engaging different ministries and organizations:** We developed the same integrated messages for all age groups of school students, which are easily understandable and feasible for implementation by the different ministries of the government, non-governmental organizations (NGOs) and UN-bodies through various platform to reach out the same populations.
4. **Engaging National Nutrition Services:** Since these messages were developed to foster both health and nutritional status of the students, National Nutrition Services under the Ministry of Health and Family Welfare may adopt the messages in promoting health and nutrition of the same age cohort of children and parents.

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## Annexures

### Annexure 1: Feedback from the First Technical Advisory Committee (TAC) meeting

**First Technical Advisory Committee Meeting**  
**Project: Development of Integrated Nutrition Messages for School**  
**Date: September 22, 2020**  
**Time: 8.30 to 9.30pm**  
**Platform: Zoom meeting platform**

#### Members of the Technical Advisory Committee

1. Mr. Hajikul Islam,

#### Agenda of the meeting:

- Dissemination of overall findings and the developed integrated nutrition messages of the project of “**Development of Integrated Nutrition Messages for Schools**” among the members of the Technical Advisory Committee(TAC)
- Describe the expected role of the TAC members at the project of “**Development of Integrated Nutrition Messages for Schools**”
- Explain the whole project in front of TAC members and get feedback from them on the project

#### Description of the event:

- This was the first virtual meeting among the members of Technical Advisory Committee (TAC) after receiving the grant from the European Union for the study of “**Development of Integrated Nutrition Messages for School**” by using the zoom meeting platform.
- BRAC James P Grant School of Public health (JPGSPH), BRAC University organized the meeting
- There were three presentations in this event
- At first Mr. Naoki Minamiguchi of Food and Agriculture Organization of United Nations, presented an overview of “**Meeting the Under-nutrition Challenge (MUCH)**” project
- Followed by Dr. KaosarAfsana presented the role of TAC members and introduce them among all
- In her second presentation she described the proposal of the research project “**Development of Integrated Nutrition Messages for School**”
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#### Feedback of the TAC members on the research proposal:

- Most of the TAC members suggested selecting representative sample size for the knowledge assessment survey of the project. The proposed sample size (n=450) was thought very small

as the total number of secondary students is 35 million across our country. Since this is a national study, national criteria should be followed in terms of sampling

- Nutritional knowledge, experiences, and food habits may vary by urban to rural and remote areas. In urban areas, schools have better facilities, and understanding of the students might be better than the rural students. These factors are needed to be considered during the sample size calculation. The sample should be a geographical representation of the country. Including information from different geographical areas would help in arriving at common items that might feature in the messages
- Assessment of the knowledge of the pre-school and school going children would not be much helpful (pre-primary or primary level students or children under 9 or 10 years), as it would not influence much on their dietary practices. It was suggested to include parents and teachers in sample
- Researchers needed to develop appropriate tools for assessment of the knowledge of students. This might also help to understand, how the students communicate with the existing messages in their modules related to nutrition
- Focus on their dietary practice in real life, their nutritional status and family status.
- Mention the gap areas present in our textbooks and curriculums.
- It needed to consider that in Bangladesh, people practiced to cover the front pages of the new books with an extra colorful paper (boyermolat). Students might be deprived from the messages if they cover their front page with an extra paper
- However, there is an insufficiency of space for providing any new message at both the front and back cover pages
- Children may become bored by seeing the same message repeatedly everyday as they like to learn something new
- The messages should be practical and social rather than bookish knowledge. Indeed, the core set of integrated messages would be drawn from the subjects that the students were learning in school across varying grade levels. It was also added that messages are already available at textbooks. Since teachers did not focus on those parts, so students did not pay attention to those messages
- Through the classroom discussions, children would suggest their parents to have sufficient nutritious food in their diets, so the messages would be delivered to their parents indirectly
- The duration of the project (only 3 months) was considered very short to complete all activities of the project properly by October and November during the current pandemic COVID-19 situation. Generally, duration of this kind of study is 1-1.5 year
- Initiate it as a pilot and then expand to the whole country

### **Next Steps:**

- Share the questionnaires with the Technical Advisory Committee (TAC). Methodology should be documented in detail
- The members of the TAC needed to discuss more regarding questionnaire and methodology for contributing more significantly

### **Members of the Technical Advisory Committee**

1. Mr. Hajiul Islam, Research Director Policy and Coordination, Food Policy and Monitoring Unit (FPMU), Ministry of Food, Government of Bangladesh (GoB)
2. Mr. Mostafa Faruq Al Banna, Associate Research Director, Food Policy and Monitoring Unit (FPMU), Ministry of Food GoB
3. Prof Dr. Nazma Shaheen. Professor, Institute of Nutrition and Food Science, University of Dhaka
4. Dr. Tahmeed Ahmed, Executive Director, ICDDR
5. Prof. Syed Mahfooz Ali, Senior Specialist, National Curriculum and Textbook Board, Ministry of Education, GoB
6. Mr. Mazharul Huq Masud, Assistant Director Training, Directorate of Secondary and Higher Education (DSHE), Ministry of Education, GoB
7. Dr. S. M. Mustafizur Rahman, Line Director, National Nutrition Services, Directorate General Health Services, Ministry of Health and Family Welfare, GoB
8. Dr. Khalilur Rahman, Director General, Bangladesh Nutrition Council, Ministry of Health and Family Welfare, GoB
9. Ms. Farzana Rahman Bhuiyan, Senior Scientific Officer, Bangladesh Institute of Research and Training on Applied Nutrition (BIRTAN), Ministry of Agriculture, GoB
10. Dr. Rudaba Khondker, Country Director, Global Alliance for Improved Nutrition
11. Ms. Tonima Sharmin, Nutrition Program Officer, World Food Programme
12. Mr. Naoki Minamiguchi, Chief Technical Adviser MUCH FAO (Ex-officio)
13. Dr. Lalita Bhattacharjee, Senior Nutrition Advisor, MUCH FAO (Ex-officio)

## **Annexure 2: Feedback from the Second Technical Advisory Committee (TAC) meeting**

### **Second Technical Advisory Committee (TAC) Meeting Project: Development of Integrated Nutrition Messages for School**

**Date: November 26, 2020**

**Time: 8:00pm to 9:00pm**

**Platform: Zoom meeting platform**

#### **Agenda of the meeting:**

- Sharing research findings on content analysis and key informant interviews (KIIs) among the members of the Technical Advisory Committee (TAC)
- Informing them about progress of the study
- Sharing the preliminary integrated nutrition messages and getting feedback from them on the developed messages

#### **Description of the event:**

- BRAC James P Grant School of Public health (JPGSPH), BRAC University organized this second virtual technical advisory committee meeting via Zoom meeting platform
- Prof Dr. KaosarAfsana presented research project including progress of the study along with the preliminary messages developed for getting feedback from the TAC members

#### **Discussion:**

The TAC members discussed several issues encompassing preliminary messages, strategies to disseminate the messages, pages on disseminating the messages, how to make messages attractive to students, clarity of the messages, improvement of the messages etc. In addition, the TAC members also provided feedback on the findings of content analysis. Important discussion points on the preliminary messages and recommendations of TAC members are given below:

- **Drinking water**  
Measurement of drinking water was a concern especially how to assess the size of a glass containing the recommended amount of water for that particular group. One their suggestion was the size of the glass that could be given in the messages, such as five 250 ml glasses water for the children of pre-primary school to class 2.
- **Representation of leafy vegetables**  
There was concern about adding only one picture of green leafy vegetable to this food group. Although children do not prefer eating vegetables, leafy vegetables are highly nutrient dense food. More colorful leafy vegetables needed to be incorporated, especially, red amaranth, spinach, and water spinach. One of the member mentioned that red amaranth was rich source of micronutrient. Therefore, this leafy vegetable must be promoted. The research team had already started working on it for adding the illustrations of water spinach and spinach.
- **Representation of Pulse & legume and Nuts & seeds**

Dry bean seeds would be in the food groups of pulse & legume. Peanut, bean sprouts, and sesame had to be added in the nuts and seeds section. Most of the TAC members suggested excluding almond from the food group of the plate as it was an unfamiliar and unaffordable food among general people of Bangladesh.

- **COVID-19 pandemic and promotion of local foods**

It was suggested that the foods on the plate should be healthy, and safe and affordable to the parents of the students. As the financial condition of many people has deteriorated due to the current pandemic situation, foods on the plate have to be affordable. In addition, only available foods in Bangladesh should be promoted through the messages.

- **Practical and attractive messages**

Messages should be practical so that students and their family may practice easily. Despite many messages being developed regarding wearing mask during COVID pandemic period, people were reluctant to wear it. Therefore, the integrated nutrition messages should be attractive to take attention and might create adequate consciousness among people. Thus, Implementation strategy of integrated nutrition message is urgent to consider in order to practice it.

- **Messages of different grades of students**

If the messages were placed on the cover page, the space would be limited. However, technical messages should be simple, easy and catchy. More messages should be added with increasing Grades. It was reiterated that the findings of the KII also suggested that for Group-1 more pictorial messages and less written messages would be developed; for Group-2 study the pictorial and written messages would be equal and for the third group the picture will be less but messages would be more comprehensive.

- **How to improve the messages**

There were suggestions regarding more action-oriented messages for the lowest group of students. The presentation of messages as cartoons- like conversation between different characters was discussed. For example, a message, "Homemade food is good for health."- could be placed by a cartoon saying, "Let's eat homemade food because they are good for health." It is more action oriented and attractive. One character may tell the other one "I eat different kinds of food every day, because I want to make myself healthy and strong."

"Take at least five groups of food in a day"- an original message of FAO is a technical message for improving dietary diversity and micronutrient intake. Messages should be clear to all about eating five types of food in a day and ten types in the week from the given food plate. Otherwise, people would misinterpret this message. They might be afraid of thinking how they would be able to afford all ten-food groups in a day.

It was also suggested that the core messages should be developed from simple to comprehensive from the lower grade to higher grade. The developed messages could be disseminated by the stakeholders who had similar interest in improving nutritional status of children and adolescents such as, youth club, adolescent club etc.

- **Strategy for influencing the Ministry of Education for incorporating the messages into the textbooks**

It was also discussed that some messages have been already incorporated in the education year of 2021. Regarding inconsistencies in the textbooks, it was suggested that the report on the content analysis should be shared with NCTB through the Ministry of Education to make corrections. Recently the NCTB included school, outside school and home as learning media and all three mediums had also been brought under the assessment system. One learning outcome period consisted of one to two periods. He added that for a learning outcome at least two-page content was required. A new subject would be incorporated in the schools called “Wellbeing.” Through this subject, the developed integrated messages would be possible to disseminate. However, the challenge would be training the teachers on the two-page content from central to roots level. The subject-based committee of NCTB would help in this regard to prepare the content, pedagogy and assessment tools.

It was also discussed that using the cover page would be more challenging. There was already so much information on the cover pages that would be competitive as well. A blank page was less challenging. Either a blank page or two pages content would be good for delivering the messages to the students.

#### **Next Steps:**

- Feedback on the pictorial and written messages would be addressed before pretesting
- Since the duration of the study was till December, 2020, the TAC members were concerned about whether the study would be completed on time with meaningful outcome. Both the research team and the TAC members drew the attention of Mr. Naoki Minaguchi for the extension of the project. He informed unofficially that the project might be extended, which would be confirmed early December.

### Annexure 3: Feedback from the third Technical Advisory Committee (TAC) meeting

**Third Technical Advisory Committee Meeting**  
**Project: Development of Integrated Nutrition Messages for School**  
**Date: March 11, 2020**  
**Time: 8.00pm to 9.00pm**  
**Platform: Zoom meeting platform**

#### Agenda of the meeting:

- Dissemination of overall findings and the developed integrated nutrition messages of the project of “**Development of Integrated Nutrition Messages for Schools**” among the members of the Technical Advisory Committee(TAC)
- Final feedback from the TAC members on the developed integrated nutrition messages

#### Description of the event:

- BRAC James P Grant School of Public health (JPGSPH), BRAC University organized this second virtual technical advisory committee meeting via Zoom meeting platform
- Prof Dr. KaosarAfsana presented research findings of the project and developed messages for getting feedback from the TAC members

#### Discussion:

The TAC members discussed several issues on the developed messages specially on the healthy diet, food groups, crafting messages more attractively, clarity of the messages and other corrections. In addition, the TAC members also what need to be done next to publish the messages in the school textbooks. They also provided lots of suggestions and comments in the textbox. Important discussion points on the preliminary messages and recommendations of TAC members are given below:

- **Healthy diet and safe food**  
Some of the TAC members suggested adding a message on ‘*avoiding fast food or junk foods.*’ They also urged to add a message to avoid sugary and fatty foods. Sometime homemade foods are not healthy. By adding excessive sugar and oil, healthy foods are converting to unhealthy foods. Thus, the suggestion came to add message to avoid high sugary, salty and fatty foods. The word **kancha** has many meaning such as, unripe or green. In the integrated message, **kanch** refers fresh. Students might interpret this Bengali word as green or unripe. That is why many of the TAC members suggested deleting the word **kancha**. It could be written “*amifol o sobjikaowar age dhuyekhai.*”
- **Food plate and 10 food groups**  
One of the members asked whether 10 food groups were in the textbooks of the national curriculum or not. They doubted whether 10 -food groups were appropriate for all levels of the students. Specially they raised their concern whether the students of the group-1 would be unable to understand about daily eating of five-food groups and even they would not able to arrange five-food groups for them. Another TAC member also raised his concern that eating five-food groups out of ten-food groups, came from the



women–minimum dietary diversity (W-MDD) concept, whether it was appropriate for the children. However, another TAC member clarified that these ten groups scientifically correct. This message would strike the students of the group-1 during taking their meal about the number of food groups. The main idea was to improve knowledge of the students about the ten-food groups but not to execute by them. Their family members would do that.

It is possible to cover five-food groups by non-vegetable food groups. However, protein is essential for both growth and immunity. One of the TAC members qualmed the given message for intake of five-food groups might be influenced the students to take all vegetable sources of foods. Another member suggest to add a message for eating five-food groups including an animal source of food groups like, fish, meat, egg, and milk.

Furthermore, they also raised concern about the affordability of the students' family to purchase food groups daily. Researchers replied that they were well informed about the affordability of most of the poor people in Bangladesh. Still Bangladesh is progressing financially and purchasing power of the people increasing. However, National Curriculum and Textbook would not differentiate the books for rich people and poor people. Therefore, researchers developed a common message for all students.

The TAC members were also concerned why red-amaranth had not been added in the plate. As, recent evidence showed that “**red amaranth**” had the highest nutrient density score. Thus, besides the three green leafy vegetables picture of red- amaranth might be added.

There was a mistake in the plate. Instead of “*danashoshy*” it should be “*danadarshoshy*.” It needed to be corrected.

- **Clarity of the pictorial messages**

Mango and jackfruit contains lots of  $\beta$ -carotene. However, the TAC members asked to add those fruits in the food plate. However, those were already in the plate, due lack of clarity and distinct, they did not understand that those were in the plate. The TAC members suggested to increase distinct the picture of the given foods.

- **Reference of quantity of daily drinking water**

One of the TAC members asked about the reference of quantity of the water suggested for the different groups of the students through the messages. The information was extracted from an authentic source. The reference would be shared with the TAC members.

- **Message of menstrual hygiene**

One of the TAC members suggested for adding of menstrual hygiene for the group-3. Government of the people's republic of Bangladesh is trying to improve menstrual hygiene practice through different initiatives. For this reason, this message would not be included here.

- **Problem with adding additional book cover**

One of the TAC members again raised the concern about the adding extra cover on the cover page *“Boi-erMolat.”* It is a traditional problem in Bangladesh to add additional cover on the cover-page of book. If the developed messages published in the cover page and parents and teacher cover it with additional pages how could the students learn the integrated nutrition messages. However, TAC member from the ministry of education was very optimistic that laminated cover pages might help to present the developed integrated message through inside of the two cover pages.

- **Wearing sandal**

The TAC members also disagree with the message about always wearing sandal or shoe. They said that the student should contact with earth and grass once in a day. However, it would increase the risk of warm infestation. Some of the TAC members suggested simplifying the message by adding message to wear sandal during going to latrine.

#### **Next Steps:**

- TAC members from the Ministry of education, the Government of People’s Republic of Bangladesh asked to share the report with the Director of NCTB as early as possible for incorporating the messages to the textbooks by next year
- One of the TAC members also requested to conduct the last TAC meeting and present the study findings in front of the current Secretary of Ministry of Food, Government of the People’s Republic of Bangladesh that he might know about the study of the research. The research team intended to share the findings by next April

## **Annexure 4: Inception workshop**

### **Inception workshop**

An inception workshop was held virtually on September 30, 2020, from 2.00 pm to 4.00 pm (Bangladesh Standard Time). The purpose of this workshop was to build consensus among the stake-holding partners on various aspects of the research project including objectives, methodology, deliverables, work plans, and other issues. The virtual workshop was convened via zoom video conferencing that included the presentation about the overview of “Meeting the Under-nutrition Challenge (MUCH)” project, description about the study design, activity plans and the progress so far done on the project. After the presentations, arrange of issues were discussed during the workshop to address in implementing the project effectively and in achieving the project goals. The participants shared their experiences built on their existing programs. The key points and suggestions, mentioned by the participants, are described below:

The participants suggested that Ministry of Primary and Mass Education needs to be included in the TAC as they are responsible for pre-primary and primary level education. They also discussed that considering the COVID-19 pandemic and flood, ‘nutrition in emergency’ needs to be addressed focusing on health, nutrition and hygiene. In terms of reviewing policies, they mentioned about the National School Meal Policy 2019, which has been just approved by the cabinet division 2019 needs to be reviewed as well. As discussed in the first TAC meeting, they highlighted that there are many messages already present in the textbooks like, nutrition deficiency, iron, how to get rid of iron deficiency, folic acid etc. Representative from nutrition International mentioned that they celebrate nutrition day as part of their school nutrition programme where banners and posters are presented, discussions are held between teachers and students and responsibilities are given to children for selecting nutritious food. However, the expected outcome is yet to be achieved as there is inefficiency among teachers in terms of their knowledge and skills to deliver nutrition related messages. Therefore, importance of improving the classroom environment and pedagogy and teachers’ training on particular topics and pedagogy was emphasized. Beyond this, it was advised to reach out the parents through Parents Teacher Association (PTA), to arrange meeting between teachers and parents every one or two months.

Representative from UNICEF mentioned that they have been working with the Ministry of Education and National Nutrition Services to develop operational guidelines for implementation of interventions addressing adolescent nutrition at schools since last year. The guideline has been developed and six interventions have been identified for implementation. It includes teachers’ training through online to be launched in coordination with NNS and Directorate of Secondary and Higher Education (DSHE) after developing an operational guideline in discussion with health managers, educational managers and teachers before COVID situation. The training stresses appropriate messages and activities such as anthropometric measurement twice in a year, iron folic acid for adolescent girls on weekly basis, strengthening ongoing deworming programs at school twice in a year, the referral system and nutrition education every week in a very systematic manner with the help of class teacher and the leader of the class and by boosting up through assembly). They are working with the Ministry of Education and Directorate of Secondary and Higher Education to implement them in all schools at a time. They indicated that this research project on “Development of Integrated Nutrition Messages for School” will create opportunities for further collaboration to implement their activities

efficiently if the messages are compiled in the book at one page. It was raised that conveying messages only through the cover page might not be useful unless the students are given assignments not engaged by giving assignments on similar topic. In addition, it was suggested to provide a leaflet during parents' meetings on preparing balanced diet for children as they play the most significant role in ensuring a healthy diet to their children.

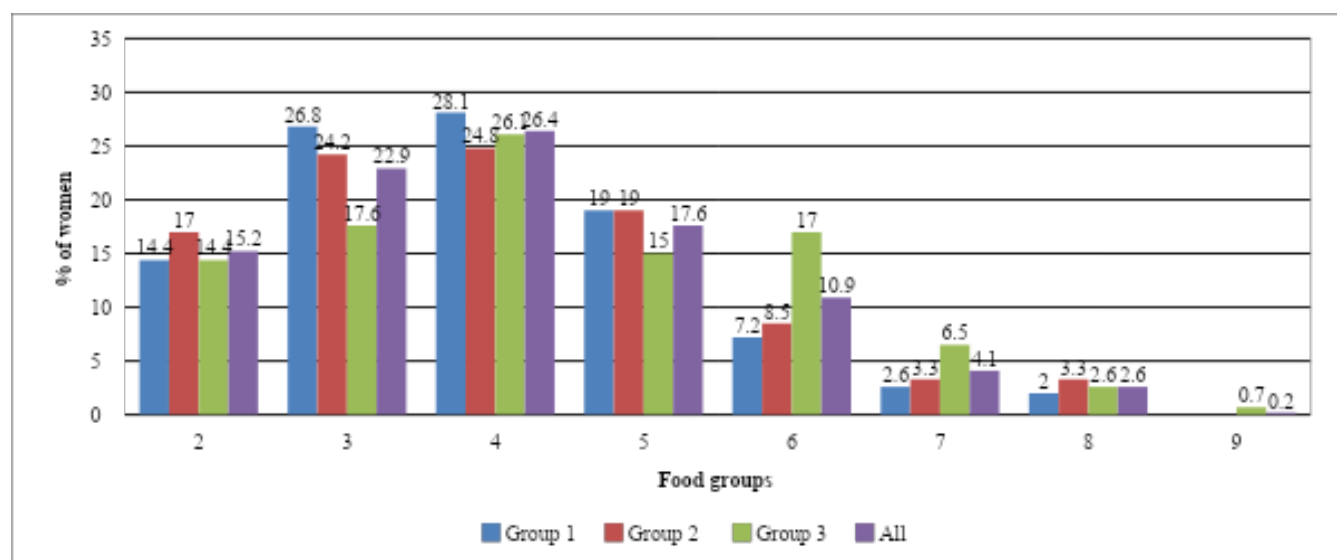
The participants asked on assessing impact of nutritional knowledge or behavior in the long run among both the students and the parents. It was also advised to understand the perception of the students on healthy foods and safe foods, and the factors that drive them to their food choice motives. Ms. Mubina, a schoolteacher said that her school has been taking care of the students' healthy activities and updating their health information through measurement of BMI twice in a year (if they are overweight or underweight). They inform the result of the measurement to the parents; however, the confusion arises as the tiffin, the students bring, are not much healthy. The teachers of that school also got training on these matters several times. She mentioned that the students are learning about the nutrients in the book, however, they do not know how much food they need to take and also about the diet chart. As this research is going to educate the children on healthy and nutritious food, it is important that the schools authorities are discussed and informed to provide the students with the healthy options so that they can choose accordingly. As conveying messages through demonstrating is found to be effective, some also emphasized about the importance of demonstration strategy.

# Annexure 5: Guideline of comprehension and aesthetic test of the initially developed messages

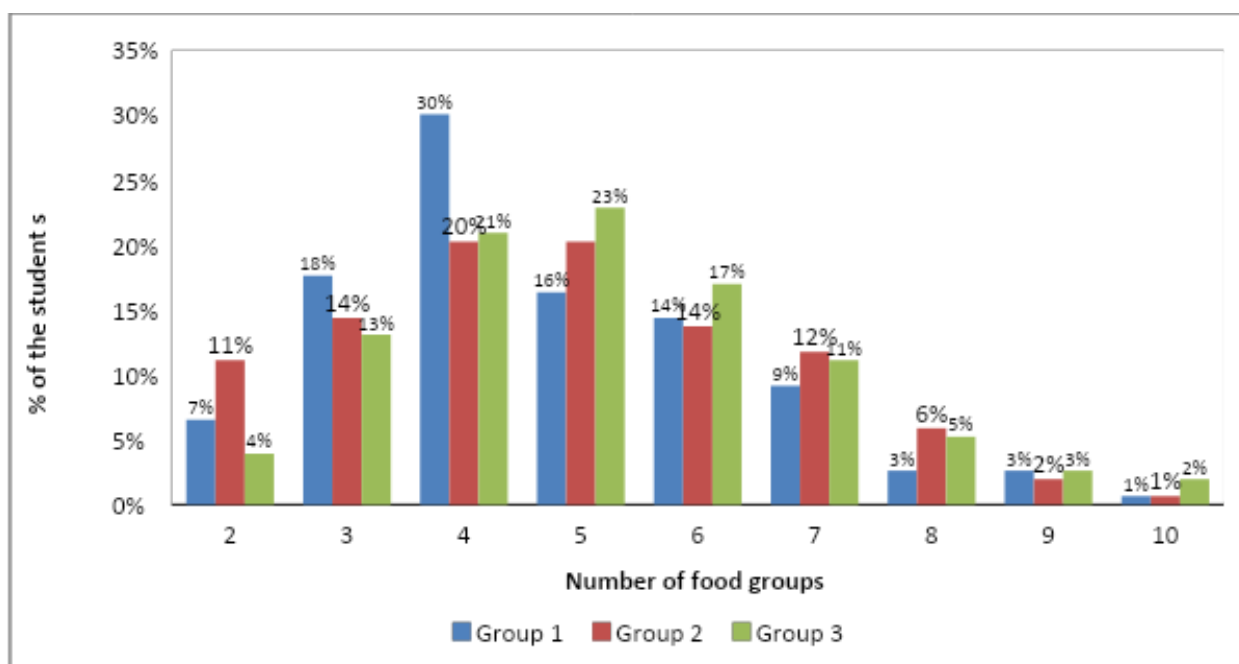
Teachers	Parents	Students
First show the photo and the messages together	First show the photo. After that ask question	Separate questions for separate groups of the students
Ask to read the message and observe the pictorial message	What do you understand from this photo?	Show the photos
Ask what he/she thinks about the messages.	show the photo and messages together and ask question	Ask questions on the photos
Whether the students would understand the messages?	Now what do you understand by reading and seeing the message and photo together?	What do you understand from this photo?
How can we improve the pictorial messages? (color, size, affordability)	What is the problem with the photo and message to understand?	What makes you difficult to understand this photo
What can be done to make this message to be more understandable to the students	You think the color of the foods are correct?	Tell me the name of the foods this plate
	You think all foods are proportionately correct.	What would be the benefit if you would eat these foods
	Do you think you can manage five kinds of foods for all family members of your household? If yes/no how can you manage or what are the difficulties to manage?	Do you think these food s would benefit other people also?
	Do you think these foods are beneficial for your school going children? why ?	Would be possible for you to eat this food daily? If yes/no why?
	You think all the foods in the photo are good for all ages of people ?why?	You think color of the foods are correct?
	How can we improve this photo and message to make this more understandable?	Do you think size of the food proportionally correct
		How can we make it more understandable to all
		<b>Guideline for messages</b> First read out all the messages for the students. Later ask them question
		Do understand what I am reading
		Me what do you understand
		Now you read this messages (observe whether they can read or they have problem to read it)
		Now ask what problem do you face during reading this messages

		What can we do to make this messages more understandable to you or all
		What do you think these messages are correct or wrong? Why ?
		Now tell me what do you understand from the photo and the messages together
		Do you think both together will help students eat healthy foods regularly? If yes/ no why?

**Annexure 6: Food groups diversity score of mothers out of ten food groups**



**Annexure 7: Food groups diversity score of the students out of ten food groups**





**Annexure 8: Proportion of students could mention names of energy producing foods as, rice, roti, nodules, potato, sweet potato etc.**

<b>Name of the foods</b>	<b>Group of the students</b>	<b>Round 1,% (n)</b>	<b>Round 2, %(n)</b>	<b>P-value *</b>
Rice	Group 1 (n=50)	100 (50)	100 (50)	-
	Group 2 (n=50)	100 (50)	100 (50)	-
	Group 3 (n=50)	100 (50)	100 (50)	-
Roti	Group 1 (n=50)	30.0 (15)	86(43)	0.000
	Group 2 (n=50)	18.0(9)	72.0(36)	0.000
	Group 3 (n=50)	44.0(22)	96.0(48)	0.000
Nodules	Group 1 (n=50)	0.0(0)	38.0(19)	0.000
	Group 2 (n=50)	0.0(0)	62.0(31)	0.000
	Group 3 (n=50)	4.0(2)	56.0(28)	0.000
Potato	Group 1 (n=50)	6.0(3)	34.0(17)	0.000
	Group 2 (n=50)	8.0(4)	68.0(34)	0.000
	Group 3 (n=50)	6.0(3)	66.0(33)	0.000
Sweet potato	Group 1 (n=50)	32.0(16)	66.0(33)	0.001
	Group 2 (n=50)	26.0(15)	66.0(33)	0.000
	Group 3 (n=50)	30.0(15)	88.0(44)	0.000

\*Chi-square test

### Annexure 9:: Proportion of students could mention name of foods for bodybuilding and maintenance

Name of the foods	Group of the students	Round 1, % (n)	Round 2, %(n)	P-value *
Pulse and legume	Group 1 (n=50)	14.0(7)	42.0(21)	0.002
	Group 2 (n=50)	10.0(5)	46.0(23)	0.000
	Group 3 (n=50)	12.0(6)	50.0(25)	0.000
Nuts and seeds	Group 1 (n=50)	0.0(0)	8.0(4)	0.410
	Group 2 (n=50)	6.0(30)	26.0(13)	0.006
	Group 3 (n=50)	10.0(5)	40.0(20)	0.001
Milk and milk products	Group 1 (n=50)	58.0(29)	72.0(36)	0.142
	Group 2 (n=50)	50.0(25)	72.0(36)	0.024
	Group 3 (n=50)	60.0(30)	86.0(43)	0.003
Fish, meat & poultry	Group 1 (n=50)	60.0(30)	92.0(46)	0.000
	Group 2 (n=50)	38.0(19)	90.0(45)	0.000
	Group 3 (n=50)	54.0(27)	98.0(49)	0.000
Egg	Group 1 (n=50)	62.0(31)	80.0(40)	0.047
	Group 2 (n=50)	44.0(22)	84.0(42)	0.000
	Group 3 (n=50)	48.0(24)	84.0(42)	0.000

\*Chi-square test

### Annexure 10: Proportion of students could mention name of foods for prevention of disease

Name of the foods	Group of the students	Round 1, % (n)	Round 2, %(n)	P-value *
Green leafy vegetables	Group 1 (n=50)	64.0(32)	88.0(44)	0.005
	Group 2 (n=50)	58.0(29)	80.0(40)	0.071
	Group 3 (n=50)	44.0(22)	92.0(46)	0.000
Yellow & orange fruits & vegetables	Group 1 (n=50)	28.0(14)	56.0(28)	0.005
	Group 2 (n=50)	10.0(5)	62.0(31)	0.000
	Group 3 (n=50)	26.0(13)	92.0(45)	0.000
Other vegetables	Group 1 (n=50)	40.0(20)	78.0(39)	0.000
	Group 2 (n=50)	16.0(8)	72.0(36)	0.000
	Group 3 (n=50)	24.0(12)	84.0(42)	0.000
Other fruits	Group 1 (n=50)	16.0(8)	50.0(25)	0.000
	Group 2 (n=50)	20.0(10)	56.0(28)	0.000
	Group 3 (n=50)	48.0(24)	68.0(34)	0.043

\*Chi-square test

**Annexure 11: Intake of different food groups by the children during last 24 hours of interview**

Food groups	Student group	Round 1 % (n)	Round 2 %(n)	p-value
Cereals roots and tuber	Group 1 (n=50)	100 (50)	100 (50)	-
	Group 2 (n=50)	100 (50)	100 (50)	-
	Group 3(n=50)	100(50)	100 (50)	-
Lentil and legume	Group 1 (n=50)	34.0(17)	30.5(15)	0.668
	Group 2 (n=50)	24.0(12)	34.0(17)	0.271
	Group 3(n=50)	32.0(16)	28.0(14)	0.663
Nuts and seeds	Group 1 (n=50)	24.0(12)	18.0(9)	0.461
	Group 2 (n=50)	22.0(11)	34.0(17)	0.181
	Group 3(n=50)	16.0(8)	28,0(14)	0.148
Milk and milk products	Group 1 (n=50)	46.0(23)	36.0(18)	0.309
	Group 2 (n=50)	44.0(23)	60.0(30)	0.191
	Group 3(n=50)	50.0(25)	60.0(30)	0.315
Organ meat	Group 1 (n=50)	10.5(5)	8.0(4)	0.727
	Group 2 (n=50)	6.0(3)	14.0(7)	0.182
	Group 3(n=50)	12.0(6)	4.0(2)	0.140
Meat and poultry	Group 1 (n=50)	36.0(18)	26.0(13)	0.280
	Group 2 (n=50)	32.0(16)	48.0(24)	0.120
	Group 3(n=50)	32.0(16)	40.0(20)	0.405
Fish and sea foods	Group 1 (n=50)	48.0(24)	56.0(28)	0.423
	Group 2 (n=50)	56.0(28)	64.0(32)	0.414
	Group 3(n=50)	50.0(25)	58.0(29)	0.422
Egg	Group 1 (n=50)	48.0(24)	58.0(29)	0.316
	Group 2 (n=50)	52.0(26)	42.0(21)	0.316
	Group 3(n=50)	52.0(26)	46.0(23)	0.548
Green leafy vegetables	Group 1 (n=50)	32.0(16)	50.0(25)	0.067
	Group 2 (n=50)	42.0(21)	64.0(32)	0.028
	Group 3(n=50)	50.0(25)	52.0(26)	0.842
Yellow and orange vegetables and fruits	Group 1 (n=50)	26.0(13)	16.0(8)	0.220
	Group 2 (n=50)	28.0(14)	26.0(13)	0.822
	Group 3(n=50)	30.0(15)	12.0(6)	0.027
Other vegetables	Group 1 (n=50)	90.0(45)	98.0(49)	0.092
	Group 2 (n=50)	96.0(48)	96.0(48)	1.000
	Group 3(n=50)	94.0(47)	96.0(48)	0.646
Other fruits	Group 1 (n=50)	32.0 (16)	34.0(17)	0.822
	Group 2 (n=50)	44.0(22)	48.0(24)	0.688
	Group 3(n=50)	24.0(12)	44.0(22)	0.035

**Annexure 12: Intake of different food groups by the mothers of different groups of children during last 24 hours of interview**

Food groups	Student group	Round 1 % (n)	Round 2 % (n)	p-value
Cereals roots and tuber	Group 1 (n=50)	100 (50)	100 (50)	-
	Group 2 (n=50)	100 (50)	100 (50)	-
	Group 3(n=50)	100(50)	100 (50)	-
Lentil and legume	Group 1 (n=50)	28.0(14)	26.0(13)	0.822
	Group 2 (n=50)	26.0(13)	32.0(16)	0.509
	Group 3(n=50)	22.0(11)	22.0(11)	1.000
Nuts and seeds	Group 1 (n=50)	14.0(7)	12.0(6)	0.766
	Group 2 (n=50)	12.0(6)	18.0(9)	0.401
	Group 3(n=50)	10.0(5)	8.0(4)	0.727
Milk and milk products	Group 1 (n=50)	36.0(18)	34.0(17)	0.634
	Group 2 (n=50)	36.0(18)	46.0(23)	0.309
	Group 3(n=50)	48.0(24)	50.0(25)	0.841
Organ meat	Group 1 (n=50)	4.0(2)	8.0(4)	0.400
	Group 2 (n=50)	2.0(1)	8.0(4)	0.160
	Group 3(n=50)	4.0(2)	4.0(2)	1.000
Meat and poultry	Group 1 (n=50)	28.0(14)	28.0(14)	1.000
	Group 2 (n=50)	38.0(19)	46.0(23)	0.410
	Group 3(n=50)	28.0(14)	32.0(16)	0.660
Fish and sea foods	Group 1 (n=50)	46.0(23)	64.0(32)	0.070
	Group 2 (n=50)	58.0(29)	64.0(32)	0.539
	Group 3(n=50)	44.0(22)	58.0(29)	0.161
Egg	Group 1 (n=50)	42.0(21)	46.0(23)	0.687
	Group 2 (n=50)	44.0(22)	40.0(20)	0.685
	Group 3(n=50)	46.0(23)	46.0(23)	1.000
Green leafy vegetables	Group 1 (n=50)	34.0(17)	60.0(30)	0.009
	Group 2 (n=50)	40.0(20)	70.0(35)	0.003
	Group 3(n=50)	54.0(27)	50.0(25)	0.689
Yellow and orange vegetables and fruits	Group 1 (n=50)	14.0(7)	14.0(7)	1.000
	Group 2 (n=50)	30.0(15)	16.0(8)	0.096
	Group 3(n=50)	26.0(13)	10.0(5)	0.037
Other vegetables	Group 1 (n=50)	92.0(46)	98.0(49)	0.169
	Group 2 (n=50)	96.0(48)	100.0(50)	0.153
	Group 3(n=50)	92.0(46)	96.0(48)	0.400
Other fruits	Group 1 (n=50)	22.0(11)	30.0(15)	0.362
	Group 2 (n=50)	34.0(17)	30.0(15)	0.668
	Group 3(n=50)	22.0(11)	40.0(20)	0.052

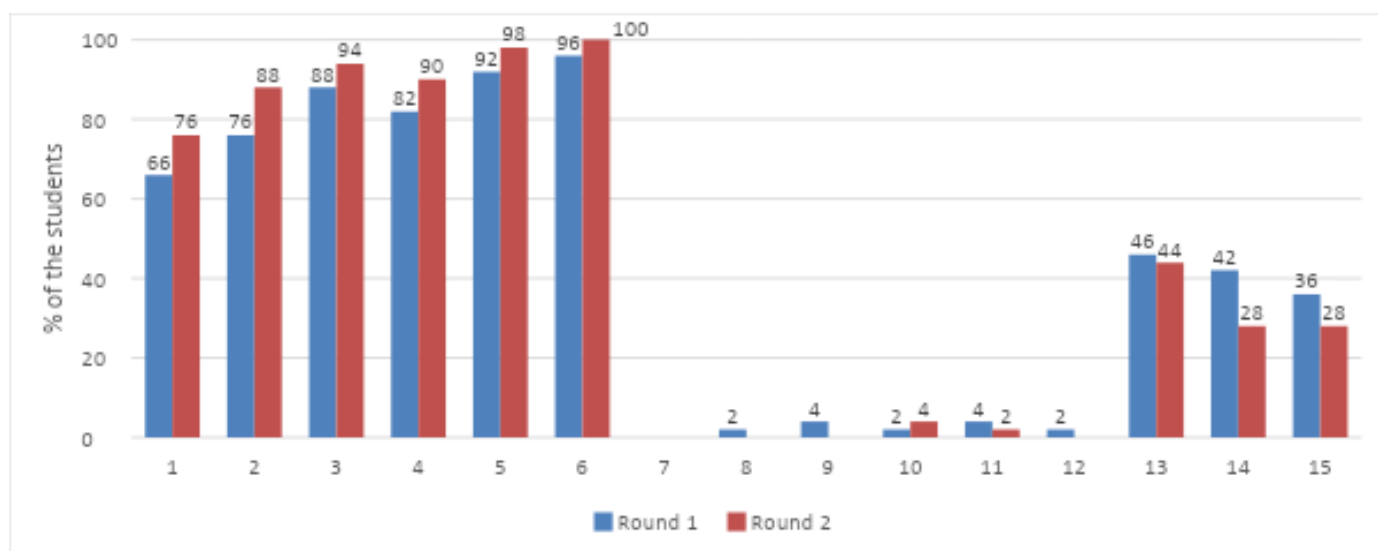
\*Chi-square test

### Annexure 13: Source of information received on having adequate foods and drinking water

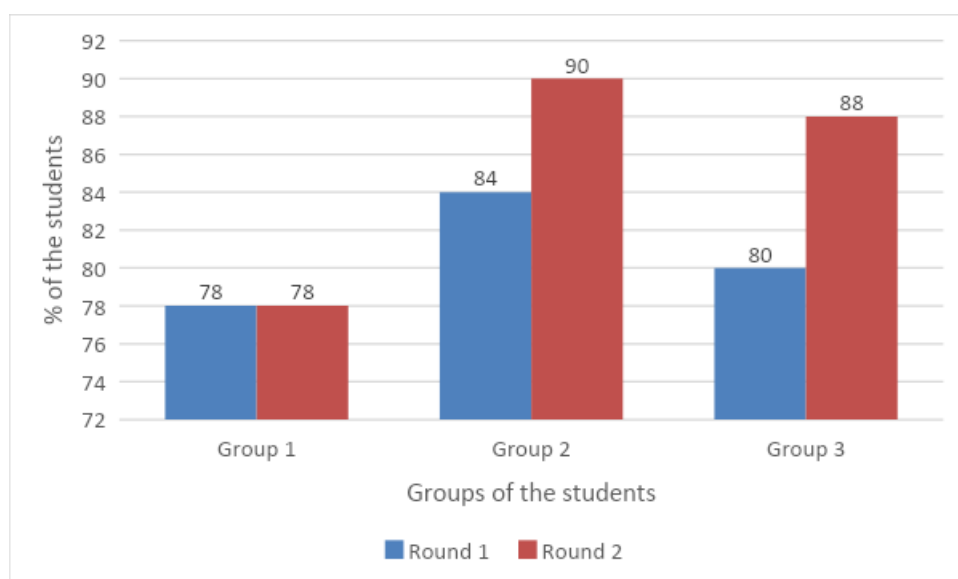
Source of information	Student group	Round 1, % (n)	Round 2, % (n)	p-value*
Text book	Group 1 (n=50)	6.0(3)	10.0(5)	0.461
	Group 2 (n=50)	24.0(12)	20.0(10)	0.629
	Group 3(n=50)	52.0(26)	40.0(20)	0.229
School teacher	Group 1 (n=50)	8.0(4)	4.0(2)	0.400
	Group 2 (n=50)	22.0(11)	24.0(12)	0.812
	Group 3(n=50)	26.0(13)	36.0(18)	0.280
GO and NGO health worker	Group 1 (n=50)	10.0(5)	0.0(0)	0.022
	Group 2 (n=50)	2.0(1)	0.0(0)	0.315
	Group 3(n=50)	4.0(2)	4.0(2)	1.000
Health worker of BRAC university	Group 1 (n=50)	0.0(0)	94.0(47)	0.000
	Group 2 (n=50)	0.0(0)	98.0(49)	0.000
	Group 3(n=50)	0.0(0)	98.0(49)	0.000
Mass media and social media	Group 1 (n=50)	12.0(6)	8.0(4)	0.505
	Group 2 (n=50)	4.0(2)	10.0(5)	0.240
	Group 3(n=50)	2.0(1)	14.0(7)	0.027
Family members	Group 1 (n=50)	38.0(19)	38.0(19)	1.000
	Group 2 (n=50)	48.0(24)	38.0(19)	0.313
	Group 3(n=50)	26.0(13)	44.0(22)	0.059
Relatives	Group 1 (n=50)	28.0(14)	8.0(4)	0.009
	Group 2 (n=50)	14.0(7)	4.0(2)	0.081
	Group 3(n=50)	2.0(1)	2.0(1)	1.000

\*Chi-square test

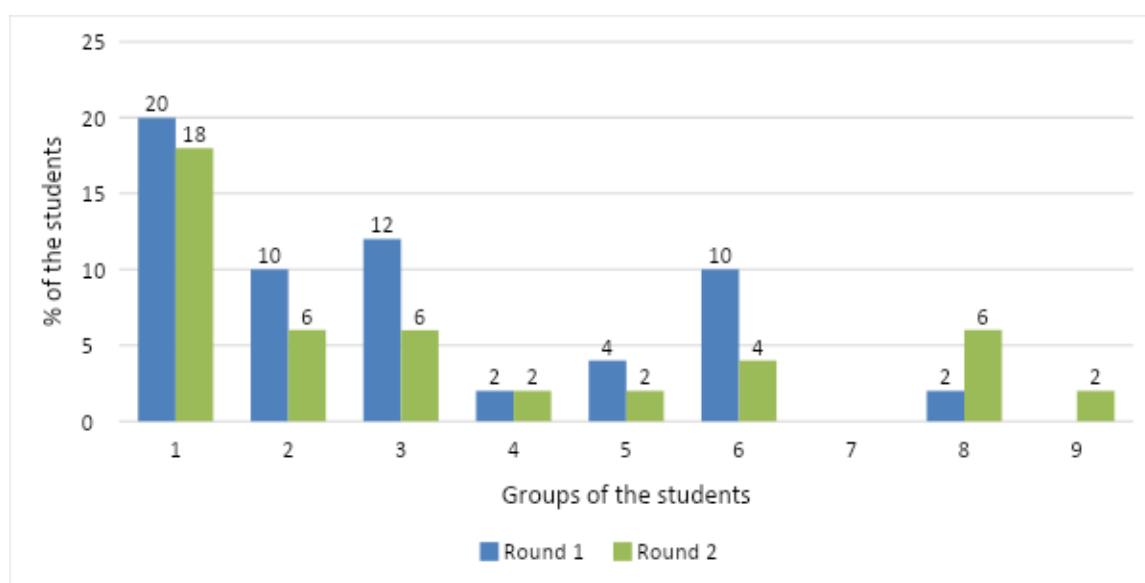
### Annexure 14: Material usually used for brushing teeth



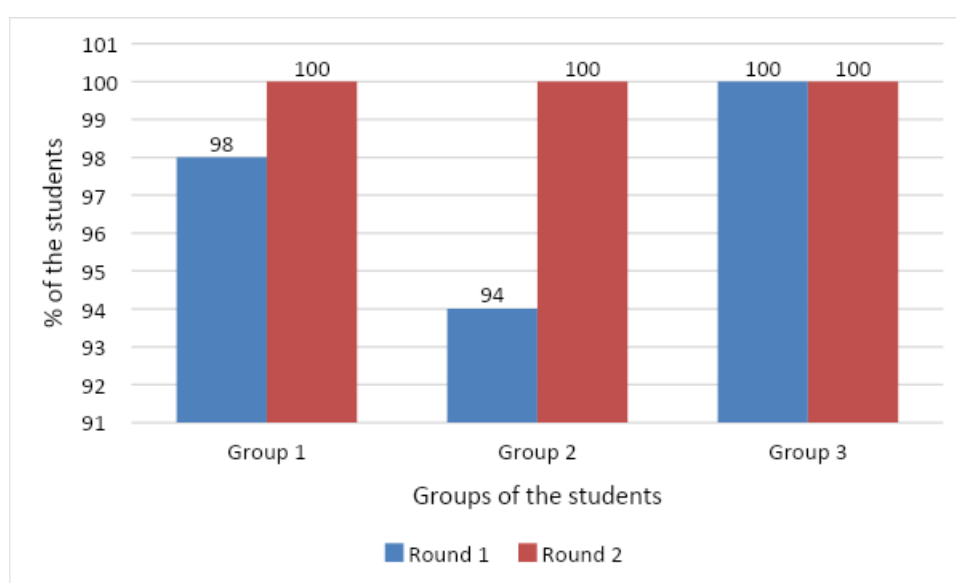
**Annexure 15: Availability of paste and brush at households of the students**



**Annexure 16: Reason for unavailability of paste and brush at home of the students**



**Annexure 17: Practice of wearing sandal during going to latrine**



**Annexure 18: Source of information received on hygiene practice**

Source of information	Student group	Round 1, % (n)	Round 2, % (n)	p-value*
Text book	Group 1 (n=50)	22.0 (11)	12.0(0)	0.183
	Group 2 (n=50)	26.0(13)	18.0(9)	0.334
	Group 3(n=50)	48.0(24)	54.0(27)	0.548

School teacher	Group 1 (n=50)	24.0(12)	14.0(7)	0.202
	Group 2 (n=50)	42.0(21)	26.0(13)	0.091
	Group 3(n=50)	30.0(15)	52.0(26)	0.025
GO and NGO health worker	Group 1 (n=50)	8.0(4)	2.0(1)	0.362
	Group 2 (n=50)	2.0(1)	2.0(1)	1.000
	Group 3(n=50)	10.0(5)	4.0(2)	0.436
Health worker of BRAC university	Group 1 (n=50)	0.0(0)	92.0(48)	0.000
	Group 2 (n=50)	6.0(3)	96.0(48)	0.000
	Group 3(n=50)	0.0(0)	100.0(0)	0.000
Mass media and social media	Group 1 (n=50)	34.0(17)	36.0(18)	0.834
	Group 2 (n=50)	68.0(34)	66.0(33)	0.832
	Group 3(n=50)	60.0(30)	46.0(23)	0.161
Family members	Group 1 (n=50)	54.0(27)	44.0(22)	0.317
	Group 2 (n=50)	64.0(32)	46.0(23)	0.070
	Group 3(n=50)	40.0(20)	42.0(21)	0.839
Relatives	Group 1 (n=50)	22.0(11)	6.0(3)	0.021
	Group 2 (n=50)	14.0(7)	2.0(1)	0.027
	Group 3(n=50)	6.0(3)	6.0(3)	1.000

\*Chi-square test

#### Annexure 19: Source of information on physical exercise and adequate sleeping

Source of information	Student group	Round 1, % (n)	Round 2, % (n)	p-value*
Text book	Group 1 (n=50)	22.0(11)	16.0(8)	0.444
	Group 2 (n=50)	32.0(16)	10.0(5)	0.007
	Group 3(n=50)	52.0(26)	50.0(25)	0.841
School teacher	Group 1 (n=50)	20.0(10)	14.0(7)	0.424
	Group 2 (n=50)	46.0(23)	20.0(10)	0.006
	Group 3(n=50)	36.0(18)	48.0(24)	0.224
GO and NGO health worker	Group 1 (n=50)	4.0(2)	2.0(1)	0.558
	Group 2 (n=50)	-	-	-
	Group 3(n=50)	6.0(3)	2.0(1)	0.307



Health worker of BRAC university	Group 1 (n=50)			
	Group 2 (n=50)	4.0(2)	98.0(49)	
	Group 3(n=50)			
Mass media and social media	Group 1 (n=50)	12.0(6)	8.0(4)	0.505
	Group 2 (n=50)	4.0(2)	10.0(5)	0.240
	Group 3(n=50)	2.0(1)	14.0(7)	0.027
Family members	Group 1 (n=50)	38.0(19)	38.0(19)	1.000
	Group 2 (n=50)	48.0(24)	38.0(19)	0.313
	Group 3(n=50)	26.0(13)	44.0(22)	0.059
Relatives	Group 1 (n=50)	28.0(14)	8.0(4)	0.009
	Group 2 (n=50)	14.0(7)	4.0(2)	0.081
	Group 3(n=50)	2.0(1)	2.0(1)	1.000

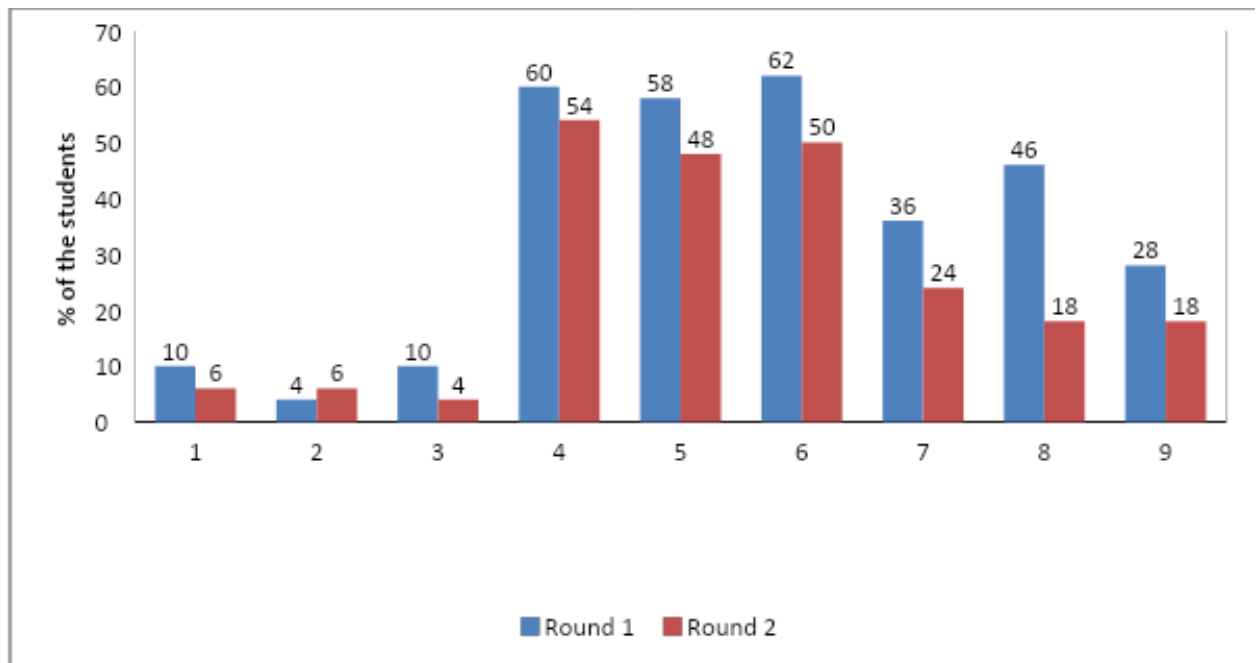
\*Chi-square test

#### Annexure 20: Source of information on benefits of tree plantation

Source of information	Student group	Round 1, % (n)	Round 2, % (n)	p-value*
Text book	Group 1 (n=50)	20.0(10)	20.0(10)	1.000
	Group 2 (n=50)	46.0(23)	30.0(15)	0.099
	Group 3(n=50)	64.0(32)	64.0(32)	1.000
School teacher	Group 1 (n=50)	20.0(10)	14.0(7)	0.424
	Group 2 (n=50)	50.0(25)	40.0(20)	0.315
	Group 3(n=50)	34.0(17)	38.0(19)	0.016
GO and NGO health worker	Group 1 (n=50)	2.0(1)	2.0(1)	1.000
	Group 2 (n=50)	-	-	-
	Group 3(n=50)	4.0(2)	4.0(2)	1.000
Health worker of BRAC university	Group 1 (n=50)	0.0(0)	90.0(45)	0.000
	Group 2 (n=50)	0.0(0)	98.0(49)	0.000
	Group 3(n=50)	0.0(0)	92.0(46)	0.000
Mass media and social media	Group 1 (n=50)	14.0(7)	26.0(13)	0.134
	Group 2 (n=50)	16.0(8)	6.0(3)	0.110
	Group 3(n=50)	12.0(6)	22.0(11)	0.183
Family members	Group 1 (n=50)	54.0(27)	36.0(18)	0.070
	Group 2 (n=50)	40.0(20)	48.0(24)	0.420
	Group 3(n=50)	38.0(19)	40.0(20)	0.838

\*Chi-square test

#### Annexure 21: Reason for not brushing teeth after taking breakfast

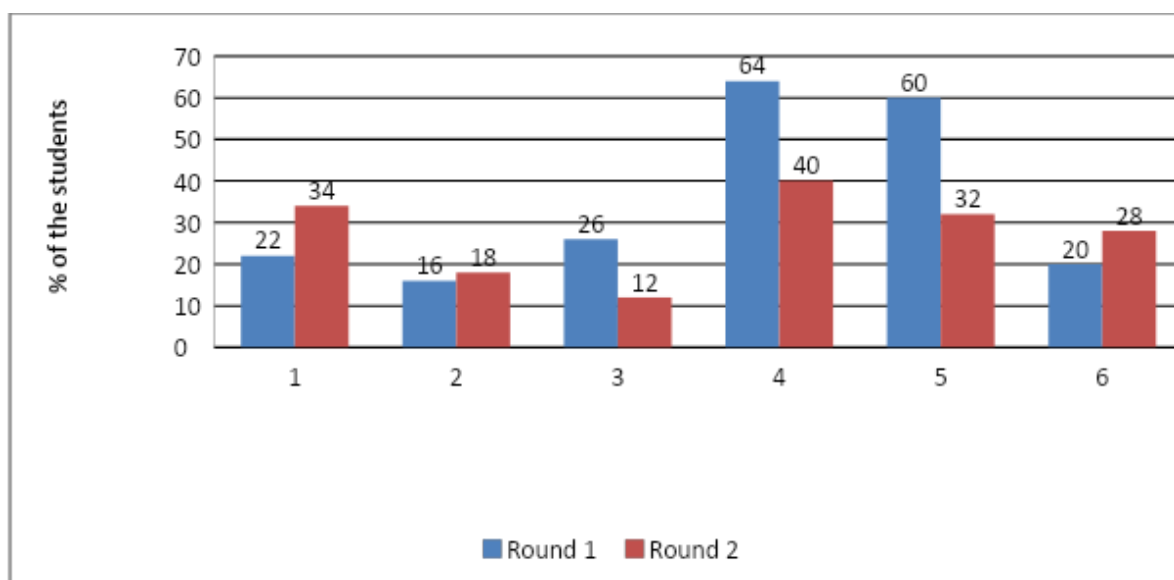


Group 1: Round1 vsRound 2.  $p < 0.001$

Group 2: Round 1 vsRound 2,  $p < 0.001$

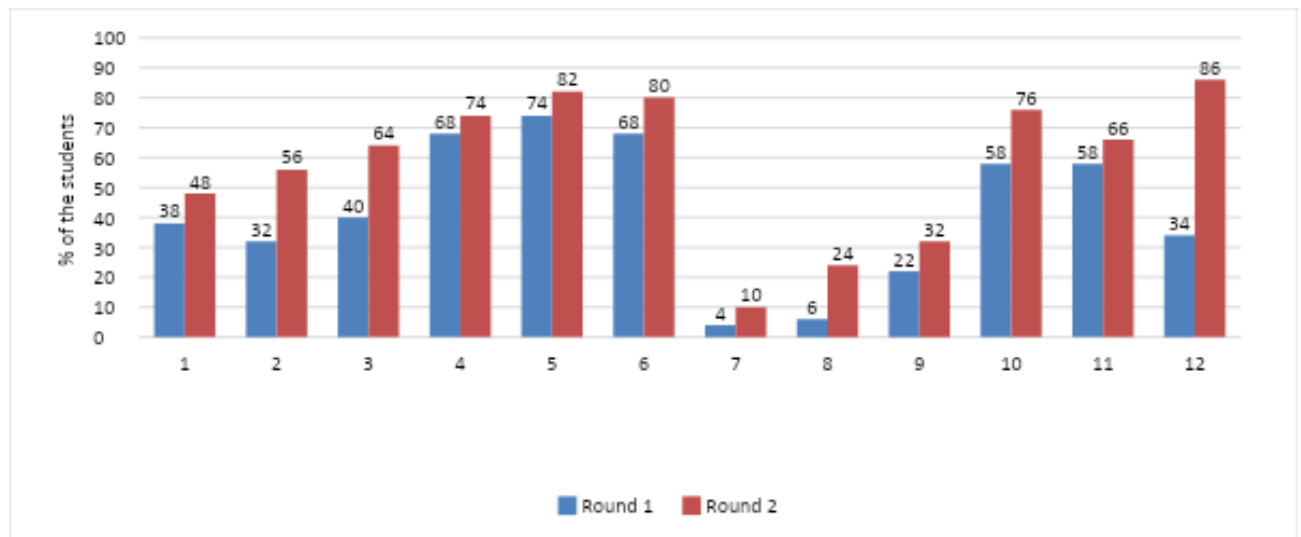
Group 3: Round 1 vsRound 2,  $p < 0.001$

#### Annexure 22: Reasons for not brushing teeth before sleeping by the students



Group 1: Round1 vsRound 2.  $p < 0.001$  ;Group2: Round 1 vsRound 2,  $p < 0.001$ ; Group 3: Round 1 vsRound 2,  $p < 0.001$

#### Annexure 23: Knowledge on the benefit of brushing teeth among the students



Food particles will be cleared: Group 2, Round 1vs Round2,  $p < 0.001$ ; Group 3, Round 1vs.Round2  $P < 0.001$

No bad smell: Group 1: Round1 vsRound 2.  $p < 0.001$  ; Group 3: Round 1 vsRound 2,  $p < 0.001$