A Study on the impact of dietary diversity and hygiene practice on nutritional status of adolescents (age group 10-19) in rural area, Bangladesh: A cross sectional study

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A Study on the impact of dietary diversity and hygiene practice on nutritional status of adolescents (age group 10-19) in rural area, Bangladesh: A cross sectional study

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Assistant Professor
Co-Supervisor
Department of Applied Food Science & Nutrition

Dedicated

To my

Beloved

Family, Friends and

Honorable Teacher

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The Author

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LIST OF ABBREVIATION

Abbreviations	Elaboration
WHO	World Health Organization (WHO
BMI	Body Mass Index
MUAC	Mid Upper Arm Circumference
FAO	Food and Agriculture Organization
IDDS	Individual Dietary Diversity Score
HDDS	Household Dietary Diversity Score
BBS	Bangladesh Bureau of Statistics
%	Percent
SAM	Severe Acute Malnutrition
MAM	Moderate Acute Malnutrition
DD	Dietary Diversity
WB	World Bank

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ABSTRACT

Adolescent boys and girls belong to the extremely important segment of our society. Nutritional deficiency in this period causes many life time consequences like underweight, stunting, anemia, weakness, vulnerable to diseases or infections etc. The situation gets worse in case of girls as they are the future mothers. The purpose of this study is to assess the impact of dietary diversity and hygiene practice on the nutritional status of the adolescents. This study was carried out among adolescents (age group 10-19 years) in a selected rural area of Bangladesh. A community based, descriptive cross-sectional survey was conducted and 24 hour recall method was used to determine the dietary diversity score. 345 students were selected randomly for this study. Based on this assessment, 63.48% of the participants were under weight where 38.84% were adolescent girls and 24.64% were boys. According to MUAC measurement the prevalence of MAM participants were 19.47% in age group between 10 to 14 years. Again in age group between 15 to 19 yrs there were 5.04% SAM and 34.45% MAM participants. Majority percent of the participants, around 29.86% had IDD Score 8. And only 0.58% participants scored 13 in IDDS scale given by FAO (2013). Though 81.15% participants had normal blood glucose level, but still 9.57% had hypoglycemia and 4.06% had severe hypoglycemia and 5.22% had high blood glucose level. 96.28% participants collect their drinking water while 75.65% from pod for cooking purpose. But only 14.78 % and 13.33% participants filter their drinking and cooking water respectively. Still now 57.1% had pit sanitary system and only 1.45% had piped sewer system facility. Hand washing practice is also poor among adolescent, almost 35.65% never wash hands before eating, 24.93% after using toilets and 55.94% before preparing food.

Key word: Dietary diversity, MUAC, IDD score, sanitary system, Hypoglycemia, Hyperglycemia

CHAPTER 1: INTRODUCTION

Adolescence period mainly consider the age group between 10 to 19 years old. It is the time when human growth and development takes place after childhood and before adulthood.This period is known for the rapid mental and physical growth. But the adolescence time period slightly fluctuates among boys and girls. However girls begin their adolescent growth at the age of 9. About 20% or more of adult height, 50% of adult weight and 50% of adult skeletal mass are developed in this adolescent period. (Kurshed et al*.,* 2010).As growth of adulthood related with the nutritional status of adolescence period thus it is the most important period of life for overall growth and development.
Proper nutrition in this period of time, plays a vital role for future lifespan (Tamanna et al*.,* 2013). On the other hand lack of nutrition in this period even causes chronic damages to the health of the adolescents. This nutritional deficiencies cause diseased and unhealthy adulthood. Some common complications created due to nutritional deficiency during this period are stunting, wasting, anemia, poor immunity system, low BMI etc(Joshi et al., 2014).Studies have proved that nutritional deficiency due to low dietary diversity has negative consequences for health, immunity, mental health and reproductive and social capacities (Underwood, 1998).

Nutritional status of adolescents may vary due to different influencing factors like regional and institutional variations, ethnic differences, food diversity, food consumption pattern, sanitation system, hygiene practice, local availability, financial solvency, families educational status etc. There are also some environmental factors such as family, socio economic status, socio demographic factors which are connected to nutritional status of adolescents (Kamble, 2003). Age, sex, mother's educational status also influence the nutritional status of this age group (Elena and Luminita, 2007; Doust mohammadian et al*.,* 2009).

Body mass index (BMI) which is an indicator of nutritional status is closely related to an individual food consumption pattern (Shetty & James,1994), and the World Health Organization suggested that one of the main strategies to improve the nutritional status is increased dietary diversity at the household level. Scientific community has given greater

emphasis on a balanced diet, laying down dietary guidelines to ensure adequate nutrient intake by individuals. Both under nutrition and over nutrition are harmful for human being. So a balanced dietary consumption is required for a healthy life. One of the most important task for the adolescents and their families in this adolescence period is to lay out the foundation for chronic disease prevention by the promotion and maintenance of healthful lifestyle. That is why adolescence represents a period of peak concern and requires extra care and nourishment for the rapid physical and emotional development. But the true scenario is completely opposite. Little attention has been paid to adolescent nutrition in developing countries In developing countries dietary diversity is given greater importance especially to address nutritional deficiencies. Studies show that high dietary diversity has a positive impact on nutritional status. On the other hand, there is widespread recognition that low dietary diversity is associated with chronic nutritional deficiencies (Ruel, 2003). Poor sanitary management and unhealthy hygiene practice is also responsible for many diseases and poor nutrient absorption.

This study was undertaken to know the impact of dietary diversity and hygiene practice to nutritional status of adolescents in rural area of Bangladesh. It also represents the influence of other variables to nutritional status. The present scenario of the rural areas of Bangladesh about adolescent's nutritional condition is also shown in the study. Achieving the knowledge of relation between dietary diversity and hygiene practice with nutritional status of adolescents may give an idea to frame the strategies to improve the nutritional condition of adolescents.

1.1: Objectives

- To know the rate of malnutrition among the adolescent boys and girls
- To determine the impact of dietary diversity on nutritional status of the adolescent boys and girls,
- To determine the rate of hygiene practice among the adolescent boys and girls in the rural areas of Bangladesh.

CHAPTER-2: REVIEW OF LITERATURE

According to World Health Organization, Adolescent period indicates the age group of 10 to 19 years. This period marked by physical, psychological and social changes and generally divided into two phases: early teens between 10 and 14 years and late teens between 15 and 19 years. This life phase has high priority importance because it gives many life keys in time that determine the direction for the future: social, economic, biological and demographic events. That is why Adolescent period is the most important period of life but a lot of boys and girls enter adolescence malnourished especially in underdeveloped and developing countries. It makes them vulnerable to disease and leads them to early death. A proper nutritional status and hygienic life style in this period ensures a good health in later stage of life. Due to poor socio economic status health of adolescent boys and girls are neglected as they are considered to be less vulnerable to disease than the young children or older members of the family. As a result they do not get adequate food and nutrition. From last decade the scenario is changing and their nutritional health is getting attention. The global economy is changing rapidly due to urbanization which is bringing a significant change in the nutritional status of adolescents from last two decades. But adolescents in developing countries like Bangladesh are still susceptible to nutritional deficiencies. The reason behind this situation is nutritional deficiency in early childhood (WHO, 1985). Poor Socio-economic condition, child labor, burden of disease, lack of nutritional knowledge and unaware of long-term consequences of under nutrition during adolescent period, lack of health facilities and unhygienic life style are some factors which influence the nutritional status of adolescents (Kurz et al., 1994).It is said that a window of opportunity is represented by adolescent to prepare a nutritionally healthy adult life (Kaur et al., 2007).

2.1: Growth and development during adolescent period

In the life cycle adolescent period is considered as a unique intervention point. Body's growth and other physiological changes are very rapid during the early adolescent time. That is why a special support, care and health service is required in this period of time (Nahar et al., 1990-1991). At that time almost 29 percent of adult height and around 50

percent of adult skeleton is maintained. Not only this, body composition and dietary patterns followed in adolescent period are very much likely to be continued in adulthood. (Rolland-Cahcera et al., 1994). In this adolescent period the requirements of calories and protein are maximum and the requirements of other nutrients like iron, calcium and vitamins are also increased. In adolescent period it is protein which helps to produce muscle tissues and maintain them and also repair tissue to support growth and development (Petrie et al., 2004).

2.2: Nutritional Status in adolescents

In adolescent period girls and boys are more likely to be malnourished rather than overweight or obese especially in rural areas of Bangladesh**.** Malnutrition is a condition which indicates the nutritional deficiency which includes the deficiency of both micronutrients and macronutrients. On the other hand, excess intake of energy and less energy burns causes overweight or obesity (Hall et al., 2011) According to world health organization over weight and obesity are attributed to increased consumption of energy dense ,nutrient poor foods with high levels of sugar and saturated fats combined with reduced physical activity (WHO, 2003). As much as 50% of adults' ideal body weight is gained in adolescence, and a failure to consume an adequate and balanced diet at this period of time can have a negative impact on growth status. On the other hand, excess intake of energy-dense foods may cause health problems such as obesity.

2.3: Consequences of Malnutrition and over-nutrition among adolescents

Poor nutritional status in adolescent period delays normal physiological development and causes adverse health consequences along with mental and physical health and a significant and widespread problem. Especially girls are more vulnerable and underweight pregnant adolescents are susceptible to obstructed labor and other obstetric complications (Justin et al., 2000). Malnutrition during adolescent period leads to long-term consequences in adulthood such as underweight, poor performance at school, poor general health, pregnancy and birth complications, poor immune system and susceptible to chronic diseases (WHO, 2004) (WHO, 2018).On the other hand, excess energy consumption during adolescent period leads to a unhealthy, risky adult life. But it is true that the rate of overweight and obese children is increasing day by day. Globally, the amount of overweight adults is around 41 billion and at least 300 million of them are

obese (WHO, 2003). It contribute to non-communicable diseases such as hypertension, coronary heart disease, stroke, kidney disease, liver disease, cancer and so on (WHO, 2005) (Branca et al., 2015).

2.4: Influence of Socio-economic status on nutritional status

Availability of adequate food is related with the socio-economic status, food practices and cultural tradition (WHO, 2006). Family income is deeply related with adequate food supply. It is an important factor in the determination of family's health and nutritional status of the adolescents (Nilsen et al., 2009). It is true that the income families balance their needs by either purchasing less nutritious cheep foods or by purchasing inadequate amount of foods. In both cases the adolescents suffers highly as their nutritional requirements are not considered and thus their physiological growth and development hampers. For this reason poor economic status is more likely to be associated with adolescents' malnutrition (Aseefa et al., 2013). Furthermore, educational background of the parents is also related with the nutritional status of the adolescent boys and girls. Due to lack of knowledge and social or traditional malpractice sometime families do not pay attention to the nutritional requirements of their adolescent boys and girls even being economically stable.

2.5: Relation between Individual Dietary Diversity Score and nutritional status

A balanced diet with proper amount of nutrients is very much essential for a healthy growth and development. It includes variety of foods from different food groups such as vegetables, fruits, grains and animal sources. Dietary diversity (DD) is commonly used as measure for dietary quality. It is remarked as the number of different foods or food groups consumed over a reference period of time. Individual dietary diversity scores (IDDS) aim to reflect the nutrient adequacy. It is clear from different studies done in different age groups that IDDS has a positive correlation with the nutritional status. An increase in individual dietary diversity score is related to increased nutrient adequacy of the diet. To estimate the dietary diversity score different kind of scales are used having different kind of food groups. IDDS questionnaire can be used to collect data from both individual level and household level. The number of food groups to estimate the IDDS is not same for different age group.

CHAPTER 3: MATERIALS AND METHODS

3.1: Study Place

The study was conducted among the adolescent girls and boys in two schools of Monohorganj upozila, Cumilla district. These are Khilla Aziz Ullah School and Ganauddog Girls' High School and College. Both the schools are located near khila bazaar in the village named Batabaria Bhuiyan Bari.

3.2: Study Population and study duration

Total 345 adolescent girls and boys from two school of Cumilla district were selected randomly for the study (Hossen et al. 2013). They are in between the age group of 10 to 19 years old. No participants denied taking part in this investigation. Data was collected from January to February, 2022.

3.3: Inclusion Criteria

- The adolescent boys and girls who gave written consent.
- Those boys and girls who were in the age bracket (10- 19 years).
- Those adolescent boys and girls who are studying in between class 7 to class 10.

3.4: Exclusive Criteria

- Those adolescent boys and girls who did not give written consent.
- Those boys and girls who were not in the age bracket (10-19 years).
- Those adolescent boys and girls who were physically challenged.
- Those adolescent boys and girls who were sick or corona positive.

3.5: Study design

A community based, Descriptive and cross-sectional study was conducted among adolescent boys and girls in Monoharganj upazila of Cumilla district, Bangladesh. All the participants from the selected schools willingly joined the study and provided written informed consent. The study was conducted by a standard questionnaire of relevant information. Detailed information regarding 1)socioeconomic information including name, sex, age, religion, parent's education, parent's occupation, economic status etc. 2)information of hygiene practice including source of drinking and cooking water,

sanitation system, hand washing practice 3)Anthropometric measurements including height, weight, mid-upper arm circumference (MUAC), body mass index (BMI) and glucose level was collected from each study subject. A 24-hour recall method was used to calculate the Individual Dietary Diversity Score (FAO, 2013). Individual interview was conducted to ensure the hygiene practice of each participant. The study was performed by following the design.

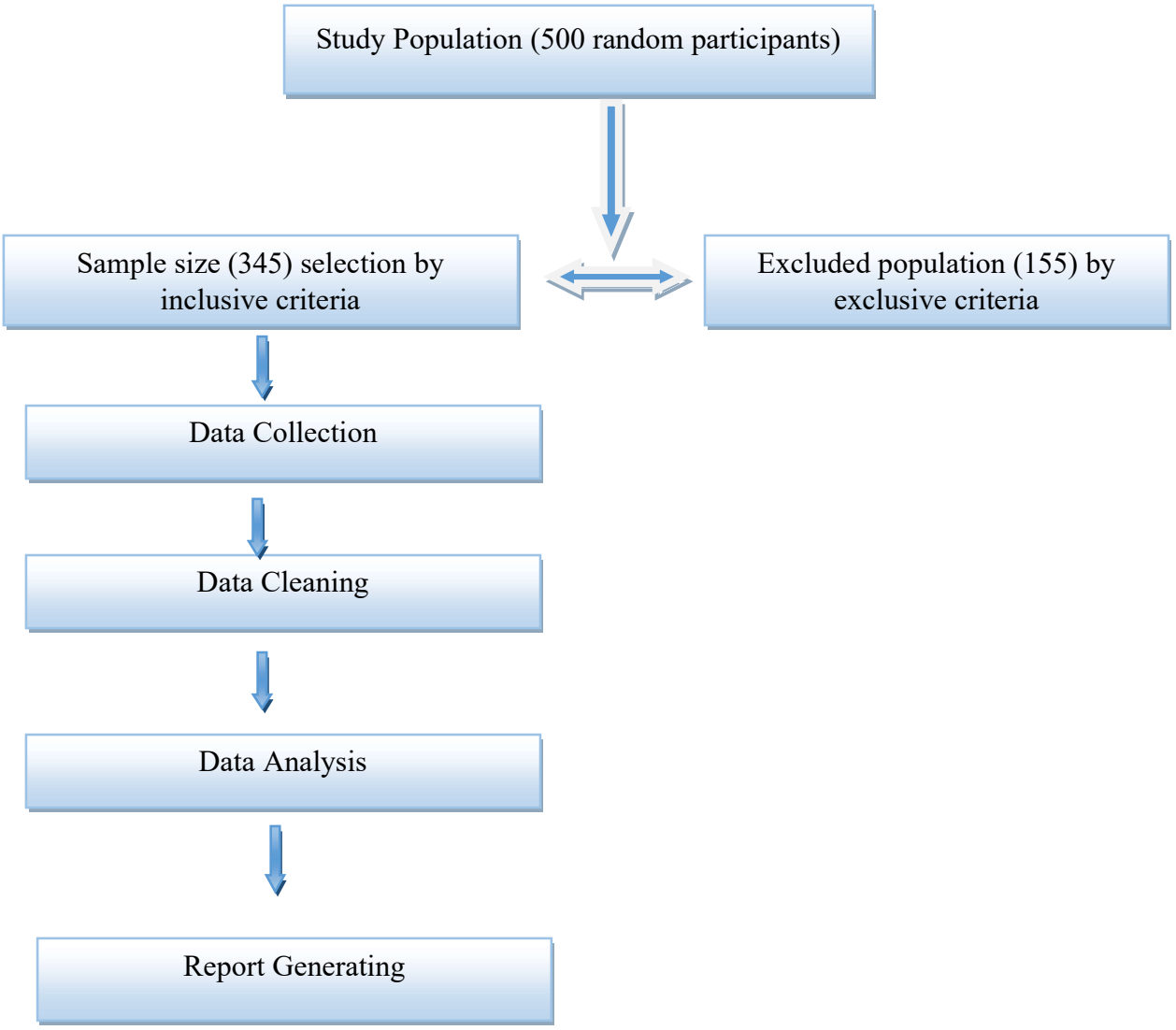

Figure 3.1: Flow chart of study design

3.6: Sample size estimation

The total sample size was calculated from the following equation with considering a significance level of 5% and achieving 80% power of the analysis:

$$n = (\frac{Z\alpha/2}{m})^2 \times P \times (1 - P) \ldots\ldots\ldots\ldots\ldots\ldots (1)$$

Here,

n = sample size;

Z = z-score which is equivalent to 1.96 at 5% level of significant;

M = margin of error;

P = proportion which is 0.65 obtained from previous study of Hossen *et al.* (2013).

The margin of error, m from equation (1) can be calculated by following formula

m= critical value × standard error

Here, critical value of z-score is 1.96 and standard error is 0.025.Putting all the value in equation (1) finally we get the sample size is 345

3.7: Assessment of Nutritional Status

3.7.1: Mid upper arm circumference (MUAC)

Mid-upper arm circumference (MUAC) measurement is a worldwide excepted anthropometric measurement to estimate the nutritional status of the participants. It is calculated in cm scale and the score vary for people from different age group. MUAC was measured by marking midway between shoulder and the elbow on the vertical axis of the upper arm with the arm bent at right angle and between the lateral and medial surface of the arm. MUAC was assessed according to age. According to (WHO 2008) MUAC distribution for adolescents was as follows:

Table 3.1: MUAC distribution for adolescents

Category	MUAC according to age	
	10 – 14 years	15 – 19 years
Normal	≥ 18.5 cm	≥ 22cm
Moderate Acute Malnutrition (MAM)	16 – 18.5 cm	18.5 – 22 cm
Severe Acute Malnutrition (SAM)	< 16 cm	< 18.5 cm

3.7.2: Body mass index (BMI)

Measurement of height

By the use of a measuring tape a height measuring scale (in cm) was drawn on a wall. The height of the adolescent boys and girls were measured against the wall. They were not wearing any footwear. They were standing with heels together and their heads positioned with their eyes looking straight ahead so that the line of vision was parallel to the body and the wood scale was brought down to the top of the head. The height at the nearest 0.1 cm was recorded. For a given anthropometric measurement, the same measurer was used to prevent variance. (Wolde et al., 2014).

Weight measurement

To measure the weight of the adolescent boys and girls a digital balance operated by battery was used. At first three objects of known weight (5 kg, 10 kg, 15 kg) was weighted by the digital balance machine. As the estimated result for the known objects were similar or the difference was less than 0.01 kg (10g), the balance machine was considered as accurate for the study. In the time of measurement all the participants were worn light clothes and in bare foot. The weight nearest 0.100kg was recorded for accurate result. For assessing nutritional status of adolescent boys and girls, particularly for their physical growth Body Mass Index calculation is widely used as it is recommended by World Health Organization. The formula is given below.

$$\text{BMI} = \frac{weight\ (kg)}{height\ (\text{m})^2}$$

The participant's BMI were categorized according to the BMI chart given by WHO.

Table 3.2: BMI chart for adolescents

Nutritional Status	BMI
Under weight	Below 18.5
Normal weight	18.5 – 24.9
Pre-obesity	25 – 29.9
Obesity class I	30 – 34.9
Obesity Class II	35 – 39.9
Obesity Class III	Above 40

3.7.3: Glucose level estimation

Glucose requirement in adolescent period is very high due to increased energy requirements. For this reason blood glucose level estimation is required to ensure the adequacy of nutrition for adolescent boys and girls. Insufficient energy intake leads to hypoglycemia. On the other hand excess consumption of carbohydrate rich foods increases blood glucose level and if continued can causes long term consequences like diabetes, liver disease etc. In the study the blood Glucose level was estimated by a battery operated digital blood glucose monitoring machine. The name of the machine was Blood Glucose Monitoring system Brand: Digital Accu Answer.

Figure 3.2: Digital Blood Glucose machine

Blood Glucose Levels (mg/dL)	Blood Glucose Levels (mmol/L)	Interpretation
< 53	< 3	Severe hypoglycemia
< 70	< 3.9	Hypoglycemia
< 125	< 7	Normal
< 200	< 10	High (Take action)
>200 - 500+	>10 - 27.7+	Metabolic Consequences (Take action)

Table 3.3: Blood Glucose level chart

A Random blood glucose level test was done. For this a drop of blood sample was taken at a random time and then tested by Digital Blood glucose monitoring machine. No matter when the participants had eaten this random blood glucose level test can be done. While measuring the blood glucose level, sanitizer was used to disinfect the finger from where the blood was collected. Proper hygiene was maintained during this test and all the wastes were carefully disposed to prevent any kind of health hazard. The amount of glucose in blood is measured in mmol/l unit and categorized as table 3.3.

3.8: Individual Dietary Diversity Score

Individual dietary diversity score can be estimated from different score scales. Foods are divided into different food groups and the IDD score is estimated by calculating the consumption of foods from these groups. It can also be calculated from Household Dietary Diversity Score by using 24 hr recall method. In the study the daily dietary diversity score for individuals were estimated by using questionnaire having food groups given below. This questionnaire has been adapted for ease of data collection from the Food And Nutrition Technical Assistance Household Dietary Diversity Score Indicator Guide (Swindale and Bilinsky, 2006). This FANTA Household Dietary Diversity Score Indicator Guide uses a scale where foods are divided into 16 food groups including cereals, white roots and tubers, vitamin A rich vegetables and tubers, dark green leafy vegetables, other vegetables, vitamin A rich fruits, other fruits, organ meat, flesh meats, eggs, fish and seafood, legume, nuts and seeds; sweets, spices, condiments and beverages. Taking foods from each groups considered 1 score and finally the total score was calculated as Individual Dietary Diversity Score.

Table 3.4: FANTA Individual Dietary Diversity Score scale

Number	Food group	Examples	YES=1 NO=0
1	CEREALS	corn/maize, rice, wheat, sorghum, millet or any other grains or foods made from these (e.g. bread, noodles, porridge or other grain products) + insert local foods e.g. cooked rice, rotti, parata, porridge or paste	
2	WHITE ROOTS AND TUBERS	white potatoes, white yam, white cassava, or other foods made from roots	
3	VITAMIN A RICH VEGETABLES AND TUBERS	pumpkin, carrot, squash, or sweet potato that are orange inside + other locally available vitamin A rich vegetables (e.g. red sweet pepper)	

4	DARK GREEN LEAFY VEGETABLES	dark green leafy vegetables, including wild forms + locally available vitamin A rich leaves such as amaranth, cassava leaves, kale, spinach	
5	OTHER VEGETABLES	other vegetables (e.g. tomato, onion, eggplant) + other locally available vegetables (e.g. cabbage, coli flower, bean)	
6	VITAMIN A RICH FRUITS	ripe mango, cantaloupe, apricot (fresh or dried), ripe papaya, dried peach, and 100% fruit juice made from these + other locally available vitamin A rich fruits	
7	OTHER FRUITS	other fruits, including wild fruits (e.g. orange, apple, banana, guava) and 100% fruit juice made from these	
8	ORGAN MEAT	liver, kidney, heart or other organ meats or blood-based foods	
9	FLESH MEATS	beef, pork, lamb, goat, rabbit, game, chicken, duck, other birds	
10	EGGS	eggs from chicken, duck, guinea fowl or any other egg	
11	FISH AND SEAFOOD	fresh or dried fish or shellfish	
12	LEGUMES, NUTS AND SEEDS	dried beans, dried peas, lentils, nuts, seeds or foods made from these (eg. hummus, peanut butter)	
13	MILK AND MILK PRODUCTS	milk, cheese, yogurt or other milk products	
14	OILS AND FATS	oil, fats or butter added to food or used for cooking	
15	SWEETS	sugar, honey, sweetened soda or sweetened juice drinks, sugary foods such as chocolates, candies, cookies and cakes	
16	SPICES, CONDIMENTS, BEVERAGES	spices (black pepper, salt), condiments (soy sauce, hot sauce), coffee, tea, alcoholic beverages	

3.9: Sanitation system

Assess to sanitation and hand washing facilities is an important factor for hygiene practice. Bangladesh has made a significant progress in sanitation system. Bangladesh has reduced the open place or no latrine percentage from 34% in 1990 to just 1% of the national population in 2015. At present the rate of improved sanitation is 61% and growing at only 1.1% percent annually. It is a significant improvement. The number of improved sanitary is satisfactory but attention to cleanliness is still lacking behind. Maintaining proper cleaning measures is as important as to have proper sanitation system. Because clean sanitation is also a part of hygiene practice and lack of attention in cleanliness may cause health hazard. According to National Hygiene Survey of Bangladesh access to latrine are categorized into following categories.

- Improved :
  - Piped sewer system
  - Septic tank
  - Pit-sanitary
- Unimproved:
  - Flush to open sources
  - Open pit
  - Hanging toilet
- No latrine.

Piped Sewer System

Piped sewer system is an underground pipe or tunnel system for transporting sewage from houses and other commercial or institutional buildings to a sewage treatment plant or disposal plant. Piped sanitary sewer system is a type of gravity sewer and a part of an overall system called “sewage system” or sewerage. Though this kind of sewage management is common in cities but hardly found in rural areas. But houses in Upazila or areas near village market may have piped sewer system.

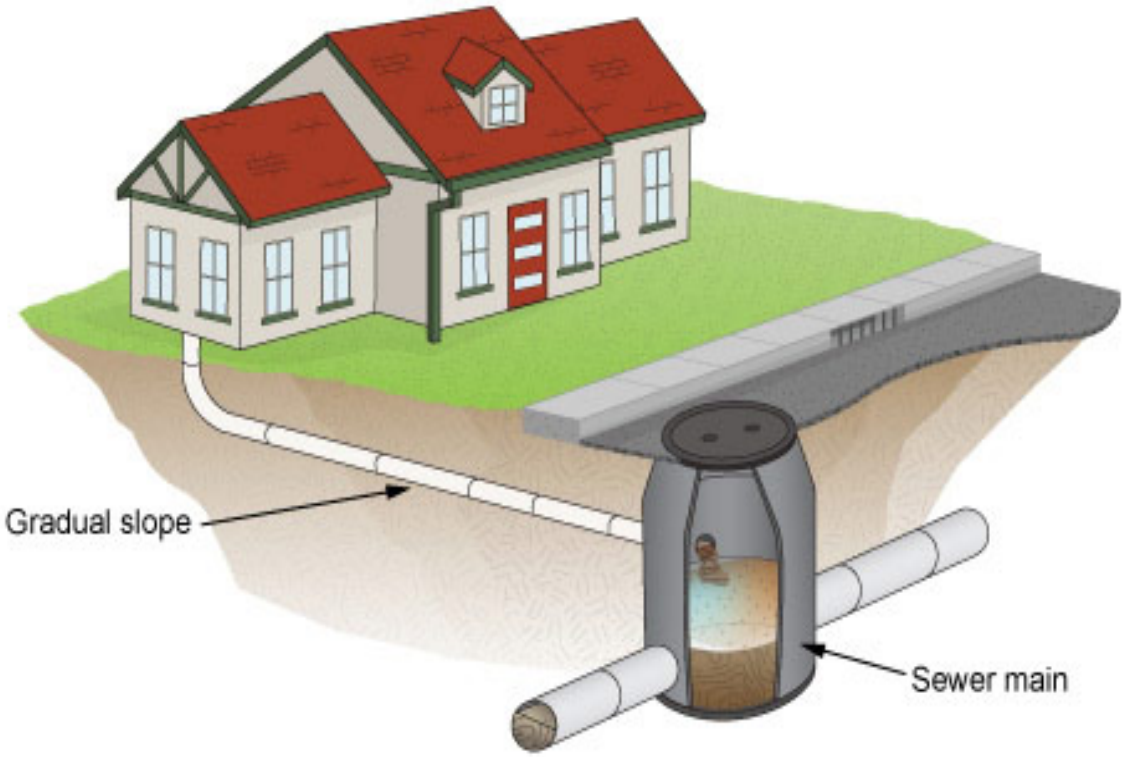

Figure 3.3: Piped Sewer System

Septic Tank Sewer System

Septic tank sewer system is an underground sewage treatment structure which is commonly used in rural areas without centralized sewer systems. It is an underground chamber, most of the time made of concrete or plastic and used as a channel for the domestic waste water (sewage) to flow to basic sewage system. They are used in areas where sewerage system is not available like village. The rate of village people using septic tank sewer system now-a-days increasing rapidly as it is comparatively less expensive. In septic tank sewer system, it is necessary to clean the tank whenever it became full.

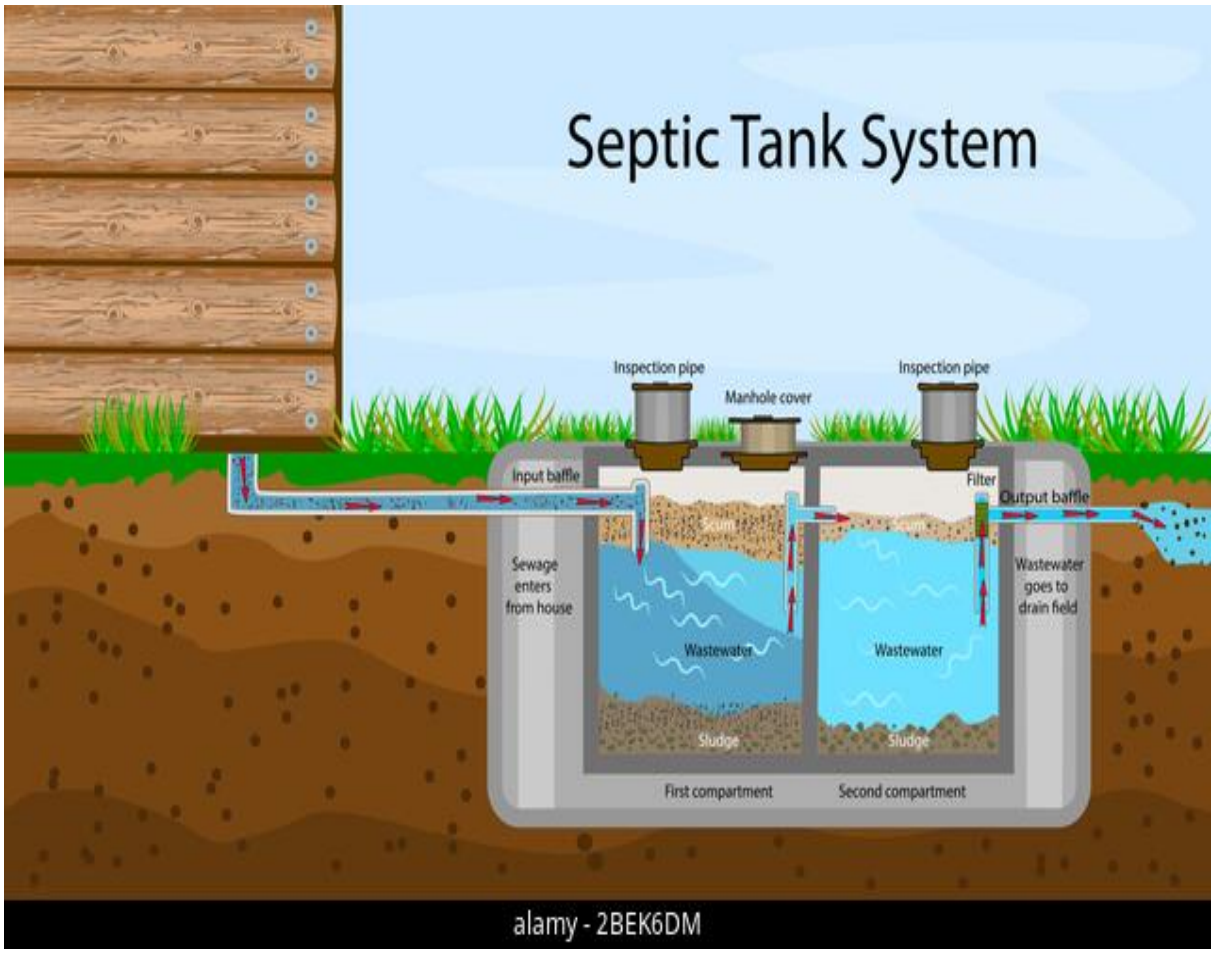

Figure 3.4: Septic tank sewer system

Pit-Sanitary System

A pit sanitary system indicates latrine which collects excreta in a pit dug placed in the ground beneath the toilet structure. If the soil is loose the pit needs to be lined with loose bricks or cement to prevent the wall from collapsing. A natural decomposition of the waste stored in the pit takes place in an anaerobic condition as the wastes are organic substances. This kind of sanitary system is more frequently seen in rural areas which are now replacing by septic tank sewer system. But this kind of sanitary system is still famous in poor areas in Bangladesh as it is the cheapest latrine system.

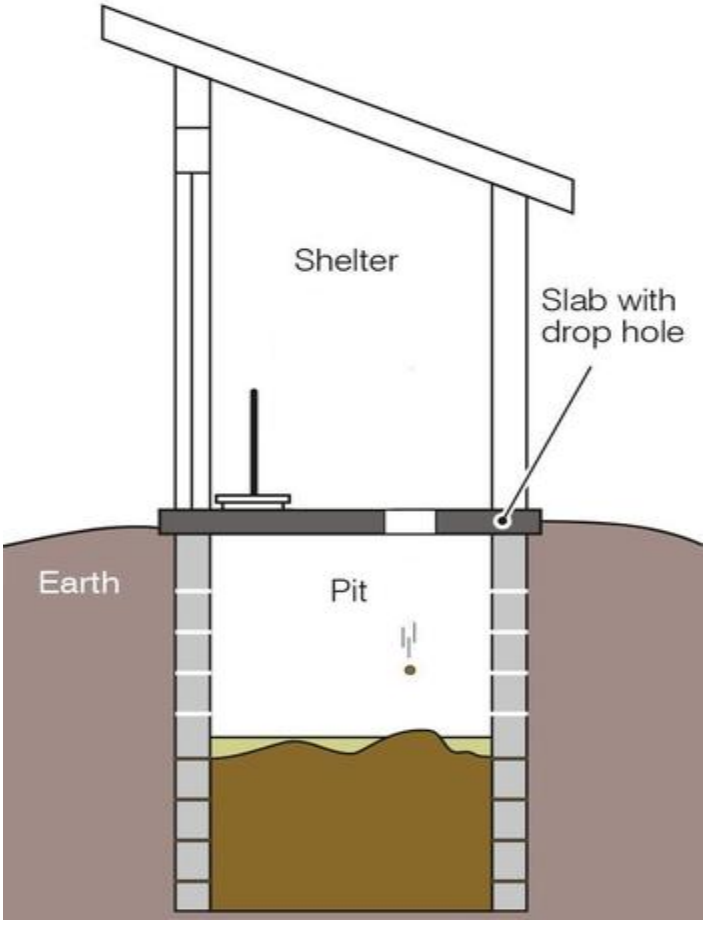

Figure 3.5: Pit-sanitary system

CHAPTER 4: RESULTS

4.1: Socio-demographic and other characteristics of the participants

The study was done with 345 participants where 119 (34.49%) of them were boys and 226 (65.51%) were girls. The average age of the boys and girls were 13.6 and 14 respectively. The number of participants has the age range between 10 to 14.9 years old were 223 and age range in between 15 to 19 years old were 122. Majority (91.6%) of the participants followed the religion Islam and only 3 participants followed Buddhism. 185 participants had medium family size having 5 to 7 family members.

Furthermore the participants are mainly from primary to higher secondary level where majority percentage of them (66.67%) from secondary level. Fathers of 189 participants went to secondary education and only 4.35% of the participant's fathers even can't read or write. On the other hand only 1.45% of the participant's mother can't read or write and maximum 71.01% (245) mothers went to secondary level.

Table 4.1: Tabulation of Socio-demographic characteristics of the participants

Determinants	Freq.	Percent
Sex		
Female	226	65.51
Male	119	34.49
Total	345	100.00
Age(yrs)		
10 -14.9	223	64.63
15 – 19	122	35.36
Total	345	100.00
Religion		
Islam	316	91.6
Hindu	26	7.55
Buddhism	3	0.86
Total	345	100.00
Family Size		
Small (≤ 4)	112	32.46
Medium (5 to 7)	185	53.62
Large (≥ 8)	48	13.9
Total	345	100.00
Respondent's education		
Primary	52	15.07
Secondary	230	66.67

Higher Secondary	63	18.26
Total	345	100.00
Father's education		
Can't Read or Write	15	4.35
Primary	62	17.97
Secondary	189	54.78
Higher Secondary	51	14.78
Above	28	8.12
Total	345	100.00
Mother's education		
Can't Read or Write	5	1.45
Primary	43	12.46
Secondary	245	71.01
Higher Secondary	34	9.86
Above	18	5.22
Total	345	100.00

4.2: Socio-economic Characteristics for Adolescent Boys and Girls:

Table 4.2 represents the parent's occupation of the participants. Among the father of 345 adolescent boys and girls majority (32.17%) are businessmen. Almost 7.25% father's do nothing. On the other hand majority (94.78%) mothers of the adolescent girls and boys are homemaker. Only 12 of them are Teachers.

Table 4.2: Tabulation of Parent's occupation of the adolescent boys and girls:

Fathers Occupation	Freq.	Percent
Businessman	111	32.17
Other's	77	22.32
Immigrant	43	12.46
Farmer	32	9.28
Do nothing	25	7.25
Teacher	23	6.67
Shop keeper	18	5.22
Govt. Employee	16	4.64
Total	345	100.00

Mothers Occupation	Freq.	Percent
Home maker	327	94.78
Teacher	12	3.48
Others	4	1.16
Business	2	0.58
Total	345	100.00

Figure 4.1 indicates the total monthly income of the participant's family. Families of 95 adolescent boys and girls have gross monthly income of between 5000 to 10000 taka. The second highest groups of families (80 families) have monthly income in between 11000 to 15000 taka.

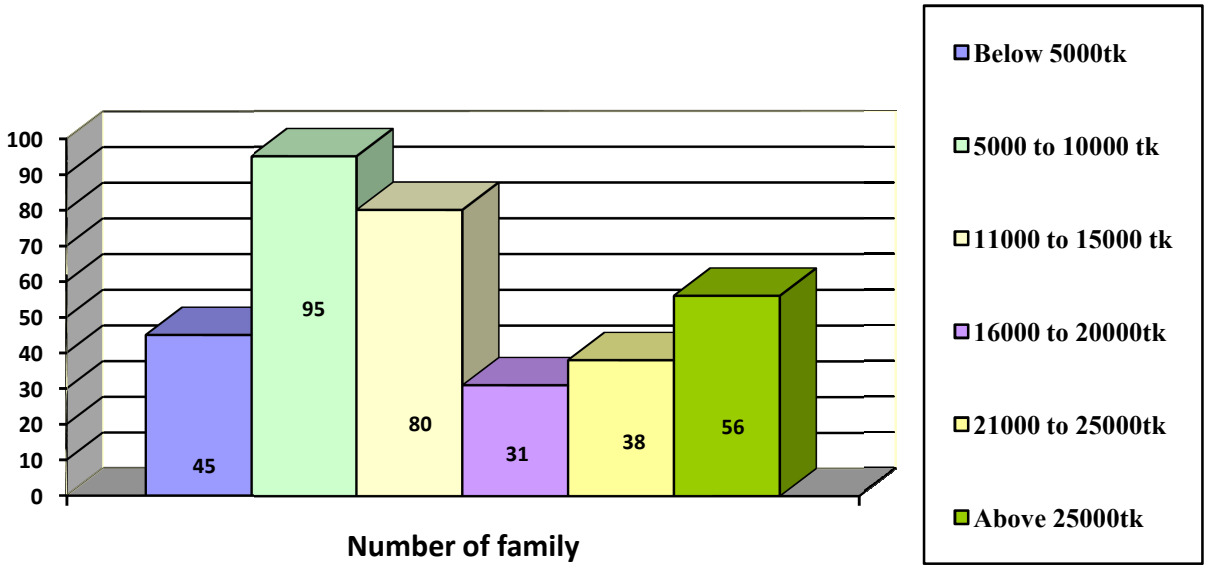

Figure 4.1: Total family monthly income of the participants:

4.3: Nutritional condition of the adolescent boys and girls of the observed areas

4.3.1: Nutritional status according to BMI

Prevalence of underweight, normal weight and pre obesity condition has been shown in the Figure 4.2**.** The average body mass index of the observed participants was 18.40 kg/m2 which was below the normal weight. Among 345 adolescent boys and girls 219 (63.48%) participants are under weight. Their BMI is lower than18.5 kg/m2. The second highest group of adolescent boys and girls with 114 participants were in the group of normal weight and only 3.48% of the participants were pre obese.

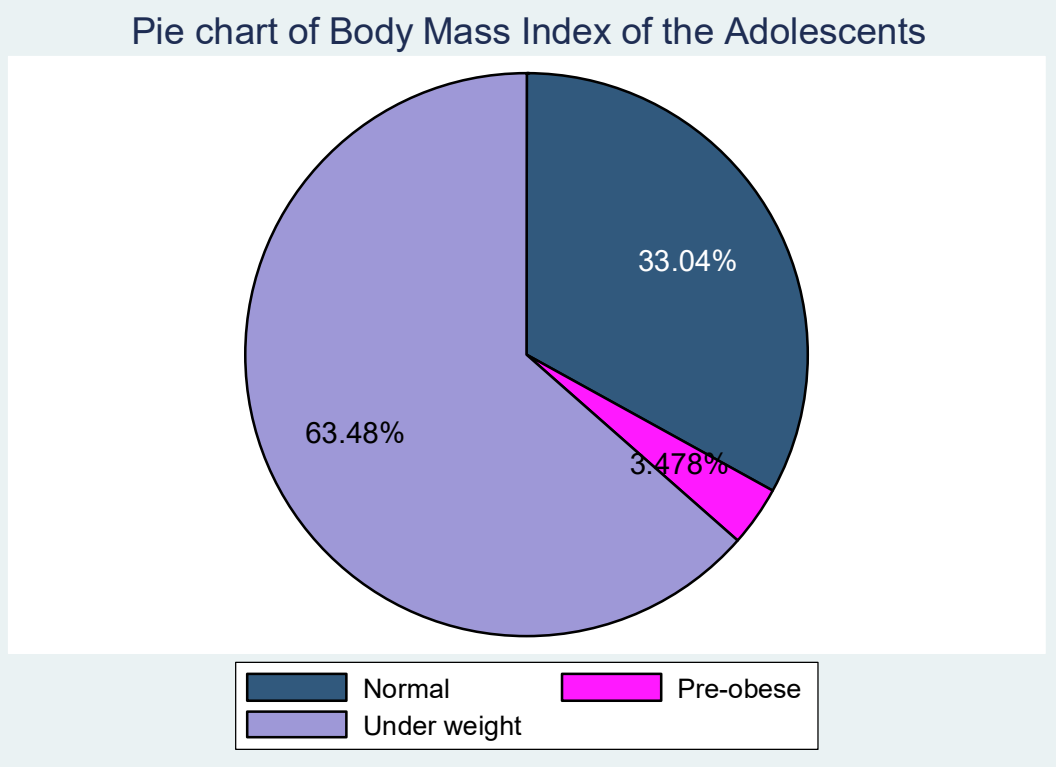

Figure 4.2: Body Mass Index of the Participants

Figure 4.3 shows the BMI status of the boys and girls. From the study, the number of underweight adolescent girl participants was 134 which were almost 38.84% of the total participants. Their average body mass index was 16.77 kg/m2. On the other hand

underweight adolescent boys were around 24.64% of the total participants having an average BMI of 16.18 kg/m2. Again there were 12 female participants who were pre-obese and had an average body mass index of 27.4 kg/m2 but none of the male participants were found pre-obese.

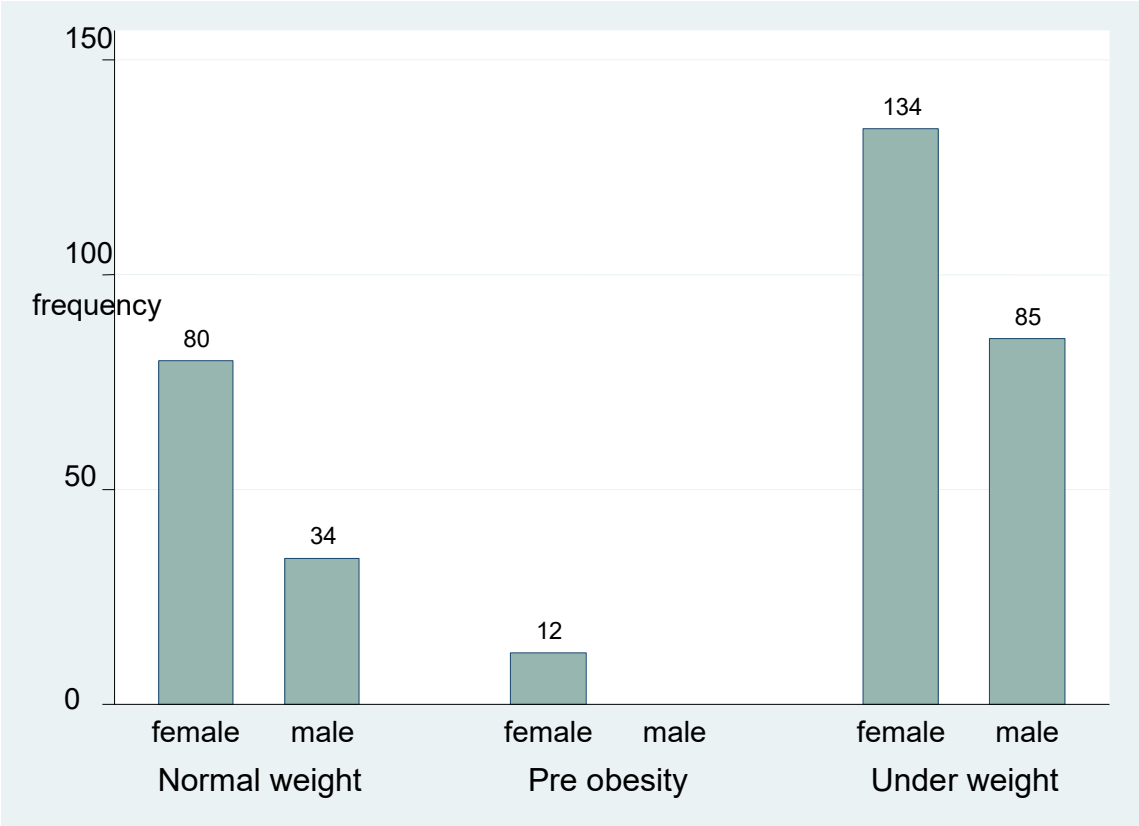

Figure 4.3: BMI status of the participants based on gender:

4.3.2: Nutritional Status according to MUAC:

MUAC status of the adolescent boys and girls of the observed areas are divided into age group 10 to 14 years, group 1 and 15 to 19 years, group 2 and displayed in table 4.3. In group 1, the prevalence of normal was 80.53%, moderate acute malnutrition was 19.47% and none of the participants from this group was severe acute malnourished.

On the other hand, in group 2, the prevalence of severe acute malnutrition (SAM) was 5.04%, moderate acute malnutrition (MAM) was 34.45% and, MUAC was normal for 60.50% of the respondents.

Table 4.3: Tabulation of Nutritional status of the adolescent boys and girls according to MUAC measurement:

MUAC(10-14YRS)	Freq.	Percent	Cum.
Normal	182	80.53	100.00
MAM	44	19.47	19.47
SAM	0	0	
Total	226	100.00	

MUAC(15-19yrs)	Freq.	Percent	Cum.
Normal	72	60.50	94.96
MAM	41	34.45	34.45
SAM	6	5.04	100.00
Total	119	100.00	

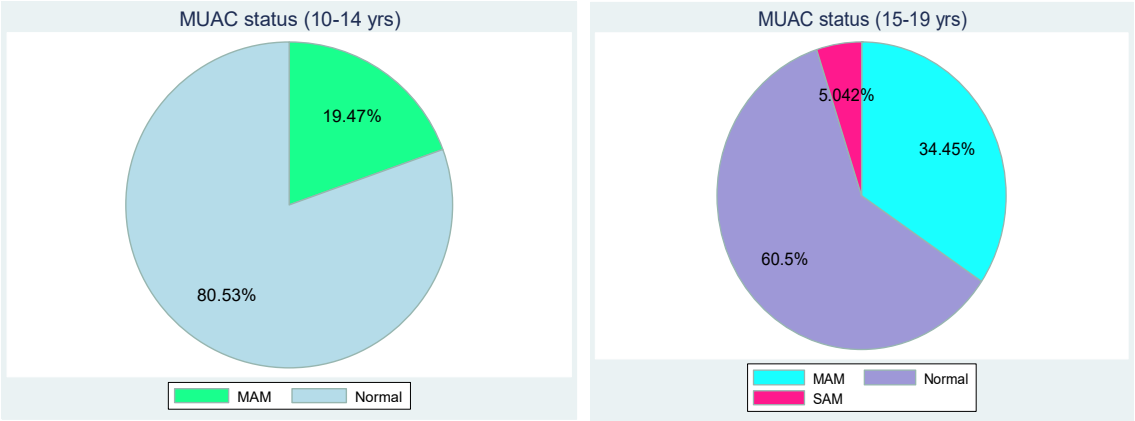

Figure 4.4: MUAC measurement of the participants based on age group

4.3.3: Nutritional status according to Glucose level:

Energy requirement of adolescent boys and girls increases due to increasing body growth and activity level. Glucose supplies the required energy. The glucose level of the adolescent girls and boys of the observed areas are shown in Figure 4.5. Among the 345 participants 4.06% were severe hypoglycemic. 33 participants were found hypoglycemic which was 9.57% of the participants. 81.16% participants had normal glucose level during the survey and only 5.22% participant had high glucose level.

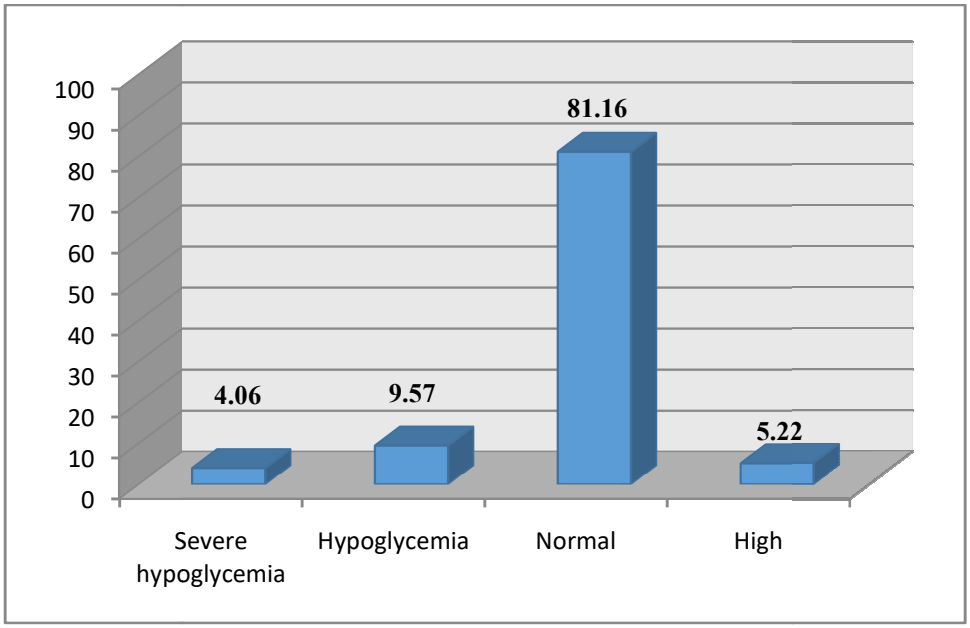

Figure 4.5: Blood Glucose Level of the participants

4.4: Individual Dietary Diversity Score of the adolescent boys and girls:

The Individual Dietary Diversity Score (IDDS) of the participants are shown in Figure-4.6. The IDD was measured by using the FANTA Individual Dietary Diversity Score Guideline. Maximum number of participants (103 participants) got 8 out of 16 scores in IDDS given by WHO. 78 participants scored 7 and 49 participants scored 9. The lowest score measured was 4 and the highest score measured was 13.

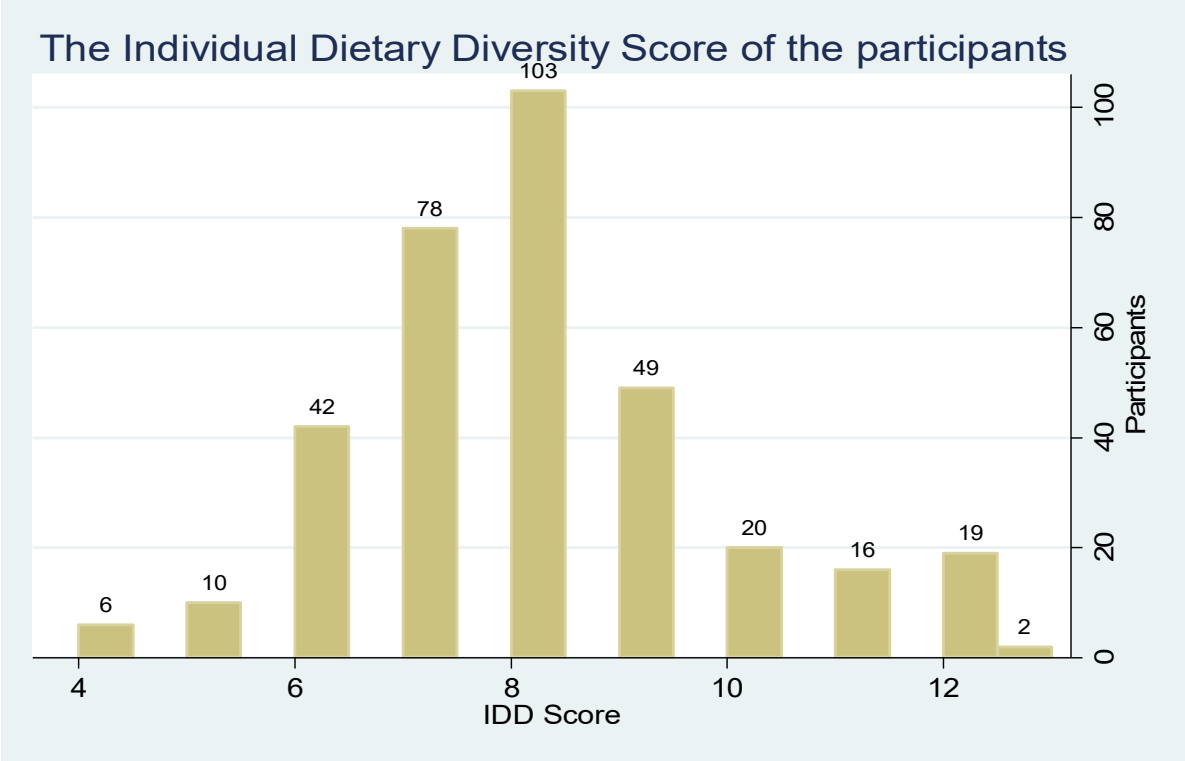

Figure 4.6: The Individual Dietary Diversity Score of the participants

4.5: Hygiene Practice:

4.5.1: Source of drinking water:

In the observed area all the participants were dependent on two sources for drinking water. Around 98.26% participants collected there drinking water from tube well and only 1.739% participants were dependent on tap water for drinking purpose. Figure 4.7 represents the sources of drinking water of the participants. No participants were found using pond water for drinking purpose. Though an affluent is flowing beside the village but no one was found to use it as a source of drinking water.

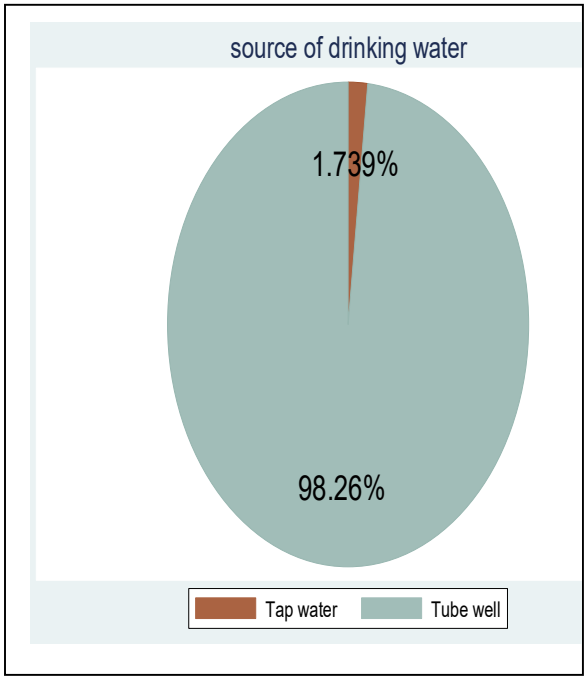

Figure 4.7: Sources of drinking water

4.5.2: Sources of cooking water:

The figure 4.8 shows the sources of cooking water in the study area. Among 345 participants 75.65% families of the adolescent boys and girls used pond water for cooking and 21.5% families used tube well water. Only 1.7% participants collected water from river and 4 families used tap water for cooking. Though pond water is very much contaminated by pollutants and not safe for cooking purpose, but still people in rural areas uses pond water for cooking and drinking purpose.

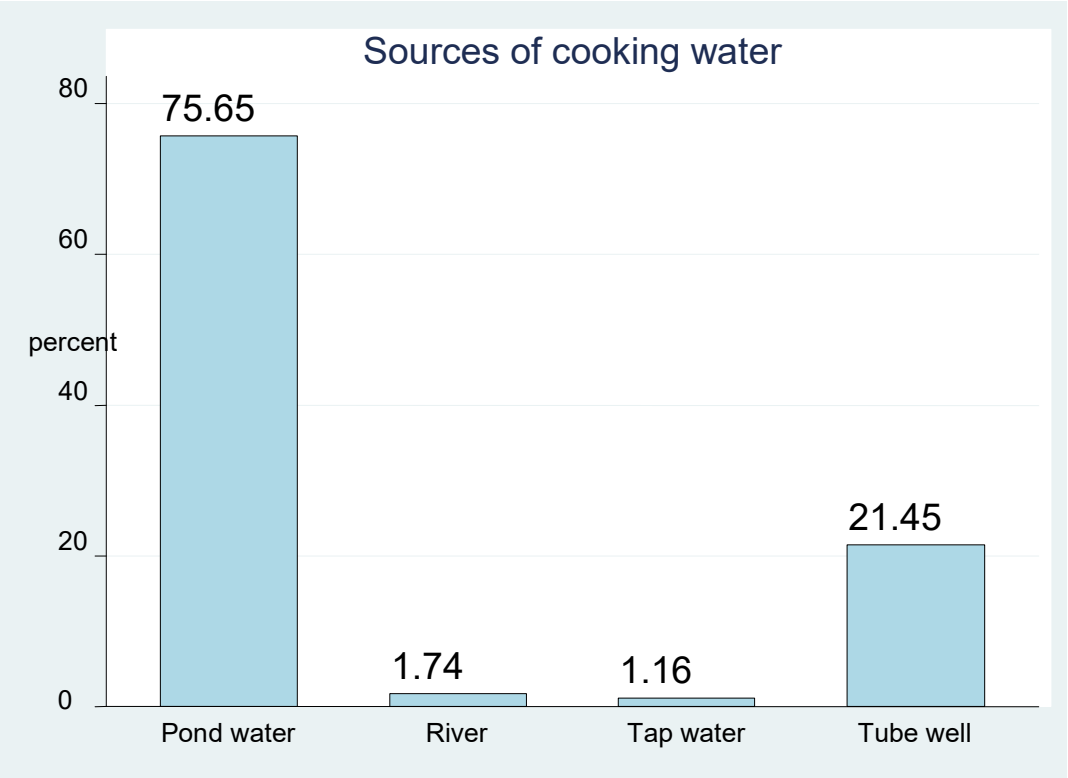

Figure 4.8: Sources of cooking water used by the participants:

4.5.3: Filtering Drinking and Cooking water:

The practice of filtering the Drinking and Cooking water are shown in Figure 4.9. 294 families of observed adolescent boys and girls did not filter their Drinking water. Only 51 families filter water before drinking. On the other hand 299 families did not filter their cooking water before using for cooking purpose. 46 families among 345 families filter their water before cooking. Majority percent of the participants were found using pond water for cooking purpose. Pond water was polluted and should be purified before use. But the overview of filtering water for drinking and cooking purpose was very poor. Only 8.11% participant who were using pond water for cooking, were found filtering their water before cooking.

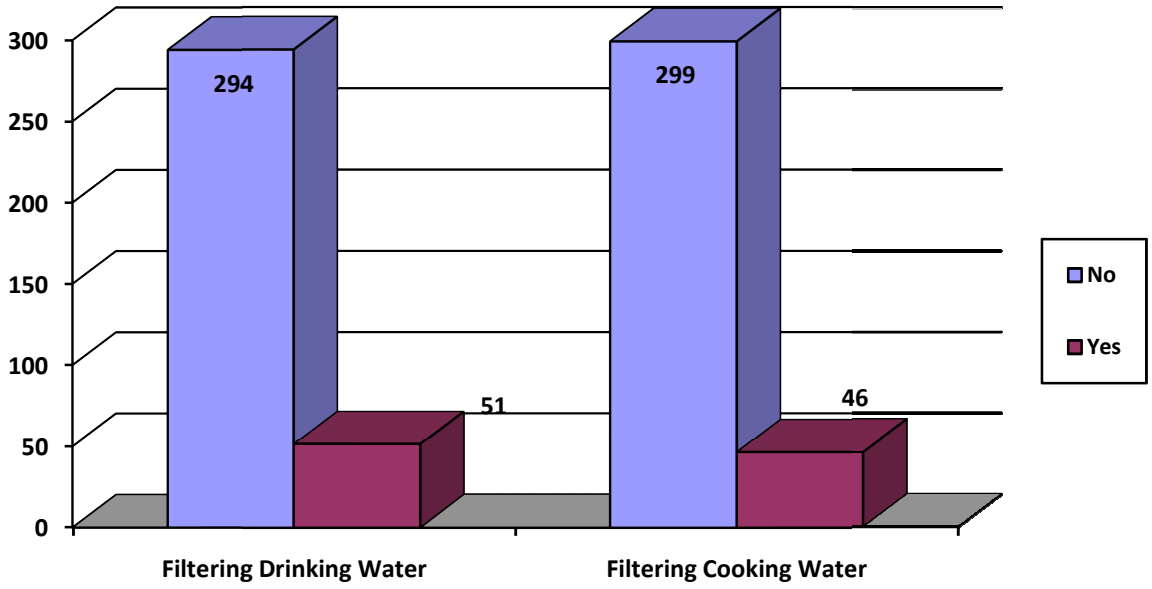

Figure 4.9: Practice of filtering drinking and cooking water by the participants:

4.5.4: Sanitation System:

Figure 4.10 represents the sanitation system of the families of the observed adolescent boys and girls. Only 1.449% participants had Piped Swear System. 41.45% participants had septic tank and 57.1% had pit sanitary system in their families.

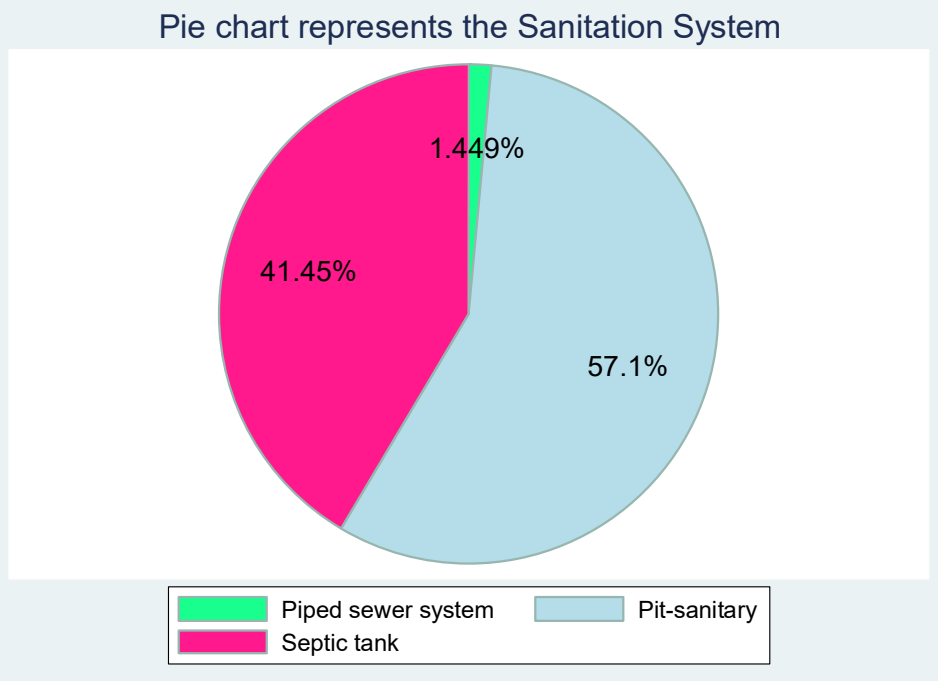

Figure 4.10: Sanitation system used by the participants

4.5.5: Hand washing practice:

Practicing hand washing before eating, after using toilet and before preparing or serving foods is a necessary daily life hack for good health. Table 4.5 shows the hand washing practice of the adolescent boys and girls who took part on the survey. Among 345 participants, 123 adolescent boys and girls never wash their hands before taking their food. Only 95 of the total participants regularly wash their hands with soap before eating.

Furthermore, 193 participants among 345 adolescent boys and girls never wash their hands. Moreover, maximum numbers of participants (149%) regularly wash their hands

with soap after using the toilet. But a lot of them (86) never wash their hands with soap after using the toilet which is very unhealthy hands before preparing or serving foods. Only 50 participants were found who regularly washes their hands with soap before preparing or serving foods.

Table 4.5: Tabulation of the hand washing practice of the participants:

Hand washing before eating	**Freq.**	**Percent**	**Cumulative frequency**
Never	123	35.65	42.61
Sometime	103	29.86	100.00
Almost All the time	24	6.96	6.96
Regularly	95	27.54	70.14
Total	345	100.00	
Hand washing after toilet	**Freq.**	**Percent**	**Cumulative frequency**
Never	86	24.93	38.55
Sometime	63	18.26	100.00
Almost all the time	47	13.62	13.62
Regularly	149	43.19	81.74
Total	345	100.00	
Hand washing before preparing food	**Freq.**	**Percent**	**Cumulative frequency**
Never	193	55.94	59.42
Sometime	90	26.09	100.00
Almost all the time	12	3.4 8	3.48
Regularly	50	14.49	73.91
Total	345	100.00	

4.6: Interrelation between Individual Dietary Diversity Score and Nutritional Status:

4.6.1: Impact of IDDS on Nutritional status according to BMI:

Table 4.5 represents the impact of Individual Dietary Diversity Score (IDDS) on the Body Mass Index (BMI) of the adolescent boys and girls of the observed areas. Maximum participants around 29.86% scored 8 in IDDS and 15.65% of them had normal weight. The second highest number of participants 22.6% scored 7 and maximum of them were under weight. The minimum IDD score recorded were 4. Among 345 participants 1.74% scored 4 and all of them were under weight. 6 out of 10 participants who scored only 5 in IDDS scale were under weight. Again 12.17% participants scored 6 where 9.27% were under weight.

Table 4.5: Tabulation of BMI status in different IDD Score.

	BMI (percent)			
IDD Score	Under weight	Normal weight	Pre obesity	Total
4 5 6 7 8 9 10 11 12 13	1.74 1.74 9.27 16.8 13.62 9.56 2.31 2.31 5.51 0.58	0 0.58 1.74 5.21 15.65 4.63 3.48 1.74 0 0	0 0.58 1.16 0.58 0.58 0 0 0.58 0 0	1.74 2.9 12.17 22.6 29.86 14.20 5.79 4.64 5.51 0.58
Total	63.47	33.04	3.48	100
Pearson Chi 2 (18) = 68.4			Pr = 0.00	

4.6.2: Impact of IDDS on Nutritional status according to MUAC:

Table 4.6 shows the impact of Individual Dietary Diversity Score on Nutritional status according to MUAC measurement. Among 345 adolescent boys and girls from the observed areas only 6 participants were found Sever Acute Malnourished and 2 of them scored 4 in IDDS scale. 2 SAM participants scored 6 and rest scored 7 in the scale.

Moreover there were 87 Moderate Acute Malnourished participants and 21 of them scored 7 out of 16 score. 23 MAM participants scored 9 and 17 MAM participants scored 12. It indicates that increased IDD score did impact in MUAC status of the participants.

Table 4.6: Tabulation of MUAC in different IDD Score

IDD Score	MUAC				Pearson Chi 2	Pr
	SAM	MAM	Normal	Total	109.9	0.0
4	2	0	4	6		
5	0	2	8	10		
6	2	8	32	42		
7	2	21	55	78		
8	0	10	93	103		
9	0	23	26	49		
10	0	4	16	20		
11	0	2	14	16		
12	0	17	2	19		
13	0	0	2	2		
Total	6	87	252	345		

4.7: Correlation between Individual Dietary Diversity score, MUAC and BMI

Table 4.7 indicates the correlation between Individual Dietary Diversity score, MUAC and BMI. According to the table IDD score, MUAC and BMI are negatively associated. The significant value for both MUAC and BMI against Individual Dietary Diversity Score is -0.176 and -0.084. This negative value indicates that Individual Dietary Diversity score is inversely associated with MUAC and BMI. In the observed area participants are taking diversified foods but the foods are not nutritious enough for fulfilling their nutritional requirements. On the other hand MUAC status and BMI value

are positively associated and they are proportionally correlated. Result of MUAC measurement increases with increasing BMI value.

Table 4.7: Correlation between IDD Score, MUAC and BMI.

	IDD Score	MUAC in cm	BMI
IDD Score	1		
MUAC in cm	-0.176	1	
BMI	-0.084	0.8297	1

4.8: Interrelation between Hygiene Practice and Nutritional Status

4.8.1: Impact of Sanitation system on BMI

Majority percent participants from the observed area used pit-sanitary system. But the most appropriate one for proper hygiene maintenance is the piped sewer system. Among 345 participants 57.10% boys and girls had pit sanitary sewer system at their house and 35.65% of them were under weight. On the other hand, around 41.45% of the participant use sewer system that has septic tank and only 26.96% were found under weight. Again 1.45% of total participants had piped sewer system at their houses. Though the rate of participants who had piped sewer system were very poor but only 0.87% were underweight. The Null hypothesis indicates that there is no significant relation between the two variables. From the Pearson Chi square test, the P value was found 0.9074. As the value is higher than 0.05, so the null hypothesis can not be rejected. It means that there were no significant relation between two variables Sanitation System and BMI.

Table 4.8: Tabulation of the impact of sanitation system on BMI

BMI	sanitation system			
	Piped sewer system	Pit-sanitary	Septic tank	Total
Normal	2	68	44	114
	0.58	19.71	12.75	33.04
Pre-obese	0	6	6	12
	0.00	1.74	1.74	3.48
Under weight	3	123	93	219
	0.87	35.65	26.96	63.48
Total	5	197	143	345
	1.45	57.10	41.45	100.00
Pearson Chi2 = 1.02 Pr = 0.9074				

4.8.2: Impact of Sanitation system on MUAC:

Table-4.9 shows the interrelation between sewer system and MUAC measurement. Among 345 adolescent boys and girls from the observed areas 85 participants were found moderate acute malnourished. Among these 85 participants 64 uses pit-sanitary system and 21 uses septic tank at their houses. It means that number of participants who have pit-sanitary system were 197 and 18.55% of them were MAM patient. On the other hand, 143 participants have septic tank facilities at their houses and only 6.09 % of them were moderate acute malnourished. But none of the participants were moderate acute malnourished or severe acute malnourished who had piped sewer system at their houses. From the Pearson Chi square test, the P value was found 0.0020. As the value is less than 0.05, so the null hypothesis can be rejected. It means that there was a significant relation between two variables Sanitation System and MUAC.

Table-4.9: Tabulation of the impact of sanitation system in MUAC:

MUAC in cm	**Sanitation System**			
	Piped sewer system	Pit-sanitary	Septic tank	Total
Moderate Acute Malnutrition	0	64	21	85
	0.00	18.55	6.09	24.64
Normal	5	131	118	254
	1.45	37.97	34.20	73.62
Severe Acute Malnutrition	0	2	4	6
	0.00	0.58	1.16	1.74
Total	5	197	143	345
	1.45	57.10	41.45	100.00
Pearson Chi2 = 16.88	**Pr = 0.0020**			

CHAPTER-5: DISCUSSION

The purpose of the study was to find out the role of dietary diversity on the nutritional status of the adolescent boys and girls and to identify the impact of hygiene practice on their nutritional status. It is because adolescence is the most important period of human life cycle as it is not only essential for the person's overall health and development but also plays vital role for the healthy future generation. Some other variables which are correlated with the nutritional status of the adolescents were parents educational status, occupation, total family income etc. In this study prevalence of underweight was found 63.48%. This is much higher than the study of Wolde et al. (2014) who found 28.0% underweight prevalence rate. Again the pre-obesity rate was found 3.48% in the study which is similar with the study of Wolde et al. (2014) who found 5.2% pre-obesity rate. Rate of underweight girls was higher than the boys. 38.84% girls were underweight where 24.64% are boys. In case of MUAC measurement 19.47% participants from age group 10 to 14 years old were found moderate acute malnourished. In age group 15 to 19 years old 34.45% and 5.04% participants were found MAM and SAM respectively. This was supported by a similar study, took place in India and the percentage of MAM and SAM participants were 39.2% and 19.8% respectively (Singh and Devi, 2013). Glucose level was found satisfactory in the study. 81.16% participants had normal glucose level, 9.57% had hypoglycemia and only 4.06% had severe hypoglycemia. This result is similar with the study done in China where 4.7% participants had hypoglycemia and only 3.06% had severe hypoglycemia (Cao Mi J et al., 2008). Researchers used various methods to measure individual and household dietary diversity. Simple counting of food varieties using diet recall method is used for this assessment. A 24-hour diet recall method was recommended by the FAO (FAO, 2013), while Hooshmand and Udipi (2013) used food frequency to measure dietary diversity. In the study Individual dietary diversity score was calculated by using FANTA Household Dietary Diversity Score Indicator Guide. The range of IDD score varied from 4 to 13 among the participants. Majority percent of the participants, 29.86% had and IDD score of 8. A similar study (Alam S et al., 2018) was done in the slum areas of Dhaka city where 63.3% participants had an IDD score ranging from 7 to 9. In our study this was around. 66.67%. Previously mentioned study found 30% participants having IDD below 7. But in this study the percentage of participants

who scored below 7 was 16.81. In our study the IDD score is negatively associated with MUAC measurement and BMI score. In case of MUAC measurement the correlation with IDD score was - 0.176 which indicates an inverse relation between IDD and MUAC. Again correlation between IDD score and BMI was - 0.084. This also indicates a negative correlation. In a study carried out by D. J. Nithya and R. V. Bhavani, 2017 in India IDD showed an positive association with BMI Z-scores in adolescents. Again Chen (2012) found that the Dietary Diversity did not associate with stunting in adolescents girls in Kilosa district of Tanzania. Dietary Diversity Score is used to access how diversified the food consumption of the participants. In our study the majority percent of the participants consume diverged type of food but still 63.48% were found underweight. It is because people in rural areas have lack of nutritional knowledge. They focus on foods which are comparatively less nutritious. Locally available nutritious fruits and vegetables are neglected while these are highly nutritious. We found that there was a tendency among the people of observed area that they consider expensive fruits, vegetables and food products such as apple, package foods, market milk etc as nutritious ones. On the other hand participants who were not capable of affording those expensive foods might be fulfilling their requirements from less diversified foods but nutritious like rice, pulses, mashed potatoes etc. That is why the rate of underweight participants was high even though majority percent of the participants consume diversified foods. In our study 57.1% participants had pit sanitary system, 41.45% had septic tank sewer system and only 1.449% had piped sewer system facilities. A study done by Bangladesh Bureau of Statistics with the help of UNICEF and Water Aid Bangladesh in 2020 found that rate of participants using pit sanitary system was 49% which was similar with our result. They also found that the rate of septic tank user was 24% and piped sewer system was 13%. Even 2% participants were found who had no latrine. But in our study we did not found anyone who had no latrine. In our study we found that the rate of hand washing practice after using toilet was 43.19% which was similar with the study done by Bangladesh Bureau of Statistics with the help of UNICEF and Water Aid Bangladesh in 2020 which found the rate was 55%. On the other hand the rate of hand washing practice before eating food and before preparing or serving food were 27.54 and 14.49% respectively. But this finding were less than the result found by Bangladesh Bureau of Statistics. They

found 40% participants wash their hands before eating and 36% wash their hands before preparing food or serving food. The source of drinking and cooking water plays important role in human health. It is because polluted drinking or cooking water are the main sources of many water borne diseases. In this study all the participants collects their drinking water from either tube well or tap water source and the rate is 98.26% and 1.739% respectively. This finding is similar with the study of Bangladesh Bureau of Statistics who found that 81% using tube well water, 8.1% inside tap water, 7.5% outside tap water and 2% using unimproved sources to collect the drinking water. In case of cooking water sources in this study the rate of participants using pond water was 75.65%, tube well water was 21.45%, river water was 1.739%, tap water was 1.16%. A different result was found by the study done by Bangladesh Bureau of Statistics who found that 71% using tube well water, 11% using inside tap water, 7.5% outside tap water and 9.1% using water from unimproved sources for cooking purpose. In the observed area participants were found collecting drinking and cooking water from unhygienic sources. But very few participants were concern about this and filter water before drinking and cooking. The rate of participants filtering their drinking water was found 14.78% where the rate was 13.33% in case of filtering cooking water.

CHAPTER-6: CONCLUSION

This study was to observe the impact of Dietary Diversity and Hygiene practice on nutritional status of the adolescents in rural area. In the observed area malnourished participants were found though the dietary diversity score was high enough. Due to misconception and lack of knowledge people in rural areas taking varieties of food but not enough nutritious or may processing their foods in inappropriate way. Again prevalence of malnutrition among participants who used pit sanitary system was more than those who used septic tank or piped sewer system. This directly indicates the positive impact of better sanitary system with the nutritional status of the adolescents.

CHAPTER-7: RECOMMENDATION AND FUTURE PERSPECTIVE

Regular intake of nutritious food can reduce the malnutrition rate among adolescents. Community based adolescent friendly health and nutrition education can contribute to improve the knowledge and status regarding nutrition. Awareness program on food preparation in proper way and knowledge on malnutrition among parents may also minimize the burden of nutritional morbidity in this study area. Improved Hygiene practices influences the nutritional status of adolescents. Awareness program should performed to spread knowledge on hygiene practice. This study included only three areas of the country and small size data. It is suggested that future work should include a greater geographical area for more authentication of findings. Larger sample for research may give more accurate results on prevalence and associated factors of malnutrition in adolescent girls. Community health extension work should be strengthening with nutritional health educators to minimize the rates of malnutrition among the adolescent in the study areas.

LIMITATIONS OF THE STUDY

This study had some limitations. Findings of this small sample may lower its generalizations. For having a meaningful conclusion, the sample size needs to be large. It was a cross sectional study which deal with only one-time nutritional status. Follow up data could be given a clear image of context. This study was done by a 24hr-recall method which do not represent the dietary habit of the participants. 5 to 7 days follow up data could give a clear scenario. Again some participants might give wrong information on food consumption intentionally or unintentionally. Finally, self-reporting of some variable might contribute some information bias. All participants present at the study time was considered for the study rather than picking data from similar socioeconomic status which may lead to unequal comparison among study areas. However, proper sampling method and statistically justified sample size may validate the findings of the study.

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QUESTIONNAIRE

Date:
Name of the respondent:
Age of the respondent:

Nutritional information's:

	Measurements
Height in cm	
Weight in kg	
BMI	
MUAC in cm	
Glucose level	

Socio-economic status:

1. Educational qualification: (Put √)

	Can't read or write	Primary	Secondary	Higher secondary	Above
Respondent					
Father					
Mother					

2. Fathers occupation:(Put √)

I.	Farmer		II.	Immigrant	
III.	Shopkeeper		IV.	Govt. employee	
V.	Business		VI.	Don't have any specific job/ do nothing	
VII.	Teacher		VIII.	Others	

3. Mothers occupation:(Put √)

I.	Housewife		II.	Business	
III.	Teacher		IV.	Others	

4. What is the monthly income of the family? .....
5. Is there any earning member in the family? .....

Individual Dietary Diversity Score:

1. How many times do you eat each day? 2/3/4/5

2. What have you eat for last 24 hours from the following table?

Food group	Example	Yes = 1 No = 0
Cereal	Rice / rotti / bread/ noodles	
Vitamin A rich vegetables and tubers	pumpkin, carrots, squash, or sweet potatoes	
White tubers and roots	white potatoes, white yams, radish etc	
Dark green leafy vegetables	dark green/leafy vegetables, including wild ones + locally available vitamin-A rich leaves such as amaranth, spinach etc	
Other vegetables	other vegetables (e.g. tomato, onion, eggplant) , including wild vegetables	
Vitamin A rich fruits	ripe mangoes, ripe papaya etc	
Other fruits	other fruits, including wild fruits	
Organ meat (iron rich)	liver, kidney, heart or other organ meats	
Flesh meats	beef, pork, lamb, goat, rabbit, chicken, duck, or other birds	
Eggs	Chicken duck or any other egg	
Fish	Fresh, dried fish or shellfish	
Legumes, nuts and seeds	beans, peas, lentils, nuts, seeds or foods made from these	
Milk and milk products	milk, cheese, yogurt or other milk products	
Oils and fats	oil, fats or butter added to food or used for cooking	
Sweets	sugar, honey, sweetened soda or sugary foods such as chocolates, candies, cookies and cakes etc	
Spices, condiments, beverages	spices(black pepper, salt), condiments (soy sauce, hot sauce), coffee, tea etc	
Total score		

HYGIENE PRACTICE:

1. Source of drinking water:(Put √)

I.	Protected Dug well		II.	Tube well	
III.	Pond water		IV.	Lake water	
V.	River		VI.	Tap water	
VII.	Others				

2. Sources of drinking water: (Put √)

i.	Protected Dug well		ii.	Tube well	
iii.	Pond water		iv.	Lake water	
v.	River		vi.	Tap water	
vii.	Others				

3. Sanitation system:(Put √)

Improved latrine	Piped sewer system	
	Septic tank	
	Pit-sanitary	
Unimproved latrine	Flush to open source	
	Open pit	
	Hanging toilet	
No latrine	No latrine	

4. Do you wash hands with soap before eating? Yes/ No
5. If yes then how often? …..regularly/almost every time/ sometimes
6. Do you wash hands with soap after toilet? Yes/ No
7. If yes then how often? …..regularly/almost every time/ sometimes
8. Do you wash hands with soap before preparing/ serving food? Yes/ No
9. If yes then how often? …..regularly/almost every time/ sometimes
10. Do you filter you water before drinking? Yes / No
11. Does your family use filter water for cooking? Yes / No

I gave answers to all these questions willingly.

Signature/ Thumbprint

PHOTO GALLERY

Height measurement

Weight measurement

MUAC measurement

Glucose level estimation

Verbal data collection.

BRIEF BIOGRAPHY OF THE STUDENT

This is Amina Nasrin Bhuiyan daughter of Md. Mosharof Hossain Bhuiyan and Chasme Ara Begum. She has passed the Secondary School Certificate Examinations in 2011 followed by Higher Secondary Certificate Examination in 2013. She obtained her Food Science and Technology Degree in 2017 (held in 2018) from Chattagram Veterinary and Animal Sciences University (CVASU), Bangladesh. Now, she is a candidate for the degree of MS in Applied Human Nutrition and Dietetics under the Department of Applied Food Science and Nutrition, Faculty of Food Science and Technology, CVASU.