# THE IMPACT OF NUTRITION IN THE ACADEMIC PERFORMANCE OF PRIMARY SCHOOL GRADUATES IN BANGLADESH

## THESIS

*Submitted for the award of the degree of*

## DOCTOR OF PHILOSOPHY IN EDUCATION

By

*TAPOSH KUMAR BISWAS*

Under the supervision and guidance of

### PROFESSOR DR. MD. ABUL EHSAN

Former Director

Institute of Education and Research



## INSTITUTE OF EDUCATION AND RESEARCH

## UNIVERSITY OF DHAKA

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## BANGLADESH

July 2019

# THE IMPACT OF NUTRITION IN THE ACADEMIC PERFORMANCE OF PRIMARY SCHOOL GRADUATES IN BANGLADESH

[This study report is submitted to the University of Dhaka for fulfillment of the requirement for the degree of Doctor of Philosophy (PhD) in Education]

By

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## DECLARATION

I, **Taposh Kumar Biswas**, hereby declare that the thesis entitled '**The Impact of Nutrition in the Academic Performance of Primary School Graduates in Bangladesh**' submitted to the Institute of Education and Research, University of Dhaka, for fulfillment of the requirement for the degree of **Doctor of Philosophy in Education**, is an original contribution of research work done by me under the supervision of **Professor Dr. Md. Abul Ehsan.** Neither the whole nor any part of the work was submitted to any other degree or diploma. My indebtedness to other researchers and their contribution has been duly acknowledged at the relevant places of the thesis.

Dhaka                                                                               Taposh Kumar Biswas

21 July 2019                                                                                    Researcher

# CERTIFICATE

This is to certify that the thesis entitled '**The Impact of Nutrition in the Academic Performance of Primary School Graduates in Bangladesh**' submitted to the Institute of Education and Research, **University of Dhaka**, for the fulfillment of the requirement for the degree of **Doctor of Philosophy in Education**, is a record of original research work done by **Taposh Kumar Biswas** under my supervision and guidance. To the best of my knowledge, the thesis has not been previously submitted to any other university or institute for the award of any degree/diploma. I further certify that the work is worth submitting for the award of the degree of PhD in Education.

Dhaka

21 July 2019

Signature

**Professor Dr. Md. Abul Ehsan**

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# ACRONYMS AND ABBREVIATIONS

| | |
|---|---|
| BANBEIS | Bangladesh Bureau of Educational Information and Statistics |
| BAZ | BMI for Age |
| BMI | Body Mass Index |
| CAMPE | Campaign for Popular Education |
| CDC | Centers for Disease Control |
| CPEIMU | Compulsory Primary Education Information and Monitoring Unit |
| DPEO | District Primary Education Officer |
| DPE | Directorate of Primary Education |
| DRP | Degree of Reading Power |
| FAO | Food and Agriculture Organization |
| FFQ | Food Frequency Questionnaire |
| FGD | Focus Group Discussion |
| HAZ | Height for Age |
| ICMR | Indian Council of Medical Research |
| IDA | Iron Deficiency Anaemia |
| IER | Institute of Education and Research |
| IQ | Intelligence Quotient |
| KAB | Knowledge-Attitude-Behaviors Model |
| LBW | Low Birth Weight |
| MDG | Millennium Development Goal |

| | |
|---|---|
| MPhil | Master of Philosophy |
| NAPE | National Academy for Primary Education |
| NCHS | National Center of Health Statistics |
| NCTB | National Curriculum and Textbook Board |
| NGO | Non-Governmental Organization |
| NHANES | National Health and Nutrition Examination Survey |
| NNPS | Newly Nationalized Primary Schools |
| PCD | Partnership for Child Development |
| PEDP | Primary Education Development Programme |
| PEM | Protein Energy Malnutrition |
| PMED | Primary and Mass Education Division |
| SD | Standard Deviation |
| SFP | School Feeding Programme |
| SKFT | Skin-fold Thickness of Triceps Muscle |
| SOWC | State of the World's Students |
| SLT | Social Learning Theory |
| RDA | Recommended Daily Allowance |
| SEB | Socio-economic background |
| SMC | School Management Committee |
| TEO | Thana Education Officer |
| TLM | Total Literacy Movement |
| UEO | Upazila Education Officer |
| UGC | University Grants Commission |
| UNESCO | United Nations Educational, Scientific and Cultural Organization |
| UNDP | United Nations Development Programme |

| | |
|---|---|
| UNICEF | United Nations Children's Fund |
| USBP | Universal-free School Breakfast Program |
| USDA | United States Department of Agriculture |
| VAD | Vitamin A Deficiency |
| WFP | World Food Programme |
| WHO | World Health Organization |
| WISC | Wechsler Intelligence Scale for Children |
| WRAT | Wide Range Achievement Test |

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# ABSTRACT

This study was carried out to find out the impact of nutritional status on the academic performance of primary school graduates (completers of 5-year schooling) in Bangladesh. The study mainly examines the relationship between nutritional status and academic performance of grade V students. Along with that, the study also tried to link the relationship between nutritional knowledge and socio-economic factors such as parents' education, family income and mothers' occupation and academic performance of the students.

In the methodology of the study, two stages of sampling techniques were chosen. One is purposive and another is random sampling. Out of eight divisions of Bangladesh, four were selected purposively considering geographical location of the country. These are Dhaka, Rajshahi, Chattogram and Barishal division. One district was chosen randomly from one division and thus, the selected districts were Tangail from Dhaka division, Natore from Rajshahi division, Feni from Chattogram division and Pirojpur from Barishal division. For selection of student sample, 08 primary schools were selected randomly from the four districts of Tangail, Natore, Feni and Pirojpur under Dhaka, Rajshahi, Chattogram and Barishal divisions of Bangladesh. From these primary schools, a total of 392 students who had already completed all the academic activities of five years of schooling and were ready to sit for the PECE examination of 2018 were chosen randomly. Socio-demographic variables such as age, parents' occupation, family income etc. and anthropometry (height, weight) of students were taken.

Academic performance is dependent variables and nutritional status and nutritional knowledge of the students and some of the selected socio-economic variables are the independent variables. As the academic performance are dependent with many factors, it is

important to consider some of those relevant factors along with nutritional status. Therefore, measuring the nutritional effects on academic performance properly, the other factors were considered. Nutritional status was represented by the measurement of height for age (HAZ) and BMI for age (BAZ) which means stunting and thinness of the students respectively.

Nutritional status was calculated by individuals' height for age (HAZ) and BMI for age (BAZ). The academic performance was measured by a set of standardized achievement test developed and used recently by CAMPE, a reputed NGO of Bangladesh. However, the qualitative data were collected from primary school teachers, parents and the education experts to supplement the quantitative data as well as to understand the importance of nutrition on academic performance profoundly. Qualitative data were obtained through interviews and focus group discussion (FGD) of teachers and parents. The in-depth interviews were taken from 08 teachers of 08 schools. A total of four focus group discussion (FGD) consisting of 28 parents was conducted. Besides these, expert opinion was taken from 10 education experts of different organization like UNICEF, World Bank, NCTB, NAPE and IER.

The findings of the study showed that nutrition is one of the major factors which are very important in the academic performance of primary school graduates in Bangladesh. The overall nutritional status was low among the primary school students studied. Around 47 percent to 55 percent of the primary school students in Bangladesh are suffering from different categories of malnutrition. The academic performance of these students was not very satisfactory. Only 10 percent of the students scored 80 percent and above marks in the performance test. On the other hand, around 30 percent of the students obtained less than 50 percent marks. While measuring the nutritional effects on academic performance, it was revealed that students with good nutritional status had performed much better carrying good marks whilst malnourished students did not achieve good marks in the performance test.

Most of the teachers and parents agreed that nutrition plays a vital role regarding the academic performance of the students. However, a notable number of malnourished students had done well in the performance test. In that case, some school and socio-economic variables (individual students' initiatives and concentration, teacher's good care, better teaching-learning environment, parental education, family income etc.) influenced students' performance. In this study, the nutritional effect was mainly focused along with the other selected variables on the academic performance. Stunting and thinness is a major problem among the students of primary school graduates in Bangladesh. Stunting hampers the academic performance of the students significantly. To overcome these problems, the government should take measures to address how to prevent stunting and thinness effectively. Although these issues are well known in other parts of the world, this study is the first attempt to examine and analyze the impact of nutrition in the fifth grade pupil performance in Bangladesh. The study also recommends that to overcome these problems, the government should develop a proper nutrition policy for primary education and implement it thoroughly.

## *Chapter 1*

## INTRODUCTION

### 1.1 Background and Rationale

Bangladesh, possessing an area of 147,570 square kilometers, is surrounded by the territory of India with the exception of a short south-eastern frontier with Myanmar Bangladesh borders the Bay of Bengal to the south. It is one of the most densely populated countries in the world with a population of over 160 million and is now the 7th most populous country in the world (BBS, 2012).

There are 64,122 government primary schools (GPS and NNPS) and 343,066 primary school teachers (GPS and NNPS) in Bangladesh and the total enrolled students at the primary level (Grade 1 to 5) are 18,602,988 (Including all 24 categories of primary schools) in Bangladesh (ASPR, 2017).

However, a good number of primary school students in Bangladesh have been suffering from different forms of malnutrition for many reasons. Large numbers of students in the primary schools of Bangladesh suffer badly from malnutrition due to poor intake of protein, fats, carbohydrates and some essential micronutrients. In Bangladesh, the total number of school students is approximately one ninth of the total population but their nutritional necessities and health status have largely been neglected. A good numbers of students in Bangladesh suffer from stunting and wasting problems, e.g., 43 percent of students under five are stunted and 48 percent are under weight.

Rates of malnutrition in Bangladesh are among the highest in the world. Of the students under 5 years of age (36 percent) approximately 5.5 million students are suffering from chronic malnutrition and 14 percent are acutely malnourished (USAID, 2018). Further, almost 54 percent of preschool-age students, more than 9.5 million students, are stunted (height for age), 56 percent are underweight and more than 17 percent are suffering from wasting (FAO, 2018). Stunting is also linked with long-term negative effects such as impaired cognitive performance. Stunting is mostly the consequence of chronic nutritional deficiency that occurs before the age of 3 years, which is hard to overcome later in life (Fiorentino, 2015).

On the other hand, according to the national nutrition report in Bangladesh, over 50 percent of primary school going students suffers from malnutrition. Bangladeshi primary school students also suffer from high rates of micronutrient deficiencies, particularly vitamin A, iron, iodine and zinc deficiency. Bangladesh should be commended for making significant progress in reducing vitamin A deficiency (VAD) among preschool students over the past 15 years; however, consumption of vitamin A - rich foods is still low, suggesting that the underlying causes of VAD require further attention and support. Anaemia is also highly prevalent among students in Bangladesh and few programs have been initiated to improve their iron status.

There are many reasons for having such status. As nutrition was not considered an essential factor in the primary school curriculum of Bangladesh, implementing nutrition as an important subject at the primary school has been lacking, hence poor knowledge of its effects and advantages.

Around 870 million people of the total of 7.1 billion people (one in eight worldwide) are suffering from chronic undernourishment (FAO, 2012).

A greater number of Bangladeshi students are attending primary school today than ever before. However, recently gathered data recommended that in developing countries like Bangladesh, a large number of school age students are affected by poor health and under - nutrition which influences their learning outcomes. According to the latest estimates, out of the world's 300 million chronically undernourished students, 170 million do not receive meals during school hours and another 130 million do not attend school (WFP, 2017). Two out of every three students in the world who do not go to primary school are girls. There is a growing concern that short-term hunger affects enrolments, attendance and ability to concentrate and thus performance of school-age students. Besides food insufficiency, primary school aged students also experience poor food quality which impedes not only health but also cognitive and social functions. Around 50 percent of school age students in Africa and 58 percent in Asia suffer from anaemia (WHO, 1998). One of the causal factors in anaemia is micronutrient deficiencies, particularly iron, folate, and vitamin A. In addition, iodine deficiency creates the most serious consequences on learning and development (UNICEF, 2002).

Withdrawal of food and discontinuation of breast-feeding while suffering diarrhoea is one of the major causes of the malnutrition among students in developing countries (Khan, *et al.*, 1986). This way of thinking is associated with low consciousness and lack of appropriate education among the parents of the society. Low consciousness and inadequate education create many problems that affect school performance.

Recent estimates based on the WHO global database suggested that 53 percent of school-aged students in developing countries are anaemic (De Benoist, B and Ling, Y 1998). Prevalence is highest in Asia (58.4%) followed by Africa (49.8%). Child anaemia is defined by the haemoglobin concentration <120 g/l among the 5-14 year age group (Talukder, 2002). Iron deficiency anaemia (IDA) is also considered as a risk factor for poor educational

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performance in school students. However, the synergistic effect of IDA in combination with other forms of malnutrition like vitamin A and iodine deficiency and other risk factors like diarrhoea may affect educational performance more strongly. It is obvious to state that any type of malnutrition may affect school performance negatively. Therefore, it has been recommended that IDA and its effects on educational performance be studied in the context of other risk factors. Around 74% of Bangladeshi students aged between 5-14 years are projected to be iron deficient (Pollitt, 1990).

The relationship between nutrition and educational performance of school students is well established. In the developing countries, many students do not enroll at primary schools in time and in many cases, they do not finish primary school and nutritional intervention could be a good solution to prevent this. Besides that, it has been argued that lack of nutrition especially in the early years of life, affects a child's aptitude to learn (Popkin & Lim-Ybanez, 1982; Moock & Leslie, 1986; Pollitt et al, 1993). Therefore, it impacts the educational performance (Shariff et. al, 2000).

Nutrition is a crucial factor that impacts the learning capacity and abilities before and after the child is in school (UNESCO, 1984). Several studies on the correlation between wasting, stunting, under - nutrition and academic performance have been recognized (Pollitt, 1990; Themane et al., 2003; Mukudi, 2003; Ivanovic et al., 2004) and all of them identified a significant relationship between nutritional status and school performance.

A significant number of research studies have been done to measure the association between academic performance and nutrition. However, what appears to be absent is research on how nutrition is connected to educational access and performance among school aged students (Themane et al., 2003). To address educational problems related to cognitive and mental

development, delayed school enrolment, poor learning, low school performance and achievement might be addressed through ensuring good nutrition at school.

The impact of nutrition on educational performance of school-age students in developing countries has been of great interest to many academics because of the recurrent reflection that a lot of students do not finish primary education and those who have did not achieve the required knowledge and skills like students in more advanced countries. Many studies in less developed countries identified that height-for-age, which is an indicator of stunting, is associated with educational performance (Shariff et al., 2000; Glewwe et al., 2001; Alderman et al., 2001 and Aturupane et al., 2013). Thus, height-for-age signifies the effect of nutritional scarcity over a number of years that may impact the academic performance of the students (Shariff et al., 2000).

The nutritional status of a population defines the general health status which impacts the growth and development of a society (World Bank Group, 1997). The academic achievement of students impacts their future educational goals and, therefore, nutrition and health emerge as a general health concern nowadays. There are indicators based on anthropometry i.e. height for age (stunting), weight for age (under-weight), weight for height (wasting) and BMI for age (thinness) which show the nutritional status of school students. BMI is the most suitable variable for assessing nutritional status (Krishnaswamy et al., 2010). Nutritional status is well-defined as the assessment of the state of the nourishment of students (Mosby, 2008). Inadequate daily food intake has a great impact on nutritional status and nutritional status may hamper a student's learning capacity (Ivanovic, et al., 2002). In addition, good academic performance is directly linked with good scores in school examinations. Therefore, it is always a matter of great concern for both students and parents. There is a growing concern among school policy makers regarding the nutritional status of teenagers and its

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impact on their academic performance. So, this becomes an important area of research for this study, especially within the Bangladeshi environment.

As malnutrition is considered one of the major influencing conditions of school performance, improvements are required in all forms of malnutrition, especially for the primary school going students. According to the World Health Organization's criteria the prevalence of under-weight, stunting and anaemia is very high and it causes serious problem in the advancement of school performance (UNICEF, 2006).

Several studies have shown that there is a crucial relationship between nutrition and health status and thus, nutrition may affect the overall activities of individuals including learning processes (UNICEF, 2004). Although nutrition plays a vital role in pupil's achievements, the policy makers in the education sector in Bangladesh rarely consider this as an important issue.

The literature on student's performances in primary schools in the developing countries presents a large amount of evidence on two important underlying dimensions, i.e. school-related factors and home-related factors (Lockheed & Verspoor, 1991). The personal level of education of the teachers, availability of quality text books and other teaching and learning materials and the use of mother tongue as the medium of instruction etc. are among the school related factors. Home related factors consist of the level of education and occupation of the parents, home language, availability of books and other media such as radio or TV (Lockheed and Verspoor, 1991). An important issue in student's learning appears to be the level and quality of nutrition available to the child.

However, the academic performance of students is linked with an organized and well developed curriculum. Increasing studies suggest that nutritional and health status is critical

for attaining high intelligence quotient (IQ) scores, scholastic achievements as well as brain development.

Educationists and experts from home and abroad believe that students are regarded as the best national resource of any country who will construct the future of a nation. On the other hand, education is an instrument for social change and opens up the possibilities of improving the common well-being of the people. Primary education is an important period to build up the awareness and behavior of the child as it is at this stage that an entire new world of optimistic and creative thoughts and ideas open up before them.

Improving nutrition can have a significant impact on survival as well as physical and cognitive development and productivity. Good nutrition, comprising adequate quality, quantity of food intake and reduction of illness is also a basic human right and is an essential input for economic development.

Significant progress has been made in cereal production in Bangladesh over the past decades as it is very much linked with reducing the rates of malnutrition of the people of the country. However, the rapid population growth and resulting high and growing food requirements pose a difficult challenge given the limited availability of cultivable land in Bangladesh. Recurring disasters further complicate the stability of food production. Recently the government of Bangladesh and interested organizations has started to encourage non-cereal food production and consumption along with food self-sufficiency. Greater attention is being given to supportive policies for agriculture input, research on non-cereal crops, and commercial and homestead promotion of poultry and fruits/vegetables are receiving greater attention. There is a clear need to diversify food sources both in terms of land/environmental sustainability, development of the rural economy and increased consumption to achieve improvements in the nutritional status of the people of Bangladesh.

According to the current enrolment rate, the primary education system of Bangladesh is one of the largest educational enterprises in the world where nutrition should be emphasized more as an important area of research in the primary education sector of Bangladesh.

However, most of the educationists and policy makers are concentrating on school factors like developing and formulating new text books, teacher training etc. and seldom thinks about nutrition and health status.

Although, school feeding programmes have been initiated in some of the areas in Bangladesh, much research is needed in the field of nutrition and its relation to education in Bangladesh.

Bangladesh has a large primary education system with about 20 million students. There has been major expansion with near-universal access, but students' learning outcomes remain a major concern. Among many factors, students' nutrition and health may be an important factor affecting participation in education and learning and learning outcome, which this study aims to investigate. So, it is appropriate to explore further and pursue research within the field of nutrition education and its impact on academic performance in Bangladesh.

## 1.2 The Research Problem

The evidence that nutrition has such an important role to play in pupil achievement persuaded the researcher to investigate what actually happens at the primary school level in Bangladesh.

Thus, the research problem is framed as "The impact of nutrition in the academic performance of primary school graduates in Bangladesh."

**1.3 Research Questions**

In order to determine the impact of nutrition on the academic performance of primary school graduates in Bangladesh, the following research questions have been formulated.

- What is the nutritional status of the primary school completers of Bangladesh?

- How do the primary school completers perform in academic performance tests?

- What are the relations between performance test results and nutritional status?

- What relationship exists between some other defined factors (nutrition knowledge, family income, parents' occupation and parents' education) and academic performance of the students?

- How important is nutrition of primary school children for their academic performance?

**1.4 Operational Definition of Key Terms Used in the Study**

**1.4.1 Nutrition**

Nutrition is the intake of food, considered in relation to the body's dietary needs. Good nutrition – an adequate, well balanced diet combined with regular physical activity – is a cornerstone of good health. Poor nutrition can lead to reduced immunity, increased susceptibility to disease, impaired physical and mental development and reduced productivity. Nutrition is the process of a living being's capability to eat foods and use the mechanism of those foods to fuel expansion and development. We need good nutrition to be healthy (Rolfes et al., 2014).

The study of nutrition may be defined as the science of food and its association with health. It is connected primarily with the part played by nutrients in bodily growth, development and

maintenance. The word *Nutrient* or "food factor" is used for specific dietary constituents such as proteins, vitamins, and minerals (Park, 1997).

The people who do not take proper and sufficient food may suffer from malnourishment. This malnourishment, however, affects all the developmental feature of the students as well as their educational performance. Malnutrition or under nutrition occurs by not taking sufficient nutrients and energy to meet an individual's requirements. The criteria used to describe malnutrition are variable and there is currently no universally established method (Elia, 2000).

Food and nutrients supply the energy and building materials for the innumerable substances that are critical to the growth and survival of living beings. The manner in which nutrients affect fundamental parts of the body and contribute to its function depends on the physiological and biochemical processes that govern their actions. Protein, fats and carbohydrates all supply the total energy pool, but the energy that they contribute is all in the same form. Exploitation and preservation of this energy to build and keep up the body requires the involvement of vitamins and minerals. They function as coenzymes, catalysts, and buffers in 'the miraculous watery arena of metabolism' (Kasdan, 2000).

Nutrition is a fundamental pillar of human life, health and development across the entire lifecycle. Proper and well balanced nutrition throughout the life-cycle is very important in maintaining health. The nutritional status of an individual can be assessed at all stages of the life-cycle from intrauterine growth to birth, through infancy, childhood, adolescence, and into adulthood and old age. The nutritional status of primary school students is often neglected and yet they are at a stage in the life- cycle that requires much attention. Nutritional status for this age group can be assessed using measures of wasting, stunting, underweight or overweight (Mushonga *et al*., 2014).

## 1.4.2 Nutritional Status

The condition of the body as influenced by the diet, the levels of nutrients in the body and the ability of those levels to maintain normal metabolic integrity is defined by the term 'nutritional statuses'. A good nutritional status means that you have a healthy body without physical signs of nutrient deficiency and your blood work indicates that you have adequate protein stores and all other levels are in balance and you have access to regular balanced meals that you can eat without issue (National Nutritional Council, 1994).

## 1.4.3 Malnutrition

Malnutrition refers to deficiencies, excesses or imbalances in a person's intake of energy and/or nutrients. The term malnutrition covers two broad groups of conditions. First is 'under nutrition' which includes stunting (low height for age), wasting (low weight for height), under-weight (low weight for age) and micronutrient deficiencies or insufficiencies (a lack of important vitamins and minerals). The other dimension is over-weight, obesity and diet-related non communicable diseases such as heart disease, stroke, diabetes and cancer.

Malnutrition is defined as a spectrum of nutritional status which covers a range of nutritional disorders- at one end under-nutrition and at the other end over-nutrition and in between growth failure. The leading cause of malnutrition is a lack of protein and energy in childhood or it may occur in pre-school or adolescent phases of life. Lack of some vitamins and micronutrients in food is also a contributory factor to malnutrition and for growth failure in early life (Morley, 1994:297-304).

Under-nutrition is closely linked with socioeconomic development of a community and it is most common in the poorest countries with a large population living in poverty in rural areas. In rural areas of poor countries, malnutrition is endemic and often seasonal. This is related to

a period of the year when food for the whole family is in short supply. During this limiting period the malnourished child may suffer from frequent infections. Other factors also contributing to malnutrition are unavailability or inadequacy of resources for the afflicted families. Every rural community has certain natural or human resources as well as certain potential for production. The proper use of resources may be affected by social, political, technical, ecological, cultural and other constraints. So, malnutrition may manifest itself as a health problem. To solve this problem requires ensuring enough foods and the right kinds of food are produced and supplied. Education both formal and non-formal is required to assist people, particularly women in achieving and ensuring good nutrition (FAO, 1997).

### 1.4.4 Health Status

This term refers to a state of complete physical, mental and social well-being and not merely the absence of disease or infirmity in the human body (WHO, 2007).

### 1.4.5 BMI

Body mass index (BMI) is a value derived from the mass (weight) and height of an individual. The BMI is defined as the body mass divided by the square of the body height and is universally expressed in units of kg/m2, resulting from mass in kilograms and height in meters (WHO, 2007).

### 1.4.6 Growth Indicators

Growth indicators are used to assess growth considering a child's age and measurements together. This term indicates how to interpret the following growth indicators for a child:

- ➢ Height for Age (HAZ): Stunting
- ➢ Weight for Age (WAZ): Wasting
- ➢ BMI for Age (BAZ): Thinness

 (WHO, 2017).

**Stunting (HAZ)**

Height-for-age reflects attained growth in length or height at the child's current age. This indicator can help identify students who are stunted (short) due to prolonged under- nutrition or repeated illness. Students who are tall for their age can also be identified, but tallness is rarely a problem unless it is excessive and may reflect uncommon endocrine disorders (WHO, 2017).

**Wasting (WAZ)**

Weight-for-age reflects body weight relative to the child's age on a given day. This indicator is used to assess whether a child is underweight or severely underweight, but it is not used to classify a child as overweight or obese. Because weight is relatively easily measured, this indicator is commonly used, but it cannot be relied upon in situations where the child's age cannot be accurately determined, such as refugee situations. It is important to note also that a child may be underweight either because of short height (stunting) or thinness or both (WHO, 2017).

**Thinness (BAZ)**

BMI (Body Mass Index) for age is an indicator that is especially useful for screening for thinness, overweight and obesity (WHO, 2017).

**1.4.7 Primary School Graduates**

The students who have completed five years of schooling, sat for the PECE examination and then received certificates from the relevant primary education authority are called 'primary graduates'. But, in this study, the students who have already completed all the academic activities after five years of schooling and were ready to sit for the PECE examination of 2018 have been considered to be primary school graduates.

### 1.4.8 Academic Performance

Academic performance refers to the competencies achieved by the fifth grade students after five years of schooling which covered most of the prescribed terminal competencies of the primary level. The competencies are measured by a standardized test. These competencies are classified by grade from A+ to F (According to the PECE grading system). In this study, the academic performance of the sample students includes those who obtained different scores from the standardized test administered by the researcher.

### 1.5 Significance of the Study

The study is designed as an initial exploration to understand the concepts of nutrition and education as well as to find out the impact of nutrition on the academic performance of primary school graduates in Bangladesh. The methodology chapter indicates in more detail exactly how the study is to be carried out, the size of the sample and what conclusions can be drawn from the findings. As rather a limited amount of literature exists regarding these issues in the context of Bangladesh, this study may be seen as a 'door-opener' shedding more light on what the researcher believes to be an extremely important but much neglected aspect of primary education in the country. As there have been very few studies in Bangladesh regarding this issue at the primary level, the findings of this study are expected to provide new understanding and knowledge regarding nutrition and education for those who may benefit from this knowledge. These stakeholders are parents, school teachers and education managers who have to take appropriate care of the young students. The findings may also create awareness among the policy makers in the education sector which may lead to appropriate policy and action steps for improving learning outcomes of students of primary education in Bangladesh.

## 1.6 Delimitation of the Study

This study will be limited to the following areas of sample selection:

Out of 08 administrative divisions of Bangladesh, this study has been limited to only four divisions, namely Dhaka, Chattagram, Barishal and Rajshahi. There are 64 districts of Bangladesh at present. Of them, only 04 were from the selected division chosen. This study is kept limited to only 08 primary schools. Thus, the findings of the study may not be treated as a generalized picture of the whole of Bangladesh.

## 1.7 Organization of the Study

The study consists of six chapters. Chapter one is the introductory part focusing mainly on background and rationale, purpose of the study and research questions. Chapter two deals with a review of related literature that sets the conceptual framework in considering the research questions. Chapter three outlines the research methodology that helps to achieve the objectives of this study. Chapter four analyses the collected data using SPSS and WHO anthro-plus software and describes the details of the findings and results and also their implications. Chapter five focuses on discussion of the research findings. Chapter six indicates major findings, conclusion and recommendation of this study.

## *Chapter 2*

# REVIEW OF RELATED LITERATURE AND RESEARCH STUDY

**2.1 Prologue**

The review of relevant literature is an essential early task of any research study. Mangal & Mangal (2013) stated, "Research is a constantly and continuously evolving human pursuit for seeking excellence and development in the field of knowledge and experience. Every research is built upon the work of previous researchers and paves the way for future researchers (p. 237)."

This review of the literature has helped in designing the methodology, analysis and interpretation of the present research. Selected books, journals, research reports and articles were reviewed and organized thematically into different categories on the basis of the research questions. This literature review contains brief summaries and findings with citations. These are accumulated into the following major themes:

- Nutrition and Cognition

- Nutritional Status and Academic Performance

- Nutritional Status and Anthropometric measurements

- Nutritional Status and Socio-economic Status

- Nutritional Status and Co-Curricular Activities

- Food Insufficiency

The review summaries are presented in the following sub-sections based on the themes listed above.

## 2.2 Nutrition and Cognition

### 2.2.1 Overview

In considering improvement of the quality of education and pupil performance, attention has been generally given to infrastructure and school facilities, the curricular content and what goes on in the classroom. However, the learning achievement and performance of students have not improved in most developing countries to the extent desired and expected (World Development Report, 2019). Access to school at the basic level has expanded very substantially, but the quality of learning is considered a major problem in most developing countries including Bangladesh. In seeking solutions to this concern, the characteristics of the children, such as their own physical and mental attributes as well as the home and family circumstances they come from, have received the attention of researchers and policy-makers.

Most of the educationists of the 1960s believed that development of infrastructure would be the best means of expanding education. Most of the countries of the world emphasized building more schools speedily as the wisest way to extend education to the general population.

In the 80s, educationists assumed that the building of schools alone is not adequate to deliver education to the mass of the people. At that time, they felt that what is happening within the school house is more significant. For this reason, reform and restructuring focused on the development of curriculum, education and training of the teacher and also improvement of teaching learning materials etc.

In this century, we have tried to ensure provision of good school buildings, enhanced curriculum and teacher instruction, striking and relevant learning and teaching materials but quality primary education is still very problematic in the global South. What is the unknown

reason for that? It may be embedded in the home variables and it might be health and nutrition of the students.

Nutrition and health problems disrupt the quality of the biochemical organism of the child and slow down the achievement of skills and abilities needed for progress in the primary school. A child who is malnourished cannot benefit fully from the best instructional materials. A malnourished child, whose nutrient and energy intake does not meet basic health necessities, is likely to be educationally disadvantaged (Levinger, 1996).

Nutritional status, health and hunger intensity influence the active learning capability of students significantly at the primary school level. A huge number of students are malnourished at the time of their birth and it affects them acutely when they begin to attend the school. In addition, some of the students are under pressure from hunger as they do not get enough food to satisfy their demand. Besides that, a large number of students in Bangladesh are likely to attend the school without taking any breakfast in the morning and that affects their short term cognition and it ultimately impacts their academic performances.

Crooks (1995) addressed the question of hunger and its impact on school activities in his review of the literature on interrelationships among diet, physical growth, verbal improvement and school performance. He pointed out that the effects of diet on school performance are not well documented. Most of the studies revealed that even in moderately well-nourished populations in the United States, provisional hunger (as opposed to malnutrition) adversely affects attention, learning, and awareness.

### 2.2.2 Additional Factors

There are several factors affecting learning that must be considered along with nutritional and health status, such as socio-economic factors, level of parental education and overall home environments. The majority of the students stay at home in their leisure time and how this leisure time is utilized is very important. However, nutrition appears to be the most important variable within all other home variables in order to achieve better performance at school. Some of the micronutrient factors like iodine, zinc and iron largely affect their cognition. Ultimately nutritional status affects long term learning capability and memory of a student. Besides, a good number of students who suffer from malnutrition eventually drop out from the school as they may suffer from illness created by malnutrition. Therefore, nutrition plays a significant role in school performance from both the qualitative as well as the quantitative points of view.

On the other hand, Goethe found that weak students do better when grouped with other weak students. As implied by Zajonc's analysis of older siblings (1976), it showed that students' performance improved if they are with students of their own kind.

There are often different results according to gender, as in Hoxby's K-12 results (2000); Sacerdote (2001) identifies that grades are higher when students have unusually academically strong roommates.

Nutritional status directly influences the outcome of the schools both quantitatively as well as qualitatively. However, malnourished children often suffer with physical weakness and diseases. Therefore, they may have been absent from the teaching learning environment for a number of days in the academic year and in many cases they drop out.

A good school plant and high quality instruction cannot create the future educational outcomes when students are very sick, weak, or very abstracted to learn. When there are many such students enrolled in primary school, the education sector performs incompetently, best possible returns on investment are not achieved, and advancement toward a wide range of development goals is forestalled. If a good numbers of students are no longer participants in the recognized school system because their health and nutrition status have rendered reasonable academic progress an unattainable goal, the result is development, and dreams, hazardously delayed (Levinger, 1996).

Various researches also focus on the relationships between nutrition and brain function and have shown the impact of dietary foundations on normal brain functions. Neurotransmitters (known as chemical messengers within the brain) have been studied in conjunction with nutrition. Growden and Wurtman (1980) recommended that the brain needs to be seen as being affected by nutrition. The concentration of amino acids and choline (in the blood) which let the brain create and use many of its neurotransmitters such as serotonin, acetylcholine, dopamine, and epinephrine means the brain, is not an autonomous organ, free from other metabolic processes in the body. For being able to make the right amount of amino acids and choline, food consumption is essential to the brain. These substances are two precursor molecules obtained from the blood that are needed to ensure the brain's normal functioning. It is no surprise that the brain is directly influenced by the food especially in terms of what we eat (Colby-Morley, 1981). Wood citing Kretsch et al. (2001) showed further possibilities that our nutrition has a role that affects our cognitive functioning. Studies on school-aged students Indicated that there is a direct correlation between poor nutrition and lowered school performance. In addition, iron also plays an important role in brain function. Kretsch et al. cited that iron has an impact on concentration from a study done with men aged 27 to 47 that looked at this issue. Subjects scored low on a concentration test corresponding

with lowered levels of iron in their bodies. A correlation was found between low iron levels in students with poor attention span; students with iron deficiency anaemia have been shown to have short attention spans. Kretsch et al. also found that zinc (another type of nutrient) had a role in cognition, especially with regard to memory. Scientists found in a test of mental function called verbal memory that because of a low-zinc diet volunteers' ability to remember everyday words slowed significantly after only three weeks (Wood, 2001). Erickson (2006) identified five key components required to keep the brain functioning properly.

The substances that we get from food are important for brain development and function. Foods such as meat, fish, milk, and cheese etc. contain proteins. Proteins are used to make most of the body's tissues including neurotransmitters - working as chemical messengers that carry information from brain cells to other brain cells. Protein deficiency, also known as Protein Energy Malnutrition, leads to poor school performance by students and causes young students to be lethargic, withdrawn, and passive, all of which help affect social and emotional development. Carbohydrates (commonly found in grains, fruits, and vegetables) are broken down into glucose (sugar) from where the brain gets its energy. Fluctuating levels of carbohydrates is responsible for dizziness and mental confusion, both of which can affect cognitive performance. If anyone wants to feel more calm and relaxed, he has to eat a carbohydrate-heavy meal because of serotonin's (a brain chemical) effect on mood. Serotonin is formed within the brain through the absorption and conversion of tryptophan. Tryptophan is absorbed within the blood and this absorption is amplified with carbohydrates (Erickson, 2006). Erickson also affirmed that fat makes up more than 60 percent of the brain and acts as an envoy in partial control of aspects such as mood. Omega-3 fatty acids are very essential for the best possible performance of the brain. Lack of Omega-3 fatty acids in the brain can lead to depression, poor memory, low IQ, learning disabilities, dyslexia, and ADD. So, it is

important to consume certain foods like fish and nuts to ensure an Omega-3 fatty acid diet (Erickson, 2006). For the brain's normal functioning Omega-3 fatty acids are crucial. The article states that a scarcity in Omega-3 fatty acids can lead to increased risk of attention-deficit disorder and dyslexia. According to Gomez-Pinilla, students performed better from others in reading, spelling, and had fewer behavioral problems because they had an increase of Omega-3 fatty acids (Wolpert & Wheeler, 2008). Wolpert and Wheeler also highlighted a study in England that found a group of students improved their school performance form others by receiving Omega-3 fatty acids. The article also describes an Australian study of 396 students between the ages of 6 and 12 who were given drinks with Omega-3 fatty acids along with other nutrients like iron, zinc, folic acid and vitamins A, B6, B12, and C. These students showed higher scores than a control group of students who did not receive the drink on tests measuring verbal intelligence, learning skills, and memory after six months and one year (Wolpert & Wheeler, 2008). Erickson (2006) also mentioned vitamins and minerals as important substances for the brain's functioning. In this case, vitamins A, C, E, and B complex vitamins are the most important. Minerals like manganese and magnesium are essential for the functioning of the brain; sodium, potassium and calcium play a role in message transmission and the thinking process.

In the Wolpert and Wheeler article, Gomez-Pinilla recommended that diets high in trans fats (found in common fast food and most junk foods) and saturated fats negatively affect cognition. Junk food especially through these trans fats affects the brain synapses as well as many molecules that aid in learning and memory. A diet (comprises low in Trans fats and high in Omega-3 fatty acids) can strengthen synapses and give cognitive benefits (Wolpert & Wheeler, 2008).

Wolfe and Burkman (2000) began their work by developing an equation: good nutrition + exercise = optimal learning. They uphold the following questions with research:

- How does breakfast help students do better in the classroom?

- Can certain foods boost a child's learning or memory?

- Do supplements assist students perform better in the classroom?

Wolfe and Burkman cited research that confirmed proper nutritional support is essential to permit the brain to function at its highest ability and to enhance learning. Wolf and Burkman recommended that it did not take expensive foods and supplements to help students reach their potential; healthful nutritional habits learned early in life helped encourage normal physiological and neurological growth and development, which translated into students' achieving optimal learning, defined as the ability to recall information, to solve problems and employ critical thinking.

### 2.2.3 Health, Well-being and Learning

To conclude Wolfe and Burkman's findings, the performance possibilities of students are very dependent upon their health and well-being; minds that have been given the proper nutrition will perform better on tests and general classroom tasks. Lahey and Rosen (2010) furthered the research that learning and behavior are affected by nutrition and recommended that diet can influence cognition and behavior in many ways, which include the condition of not enough nutrition or the condition of the lack of certain nutrients. About one-third of students who completed a food-habit questionnaire had insufficient fruit and vegetable intake. These students also showed poor school performance as compared to those students who had reasonable intake of fruits and vegetables.

Malnourished students posted lower results than the adequately nourished students but they did show age related improvement for these same activities. Differences were examined for statistical importance. Test scores for passably nourished students between 5- to 7- years old

and 8 to 10 years olds were found meaningful but most of the test scores for undernourished students showed a delay in improvement of particular cognitive functions.

Kar et al. (2008) findings should be re-examined with a bigger sample of students to see if the trend is consistent with not only malnourished and adequately nourished students but those who are corpulent from an insanitary diet. Li, Dai, Jackson, and Zhang (2008) scrutinized the connection between academic performance, cognitive functioning, and increased BMI. They perused a nationally representational sample of 2,519 students' ages eight to sixteen years old. Each respondent had finished a brief neuropsychological battery and measures of height and weight. Qualified examiners conducted tests in a standardized atmosphere using uniform measures. Body weight was calculated to the nearest 0.05 kg and height was calculated to the nearest 0.1 cm. BMI was measured in kilograms per meter square and then transformed to a sex and age particular BMI percentile. Each participant was then grouped to an overweight BMI, an at-risk BMI, or a normal BMI. Parent-reported procedures of student's TV watching habits were also observed. Students were inquired to report how many times per week they played or practiced enough to hydrosis or breathe hard. This question did not rule out school attachment, but another question about sports and exercise did. Students were then grouped as a contribution group or noncontributing group. Blood pressure, cholesterol, serum triglycerides levels, and iron deficiency were also measured. Iron insufficiency has been known to be associated with poor cognitive function, and a high incidence of iron deficiency was observed among overweight and overweight students and adolescents.

Participants' average age was 12 and they were about equally segregated by gender. The subjects incorporated disagreed on most of the characteristics from the subjects excluded. Those excluded were apparently non-white and their families' held a low socio-economic status. 20.33 percent were grouped as overweight and 15.92 percent were obese among the participants. Li et al. (2008) claimed the correlation between BMI, cognitive functioning, and

academic performance to be noticeable. Test scores reduced as BMI increased. The block design test had the greatest incongruity among participants with 5.04 percent of normal weight students scoring poorly, 9.19 percent of at-risk students scoring poorly, and 12.18 percent of obese students scoring poorly. Test scores were termed as poor when they were less than 2 standard deviations from the mean. The probability of poor performance in visuospatial organization and general mental ability were doubled among at-risk students and tripled among overweight students when compared to normal weight students.

## 2.2.4 Standardized Testing

Academic performance was standardized by a test intended to assess basic school performance. Li et al. (2008) found that being overweight was not the basic cause of poor academic performance but observed that obese adolescents identify themselves as worse students. Another result from the study was that abated cognitive function was connected with increased weight status. Cognitive scarcities on tests of motor speed, weakened performance on motor speed and manual dexterity, and executive function were found. Poor performance on memory activities was also familiar among obese people. Those with poorer cognitive ability may do worse in school and opt for a standard of living that supports weight gain. This study confirmed that this involvement may be present among overweight students or students at risk of being overweight without clinically diagnosed diabetes mellitus, vascular disease, or cardiac disease that often differentiate mature patients. Li et al. also mentioned a relationship with decreased block design and weight. Block design is a process of visuospatial organization and general mental ability which has been revealed to be sensitive to brain injuries. Results showed that the adverse effects of increased body weight on cognitive function start appearing as early as childhood. Cognitive function turn down may take place in younger persons and findings give the idea that an increase in body weight

worsens other risks factors for cardiovascular disease as time passes. One of the most lasting outcomes of iron insufficiency in students is the change of behavior and cognitive performance. Halterman, Kaczorowski, Aligne, and Szilagyi (2001) pointed out the affiliation between iron scarcity and cognitive test scores among school-aged students and adolescents.

## 2.2.5 School, Home and External Variables

There are several factors involved in the learning process such as school and home variables, political situation, democratic society, social and community awareness, mass media etc. However, nutrition is a fundamental issue in the learning process and could be affected by any of the above variables. Nutrition seems to be an important part of home variables and at the same time, it is a part of school variables. The fundamental nutritional knowledge comes from the home originally but primary school could be a proper place for spreading nutritional knowledge as well. In this way, nutrition could be an important topic to learn at the primary school and eventually, it will influence people from all walks of life and it will be considered as a social campaign and community based nutrition education program through inspiring the local people of the respective society.

Meals or lunch programmes at the school should be provided as an educational process, on condition that valuable opportunities to apply what students study in the school environment join with other policies that help to make achievable a positive school environment. Community trials suggested that nutrition education is an attainable, efficient instrument in health support programmes with a gathering point in the progress of healthy eating practices (Perez-Rodrigo C *et al.* 2001).

Health education is a compulsory subject in the schools in some developed countries such as USA, UK, Australia, and China, initially from primary school. Nutritional knowledge is

taught to the school students, but very little research has been made in relation to nutrition and school achievement (Jiang XQ *et al.,* 2000).

However, the nutritional awareness of Bangladeshi primary school students is very low. Malnutrition is a very ordinary scenario among the school students in Bangladesh. Action related to the feeding of young students has much to do with the serious problem of malnutrition in Bangladesh.

These could be an important step forward for designing and implementing school-based interventions. Nutritional policies might comprise the provision of nutrition education focusing on largely prevalent nutritional problems and its good practices. For instance, breast feeding support in the primary school premises and the provision of adequate maternity leave to the school teachers can set good instance for students and communities. Usually, all students should have at least a snack or a meal while they are at school. In many situations, policies on parental and community involvement in specific aspects of health and nutrition programmes may be useful (UNICEF, 2002).

The primary school is a good place to foster nutritional knowledge along with usual learning activities. Competence-based nutrition education programme could be taught in the primary school and it would be a better solution for primary school students in terms of nutritional knowledge as their learning process.

Nutrition has a long term effect on student's school performance as well as their future productive life. Malnourished students normally suffer from several health complications and therefore they cannot continue their prolific life. Well-nourished students can easily concentrate on their learning and as a result, they do better and their learning would be more sustainable than that of malnourished students. Those students who are in better health are generally considered to improve school performance, and also post-school productivity. In

that way, there is good evidence that nutrition directly affects school achievements as well as their working life in future (Alderman, 2001).

Developed nutritional condition has a positive and direct impact on academic performances. When student's fundamental nutritional and fitness needs are met, they have the cognitive energy to learn and achieve.

Research revealed that healthy, well-nourished students are more prepared to learn, more likely to attend school and class, and having the ability to take advantage of educational opportunities.

Glewwe (2001) had undertaken a longitudinal analysis of early childhood nutrition and academic achievement: A total sample of 3289 students born between May 1, 1983 and April 30, 1984 were randomly selected in 33 barangays (districts) in the Philippines. Better nourished students performed significantly better in school, partly because they came to school earlier and thus had more time to learn.

There is research evidence that school breakfast programs improve attendance rates and decrease tardiness. Among severely undernourished populations, a school breakfast program, logically and intuitively appears to be an ideal program to improve academic performance and cognitive functioning of children.

Acham (2010) studied nutrition, health and academic achievement of primary school students in Uganda. The population studied consisted of primary school students in class 4, between the ages of 9-16 years. This study reported that though many factors played a role in determining a child's educational outcomes, a child's health and nutritional status are factors that influence educational achievement.

Ross (2010) undertook a study on nutrition and its effects on academic performance. The aims of this study were to rethink existing literature about past research that highlighted nutrition and its relationship to brain function, cognition, learning, and social behaviors. The results supported the important link between nutrition and learning potential. Healthy eating is essential for students to achieve their full academic potential, mental growth, and lifelong health and well-being.

Schmunk (2010) had conducted study on realizing the relationship between nutritional status, obesity, and academic achievement. To identify the relation between social class, nutritional status, school meal programs, physical fitness of students, and academic achievement. Multiple methodologies both quantitative and qualitative were triangulated. The result expressed a statistically valid and valued relationship between physical fitness and academic performance.

Abudayya et al. (2011) has made a research on the associations between dietary intake, nutritional status and school performance among 932 adolescents aged 12–15 years were evaluated in a cross-sectional survey by using questionnaire in 2002 in north Gaza Strip. The results drew a conclusion that Adolescents eating fruit and vegetables more than 3 times per week were more likely to have good school performance (72.6% versus 59.9%). When adjusting for socioeconomic variables and BMI, fruit and vegetables intake was positively associated with school performance and stunting was negatively associated. The findings of this study badly state a broader implementation of school nutrition programs.

All of the above research reviews supported the hypothesis that student performance depends on different socio-economic, psychological, and environmental factors. The findings of research indicated that student performance is affected by different factors. It is in part related to the concept of learning achievement. A new paradigm about learning assumes that all

students can and should learn at a high level, and that their cognitive ability should not be considered as constraint because there are other factors like race, gender, sex which can affect student's performance (Hansen, Joe B., 2000). Some researchers have emphasized the linkage between students' achievements, economic circumstances and the risk of becoming a drop out. There is substantial evidence further explained that student performance is very much dependent on Socio Economic Background (SEB) (Beaumont –Walters, Yvonne and Kola Soyibo, (2001).

The research evidence shows a relation between nutrition among school-aged students and their performance in school, though it is mediated and influenced by other socio-economic factors (see below).

## 2.3 Nutritional Status and Anthropometric Measurements

Nutritional status is a significant index in measuring quality of life. In this context, realizing the nutritional status of students has far-reaching implications for the better development of future generations. Growth monitoring is used worldwide to examine nutritional status, health and development of individual students and also to assess overall nutritional status and health of populations. Compared to other health assessment mechanisms, assessing child growth by anthropometric measurements is comparatively inexpensive, easy to work with and non-invasive. Anthropometric examination is an essential tool in any research to measure health and nutritional condition in childhood. Physical assessments like body weight, height, circumference of arm and head, triceps, skin fold of students have been massively used to specify health and nutritional condition of communities. Linking age, body weight and height, important measures of nutrition such as height-for-age and weight-for-height can be derived.

A plethora of studies based on anthropometric measures have identified children's nutrition problems in South Asia. A few will be cited below.

Pandel et al. (2000) made a study of health status of school students with l sample of 776 students aged 5-16 years in Ludhiana, in the Punjab State of India. It showed that girls of all age except those of 14 years had lower mean weight for age compared to that of Indian Council of Medical Research (ICMR). The height for age was also less in both boys and girls than the standard.

Reddy and Rao (2000) had conducted a study on dietary habits, food consumption and nutrient intake among the Sugali, a tribal population of Andhra Pradesh, India. The sample consisted of 492 males and 474 females (drawn from 200 families) in the age group of 1–60 years. It reported that the mean consumption of different foodstuffs by various age groups compared to the Recommended Daily Allowance (RDA) was massively insufficient. During preschool ages, Sugali boys and girls suffered the largest deficiencies in their nutrient intakes.

Sunita Kumari (2005) had conducted research to examine the nutritional status of school going students from Bihar. The findings of the study pointed to a high incidence of malnutrition as shown by anthropometry. Increases in height and weight were found more among the girls than among the boys although there was not much variation in intake of food and nutrients.

Bharati et al. (2005) conducted a study on anthropometric measurements of 560 school students in Raichur, India. Height was assessed by using a portable height rod and weight by personal weighing balance. Mid Upper Arm Circumference (MUAC) was recorded with the help of flexible non-stretchable steel examining tape to the nearest 0.1 cm. The height and weight assessments were compared with National Center of Health Statistics (NCHS) standards. On the basis of these indices students were categorized into different degrees of

malnutrition. The results showed that the nutritional status of the students from rural and urban areas was lower than the NCHS standards; girls showed lower measurements than boys.

A research study was done by Medhi (2006) to evaluate the growth and nutritional status of school age students (6-14 years) of tea garden workers of Assam in India. Compared to NCHS standard and affluent Indian students, the mean height and weight of tea garden students was superior for students of all ages. Examination of nutritional status using WHO suggested anthropometric indices showed a BMI value of less than the 5th percentile of reference data was considered. The results showed that wasting, stunting and underweight was 21.2 percent, 47.4 percent and 51.7 percent respectively among the students in the age group of 6-8 years. Preponderance of stunting and thinness was 53.6 percent and 53.9 percent respectively among the students in the age group of 9-14.

Goon et al. (2011) had undertaken a study on anthropometrically determined nutritional status of urban primary school students in Makurdi of Nigeria. 2015 people were the sample for this study (979 boys and 1036 girls), aged 9-12 years, attending public primary school in Makurdi on assessment of nutritional condition by anthropometric parameters measurements such as height and weight. The results of this study were assessed by using the 2007 World Health Organization BMI thinness classification; the majority of the students exhibited Grade 1 thinness (77.3%), which was predominant at all ages (9-12 years) in both boys and girls. Gender wise, 79.8 percent of boys and 75.0 percent of girls fell within the Grade I thinness category. Based on the WHO classification, 31.3 percent students were severely malnourished.

Srivastava et al. (2012) had conducted a study on nutritional status of school-age students in the age range 11-13 years, from urban slums of Bareilly, Uttar-Pradesh (UP) in India by

using a pre-designed and pre-tested questionnaire, anthropometric measurements and clinical examination. The results have been found that the risk of malnutrition was much higher among students living in joint families, students whose mother's education was (less than or equal to) 6th standard and students with working mothers.

It is important to mention here that measuring the nutritional status of school children and its effect on children's learning has not been given much attention in the previous years unless some initiatives were undertaken, namely the school feeding programme in some areas of Bangladesh. However, the national school meal policy, 2019 has been drafted recently and here emphasized much importance on nutritional issues of primary school children of Bangladesh.

## 2.4 Nutritional Status and Socio-economic Condition

Both the socio-economic status of the family and social welfare of the community as well as the effectiveness of the health care system are directly related to the nutritional status of students. The macro level relationship between poverty and child malnutrition is well known with the risk factors for poor nutritional status basically overlapping with the correlates of poverty. A more complex relationship between social and behavioral elements and malnutrition exists that affects child feeding and rearing and eventually children are learning.

In developing countries, important determinants of malnutrition are socio-economic and environmental conditions, together with feeding practices. A study was conducted by Mujeeb and Visweswara (2000) on variations in dietary pattern and nutrient intake of 450 families with 2276 individuals, between 0-50 years age group at Hyderabad, India. The outcomes of the study indicated intakes of almost all nutrients lower than requirements among low income

families whereas upper, middle and high income families consumed more than the recommended amounts.

Another study was carried out by Akhtar *et al*. (2001) with a view to comparing nutritional status amongst students of 5 to 10 years of age of different socio-economic positions. The study was conducted at schools of Faisalabad city in Pakistan for almost 4 months. The results showed that parameters studied were good pointers of nutritional evaluation except height which was subject to a delayed nutrition effect. Further, height had substantial contrary relationship with TSFT (triceps skin fold thickness) in malnourished students but not in well-nourished ones.

Impact of socio-economic aspects on nutritional status of students in a rural community of Osun State, Nigeria was studied by Adejuyigbe et.al (2002) who selected a total of 420 students from 344 households. The outcomes of the study specified that Protein Energy Malnutrition (PEM) was the foremost childhood public health menace in the state and effective child health promotion was needed to be planned and implemented by the local government authorities.

Babar *et al.* (2010) made a focus on the impact of socio-economic factors on nutritional status in primary school students. It was a cross sectional survey conducted at Lahore in Pakistan from February to August 2005 among primary schools from public and private sectors to assess the nutritional status of primary school going students' age between 5 and 11 years belonging to different socio economic classes of the society. The results have shown that the nutritional status of students from lower socio economic class has been poor compared to their classmates from higher socio economic classes.

Sowpackiarani (2011) conducted a study focused on the effects of socioeconomic status on the nutritional and health status of selected elementary school students aged 6–10 years in

Ramanathapuram district of Tamil Nadu State in India. The students were drawn from standard I to standard V for every school. Two students per class (one boy and one girl) were selected randomly, for the execution of the study. The findings of the study showed that socioeconomic status is closely related to the nutritional status of students.

## 2.5 Nutritional Status and Co-Curricular Activities

All-round development including intellectual development is not the domain of the cognitive elements of the curriculum and classroom activities alone. Student learning and development can be judiciously realized by co-curricular activities. Co-curricular or extracurricular activities, as they are sometimes called, include stage performances, sports, student newspapers, literary expressions, acting and drama, music and other cultural activities.

Co-curricular or extra-curricular activities, if appropriately planned and carried out, provide the opportunity to practice and cultivate what is taught in the classroom, apply knowledge and skills in practical situations in the various activities, create an environment for learning with joy and excitement, exercise creativity and imagination by students, and help students in social and emotional development. To the extent nutrition and health behaviour is as much a matter of knowledge and information as one of lifestyle and attitudes, co-curricular activities are an opportunity for promoting nutrition and health behaviour of students.

Zacherman (2010) conducted a study on the relationship between involvement in extracurricular activities and academic performance. The students consisted of 51,874 students from institutions throughout the United States. The results of the study showed that there is a relationship between involvement in extracurricular activities and academic performance in college students.

Jovanoviü et al. (2010) undertook a study on the impact of physical activity on nutritional status of preschool students. The survey was conducted in preschools in Pancevo in Serbia. The sample consisted of 193 students (88 boys and 105 girls), aged 4 and 5 years. The examination of the health and nutrition status of the students and their parents was done applying the standard anthropometric measurements of height, body weight, determining the body mass index, waist circumference and comparing the values with the growth norms given by the WHO. Physical activity of the students was measured by a questionnaire survey which parents filled up. The results of the study showed that the prevalence of insufficient physical activity among preschool students in Pancevo was higher, especially among students with excessive body weight and obesity. Socio demographic and behavioral factors as well as behaviour of parents importantly contributed to physical inactivity.

Marko *et al*. (2013) conducted a study on how "Physical activity and obesity mediate the association between childhood motor function and adolescents' academic achievement." The study sample included 8,061 students from a Northern Finland Birth Cohort (1986) at age 8 years old. The main data included parent reported motor functions of the children. This was then compared to self-reported physical activity, predicted cardio respiratory fitness (cycle ergo meter test), obesity (body weight and height), and academic achievement (grades) at age 16 years. The results show that physical activity has been related to a higher grade-point average, and obesity has been associated to a lower grade-point average in adolescence.

**2.6 Food Insufficiency**

Is insufficiency of food intake by students due to poverty or other reasons a factor in nutritional status of children and their learning performance? Mention has been made earlier about children being hungry or arriving in school without breakfast in developing counties like Bangladesh. This is one of the questions to be probed by the present study.

Alaimo *et al*. (2001) examined the relationships between family income, food insufficiency, and health among US students. In this study, food insufficiency was defined as "an inadequate amount of food intake due to lack of resources" (p.782). A child was classified as "food insufficient" if it was reported that the family either "sometimes" or "often" experience scarcity of enough food to eat.

Alaimo *et al*. (2001) found that for younger students and teenage populations, Wide Range Achievement Test (WRAT) and Wechsler Intelligence Scale for Children (WISC) scores were about 1.3 to 2.5 points (on a scale of 1 to 20) lower for food insufficient students than for food sufficient students. Also, food insufficient students and teenagers were more than twice as likely to have repeated a grade and missed more school days. Forty percent of food insufficient teenagers had failed in their class as compared with only 20.7 percent of food sufficient teenagers. Food insufficient students and teenagers were more likely to strike with psychosocial problems than those who were food sufficient. Comparatively, food sufficient teenagers were more than doubly likely to have seen a psychologist, almost three times as likely to have been suspended from school, almost doubly likely to have a lot or some difficulty getting along with others, and four times as likely to have no friends. Results of this study have shown that family food insufficiency is associated with school-aged student's academic and psychosocial development and showed the negative consequences of food insecurity and hunger for American students. A thorough analysis of the data indicated that School Lunch and Breakfast Programs have shown small but significant benefits in cognition, academic achievement, and school attendance (Alaimo *et al*., 2001).

Jyoti *et al*. (2005) studied the relationship between household food insecurity and selected aspects of student's academic, social, and physical development with a four- year long study which included students from kindergarten to third grade. Improved outcomes were seen in mathematics performance, reading performance, weight, BMI, and composite social skills.

Data were gathered from the Early Child Longitudinal Study – Kindergarten Cohort (ECLS – K). The sampling size of students for whom full data was available at both kindergarten and third grade was 11,400. Full data were gathered from a scored reading or mathematics assessment and parent completion of the United States Department of Agriculture (USDA) food security module. To indicate changes in food security over the four-year period students were categorized into four groups: remained food secure at all times, remained food insecure at all times, transitioned from food security to food insecurity, and transitioned from food insecurity to food security. Students were given a battery of test to assess reading and mathematics ability. The tests were conducted individually in both kindergarten and third grade. Students' heights and weights were assessed simultaneously from both kindergarten and third grade, and BMIs were calculated from heights and weights. Social skills of the students were assessed by the teacher using a questionnaire in which teachers rated how frequently their students displayed certain social skills such as ability to learn, self-control, interpersonal skills, and externalizing and internalizing problem behaviours.

Changes in social skills scores were conducted by subtracting the kindergarten composite score from the third grade composite score. Among the students of kindergarten and third grade, 77.9 percent of student's households remained food secure, 6.0 percent remained food insecure, 9.7 percent became food secure, 6.5 percent became food insecure. Food insecurity was found at one or both times in 22.2 percent of the sampled households. Jyoti et al. observed outcomes that were expected for the ages and developmental stages of the students in the survey. Students from food insecurity households at kindergarten demonstrated a 2.34 - point smaller increase in mathematics score, a 4.39-point smaller increase in reading score, a 0.27-U greater gain in BMI, a 0.44-kg greater gain in weight, and a 0.08-point greater decline in social skills score compared to students from food secure households at kindergarten.

Students who experienced food insufficiency are likely to fail a grade in school and experience tardiness or absences from school which may affect their academic performance.

Geier *et al*. (2007) highlighted two main findings of their study. The first was that obese students were absent more (12.2 days) than normal weight students (10.1 days). The second finding was that the obese category (BMI-for-age > 95th percentile) correlated with indicators for the number of days absent, and adjusted age, race/ethnicity and gender in a low socio economic status population.

Some of the research also shows that students with iron deficiency anaemia are at a disadvantage in their school performance. Their cognitive performance also seems to get better with iron therapy. Food insufficiency is a serious problem affecting student's ability to learn. Some studies indicate that school breakfast programs seem to improve enrolment rates and decrease delay in starting school. Even for those who are suffering with severe under nourishment, school breakfast programs seem to improve school performance as well as cognitive functioning (Taras, 2005).

Recognising the importance of primary school children not being hungry while at school and also to improve their nutritional status, a national school feeding policy is under consideration by the Ministry of Primary and Mass Education in Bangladesh. Pilot programs have been underway for some time with varying approaches, such as providing specially prepared nutritionally balanced biscuits and cooked meals provided as lunch. The benefits of these initiatives have been assessed and as a result, plans are underway to expand school meal programs to serve in stages all children at the pre-primary and primary level, giving priority to more disadvantaged areas and communities of the country (National School Meal Policy, 2019).

## 2.7 Conceptual Framework of the Study

On the basis of the literature review as well as considering the research questions of the study, the following conceptual framework has been developed for this study.
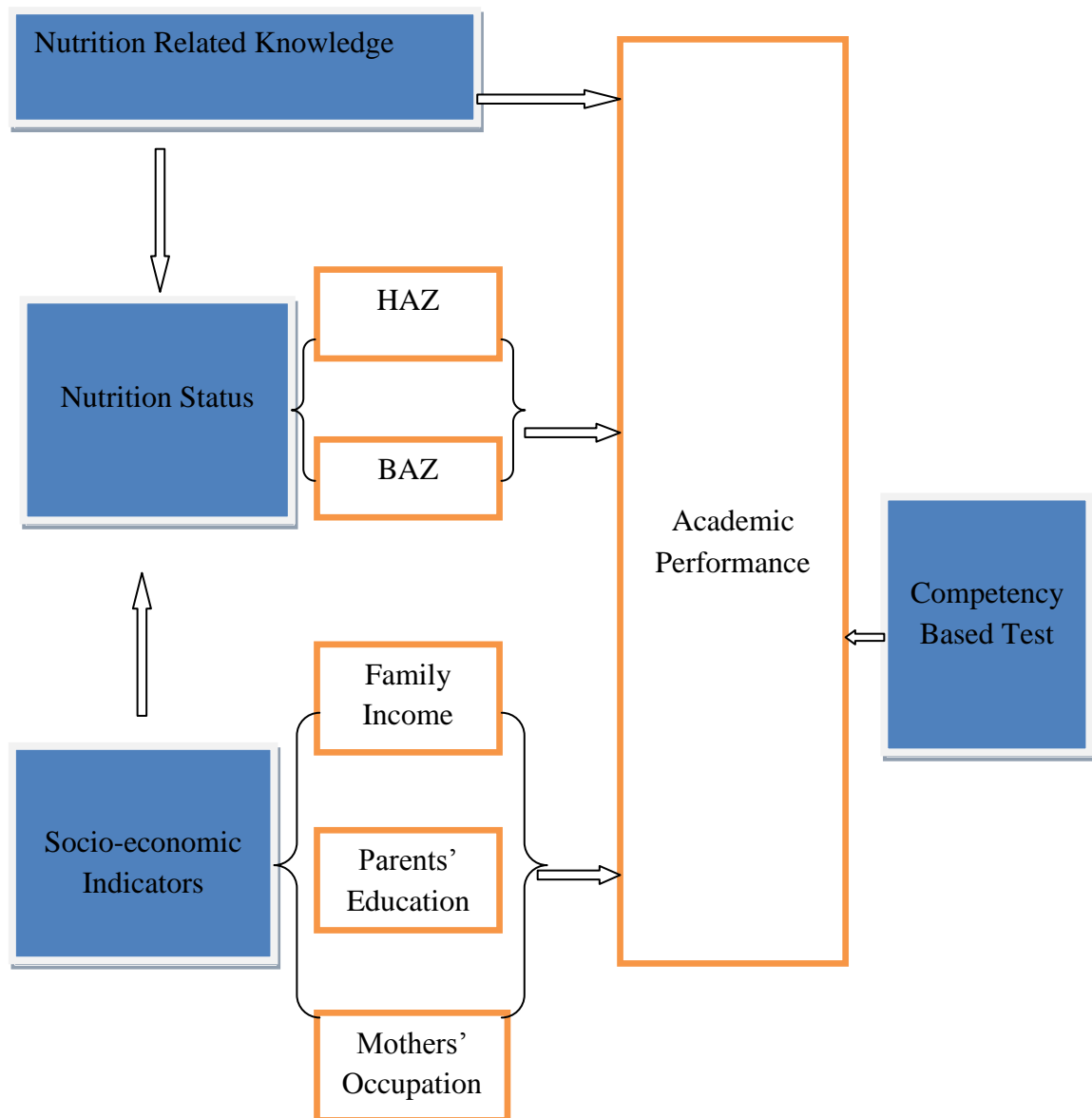


Figure: 2.1: The conceptual framework

The above figure indicates that academic performance consists of dependent variables and nutritional status; nutrition related knowledge and socio-economic status of the students are independent variables. Academic performance has been measured by taking an individual test

which is a competency based written examination test and nutritional status has been measured by calculating Height-for-Age z-score (HAZ) and BMI-for-Age z-score (BAZ). Nutrition related knowledge has been measured by asking some of the nutrition related knowledge based questions and socio-economic status has been measured by obtaining their family income, parents' education as well as mothers' occupation.

# *Chapter 3*

# METHODOLOGY OF THE STUDY

## 3.1 Prologue

Research is the art of scientific inquiry. A systematic step for initiating and conducting any research requires adopting an appropriate methodology according to the research problem. In this study, both quantitative and qualitative approaches have been considered where found necessary. The quantitative part consists of the anthropometric data, performance test scores, the socio-economic data, the nutritional data, etc. of the sample students. The qualitative part of the study included in-depth interviews with the teachers and parents and also focus group discussions with the parents of students. The variables under consideration were the academic performance (valid and reliable test scores) as a dependent variable and the nutritional status, gender, age, socio economic status, nutritional knowledge etc. of the students as the independent variables.

This chapter deals with justification of the methods, study design, sources of data, sample and sampling process, selection and development of tools, data collection procedure, and data analysis. The data gathered from different approaches have been analyzed both in quantitative as well as qualitative ways.

## 3.2 Justification of the Methods

No research method or approach is likely to prove ideal unless we are in a strict laboratory environment. Social science is rarely in this position. In this study, the researcher used quantitative measures for some aspects of the investigation, (e.g. measurement of pupil

achievement, pupils' physical characteristics, anthropometrical measurements, etc.). Qualitative approaches were used as interviews and FGDs. The researcher also made informal observation to capture the essence of the context in which the subjects, the informants and the students were functioning. Through these multiple methods the researcher has attempted to decipher the reality regarding the selected research problem. Cross checking and triangulation have been applied for the nearest approximation to truth. Generalization to all of Bangladesh may not be justifiable but the researcher has tested 'foreshadowed problems' in a specific context and drawn some defensible conclusions (Bryman, 2001).

### 3.3 Study Design

In the quantitative approach, anthropometric and socioeconomic data were collected and a performance test was designed and administered to collect student performance data. Under the qualitative approach, the focus was on gathering in-depth information and gaining understanding by individual interviews and group interaction through focus groups.

A total of 392 students were chosen for the anthropometric measurements. Students' ages were determined (based on school record and birth certificate), their height and weight were measured and the Stunting (HAZ) and Thinness (BAZ) scores were calculated (using WHO measures plus software).  Student samples were selected from grade five completers, both males and females. In addition, eight teachers from eight government primary schools were selected for interview. A total of four focus group discussions (FGDs) were arranged with the parents. Besides these, interviews with the education experts were held with five education officials as a means of further verification of the study findings. The researcher's aim was to determine the nutritional correlates of students' educational performance. In addition, documentary analysis has been done as a source of relevant data. These documents included previous school results of students, teachers' comments, and date of birth of the students. All

the data and information were collected from both primary and secondary sources applying quantitative and qualitative tools.

## 3.4 Sources of Data

As indicated, data were collected from secondary and primary sources. The secondary sources were first consulted to form a general understanding of the problem, develop the research questions and design, and identify relevant information and data. The primary sources consisted of the data collected directly from the samples using specific instruments for data collection.

### 3.4.1 Secondary Sources

For collecting data of birth of students' school records were used as secondary sources. Besides these, relevant literature from different sources such as books, journals, governments circulars, research reports etc. were considered.

The age of students, teachers' comments on their students' overall activities, and other information about the respective groups of students were taken from the original records of the schools. The head teachers were helpful and provided the documents. Besides these, some of the nutrition related charts provided by UNICEF for the primary schools were also collected. The existing curriculum and detailed syllabus of the fifth grade students were examined to explore how much emphasis was put on nutritional issues and nutrition related policy.

### 3.4.2 Primary Sources

Primary data were collected from students, teachers, parents, and education experts directly from the field. The following tools were used for this purpose:

1. Students' anthropometric information checklist

2. Performance test questions for the students

3. Interview schedule for teachers

4. Interview schedule for education experts

5. FGD guideline for parents

A detailed description of the above tools is given below:

**1. Students' Anthropometric Information Checklist**

The aim of this tool is to measure the nutritional status of the students using anthropometric data. These tools covered three sections, namely: general information, height and weight of the students, socioeconomic information, and nutrition knowledge. The general information section covered information about the students, such as the identity and code number of the students, name and roll number of the students; parent's code number and name, the name of the school and its location (district and division).

From the anthropometric information, the HAZ (Height for Age z score) was calculated to provide the measure for stunting of the students and BAZ (BMI for Age z) score that provides the measure for thinness of the students. Stunting and thinness measures represented the nutritional status of the students.

The socio-economic information section included the family background such as parents' profession, family income, gender, and their residential location both rural and semi-urban.

The nutritional knowledge section of the data consisted of a total of nine questions. All the questions were on nutrition, food and a balanced diet which explored the informants' nutrition -related awareness and knowledge. (See Annexure A)

## 2. Performance Test for the Students

A set of performance test questions for Grade V students were prepared to cover most of the terminal competencies specified in the national curriculum for primary education. This test was previously developed by a group of expert teachers under the supervision of Campaign for Popular Education (CAMPE), a renowned NGOs of Bangladesh. The instrument was recently used for measuring student learning achievement in Bangladesh. This test was adapted for this study to measure competencies in six primary school subjects. Total marks were 100 for the six subjects and scheduled time for the test was two hours. Both multiple choice and essay type questions were used in the test. (For details see Annexure B)

## 3. Interview Schedule for Teachers

To collect in-depth information, the interview is an important tool. For interviewing with the teachers, interview guidelines were prepared and strictly followed. The purpose of the interview schedule for teachers was to determine the importance of nutrition for academic performance. On the basis of the research question, a total of six in-depth questions were prepared for each interview. This interview schedule was open ended and consisted of questions like the importance of nutrition for a healthy life, the role of nutrition and a balanced diet in scholastic development of students, the effects of nutrition on school achievement, nutrition's role for attentiveness of students in class and reduced drop out, etc. These questions related to the impact of nutrition on the school performance of students. (Details of tools are given in Annexure C)

## 4. Interview Schedule for Education Experts

For cross checking and further validating the actual information, interviews with education experts were important. Thus, in-depth interviews with well-known education experts were conducted following prepared guidelines. They were asked about the importance of nutrition for academic performance of students. In addition, they were asked questions about how nutrition played a role in reducing drop out and making students more attentive, why nutrition is critical for students' scholastic development and why nutrition should be incorporated into our curriculum. Other school variables that impact school performance were discussed along with nutrition etc. These questions reflected the importance of nutrition related to other variables also important for school performance. (Details of tools are given in Annexure D)

## 5. Focus Group Discussion Guidelines for Parents

The purpose of the FGD guidelines for parents was to collect information from them about their students on nutritional issues and its importance for school performances. The FGD guidelines consisted of some rules that were strictly maintained in the FGD sessions. A total of seven guided questions were asked, which concerned the students' activities at home, regular food habits, co-curricular activities, the importance of nutrition, and overall nutrition knowledge and awareness.

At first, the researcher introduced the topic of the research to the participants and they were asked to express their thoughts and ideas about the issues frankly and openly. The researcher wrote down the main points mentioned by the participants in the FGD session. Most of the FGD sessions lasted at least two hours. The total participants were 6 to 8 in most of the cases. (Details of the guide are given in Annexure E)

## 3.5 The Population and Sample

The population universe of the study consisted of all the government primary schools of Bangladesh. The total number of government aided primary schools, is at present 74,935 (BANBEIS, 2017), spread over eight administrative divisions of Bangladesh. It was decided that four administrative divisions namely, Dhaka, Rajshahi, Chattogram and Barishal would be included in this study which would provide a reasonable distribution of geographical locations and cultural variations. A stratified random sampling procedure was followed within the four divisions – this led to the selection of the students, schools, and districts in each division

From each division one district was chosen, a total of four districts, namely, Tangail, Natore, Feni and Pirojpur. From each district two schools were selected randomly. Within the school, all the students of Grade V who had completed the five-year cycle of schooling and were preparing for the PECE examination were selected as the student sample. A total of 392 students from grade V from eight government primary schools were thus selected.

As quantitative information for the study, socio-demographic variables such as age, sex, nutritional knowledge, food habits of the students as well as parents' profession etc., and anthropometry (height, weight, etc.) of the students were collected. Nutritional status was assessed by measuring individuals' body mass index (BMI) which was calculated by weight in kg divided by height in meters squared. Besides this, stunting (HAZ) and thinness (BAZ) were calculated through WHO "anthro-plus" software. Regarding the academic performance, a specifically designed competency test was administered. Details of sampling are given in table 3.1.

Table 3.1: The sample of the study

| Division | District | Upazila | Name of the Schools | Number of Students |
|---|---|---|---|---|
| Dhaka | Tangail | Sadar | 1.Sakrail Govt. Primary School | 50 |
| | | | 2. Sonat Govt. Primary School | 50 |
| Chattogram | Feni | Daganbhuiyan | 1.Silonia Govt. Primary School | 70 |
| | | | 2. East Ramchandrapur Govt. Primary School | 34 |
| Barishal | Pirojpur | Mathbaria | 1.Mathbaria Model Govt. Primary School | 74 |
| | | | 2. Wahedabad Govt. Primary School | 44 |
| Rajshahi | Natore | Sadar | 1. Mallikhati Govt. Primary School | 29 |
| | | | 2. Jongli Sahid Govt. Primary School | 41 |
| Total | 04 | 04 | 08 | 392 |

## 3.6 Data Collection Procedure

Altogether four competent and trained data collectors were employed for field data collection who worked under the close supervision and monitoring of the researcher. A digital weight measuring machine was used for taking weight and a standard measuring tape was used for height measurement. The places for the field work were in four different districts of four

different divisions in Bangladesh. During the field work, besides collecting the quantitative data, the researcher also met students, teachers and parents to conduct the FGDs. All the fieldwork activities were conducted following official procedures regarding permission from the Government of Bangladesh. Before moving to the field work, the researcher established communication with the District Primary Education Officer (DPEO) and the Upazila Education Officer (UEO), seeking help from them.

The four research associates (two with college degree in education and another two with degrees in nutrition) were recruited after interviewing them and judging their capabilities. The researcher oriented the associates about the study and conducted practical training about use of the data collection tools. No significant problem was encountered in conducting the field work. It was a rewarding experience for the researcher and his colleagues to carry out the field work and to interact with the teachers, students, parents and education officials.

The researcher made a phone call to the head teacher or an assistant teacher prior to visiting a school, setting up a time for each visit that was mutually convenient.

Table 3.2 shows a matrix of the research questions, the methodology for inquiry, the tools used and the sample of respondents to whom the tools were applied.

Table 3.2: The methodology matrix

| SL | RQ | Method | Instruments | Students | Sample size | Sampling techniques |
|----|----|--------|-------------|----------|-------------|---------------------|
| 1 | What is the nutritional status of the primary school completers of Bangladesh? | Anthropometric Measurement | Anthropometric Checklist | Fifth grade students | 392 students | Random sampling |
| 2 | How do the primary school completers perform in academic performance tests? | Performance test | Standardized and valid test scripts | Fifth grade students | 392 students | Random sampling |
| 3 | What are the relations between performance test results and nutritional status? | Performance test | Test scripts and anthropometric checklist | Fifth grade students | 392 students | Random sampling |
| 4 | What relationship exists between some other defined factors (nutrition knowledge, family income, parents' occupation and parents' education) and academic performance of the students? | Performance test, In-depth interview, FGD and expert opinion | Checklist, Interview schedule, FGD guideline and opinion schedule | Students, Teachers and education Expert | 392 students, 08 Teachers and 05 Education Expert | Random and Purposive sampling |
| 5 | How important is nutrition of primary school children for their academic performances? | In-depth interview, FGD and expert opinion | Interview schedule, FGD guideline and opinion schedule | Teachers, parents and education Expert | 08 Teachers, 28 parents and 10 Education Expert | Purposive sampling |

## 3.7 Data Analysis

Data were analyzed using both quantitative and qualitative approaches. The anthropometric measurements were analyzed with WHO "anthro-plus" software which is a globally recognized and widely used tool. The frequencies, cross tabulations, correlation and regression have been drawn by using the SPSS (version 20) software. For qualitative perspectives in the study, a thematic analysis was made. In the quantitative analysis, supplementary information has been used from the qualitative data where found suitable to make the findings more authentic and justified.

## 3.8 Problems and Challenges Encountered During Field Work

• Although the overall support and cooperation from the primary school authority was satisfactory, in some limited cases the teachers were hesitant to spare the time or uninterested in the interviews and so did not extend their full cooperation.

• To conduct and manage interviews and FGDs with the guardians was sometimes difficult as they were busy with their own occupations especially during working hours.

• The data collection period was just before the PECE examinations and so most of the students were busy with tutorial classes in preparation for the examination. It was necessary to adjust the time for the performance test according to student's convenience.

• The accuracy of age information has been a concern. Recorded information in school records has been used, which may not always be accurate. Despite the difficulties, the best effort was made to collect the necessary data as accurately and correctly as possible. The researcher believes that the difficulties encountered have not substantially affected the findings derived from the data.

## 3.9 Ethical Considerations

The study was carried out with the approval of the Directorate of Primary Education (DPE). Written permission was obtained from the DPE and verbal (non-written) consent was obtained from the administrative officers and leaders of respective schools.

Permission from the supervisor of the research was duly taken before going to the field. Due consideration was given to not interrupting students' and teachers' regular work in school or subjecting them to any inconvenience. The students were handled and treated with care in collecting the anthropometric measures. All the information taken from the field was to be preserved and used for this research only.  Anonymity of data was maintained.

# *Chapter 4*

# ANALYSIS AND RESULTS OF THE STUDY

**4.1 Prologue**

This chapter is devoted to analysis and interpretation of data gathered through the anthropometric checklist, performance tests, the interview schedule and FGD guidelines. Data analysis has two objectives- one, to summarize and describe the data and two, to draw inferences from the data for the population from which the sample is drawn. Responses to each question of the tools were analyzed both in quantitative and qualitative terms where found suitable in order to obtain valid findings and results. The raw scores obtained from performance tests were converted to grade points and percentages. Both tabular form and graphical representations were used to interpret the results. The main object of analysis was to show the relationship between academic performance and nutritional status of the students. The presentation and analysis of data are divided into the following nine sections:

i. Demographics and background – age and gender of students, parents' education status and occupations, and family income.

ii. Nutritional knowledge of students.

iii. Nutritional status of and anthropometric data about students.

iv. Academic performance of primary school (Grade 5) completers.

v. Relationship between nutritional status of students and their academic performance.

vi. Relationship between nutritional knowledge of students and their academic performance.

vii. Socio-economic status (parents' education, occupation, income) and students' academic performance.

viii.      Multiple regression analyses showing the relationship of the nutritional status of students, the nutritional knowledge of students, and the socio-economic status of students with students' academic performance.

ix.    Qualitative information collected through interviews and FGDs which complemented quantitative data.

## 4.2 Demographics and Background Information

### 4.2.1 Age Distribution of the Students

Table 4.1 shows the age distribution of the students in the sample.

Table 4.1: Distribution of students by age group

| Age group | N | % |
|-----------|-----|-------|
| 9-10 | 88 | 22.45 |
| 11-12 | 285 | 72.71 |
| 13-14 | 17 | 4.34 |
| 15-16 | 02 | .51 |
| Total | 392 | 100% |

The age range of the sample of students was from 9 to 15 years. A large majority (72.71%) belongs to the age group between 11 and 12 years.

## 4.2.2 Gender Distribution of the Students

The following figure (Figure 4.1) shows the gender distribution of the students.
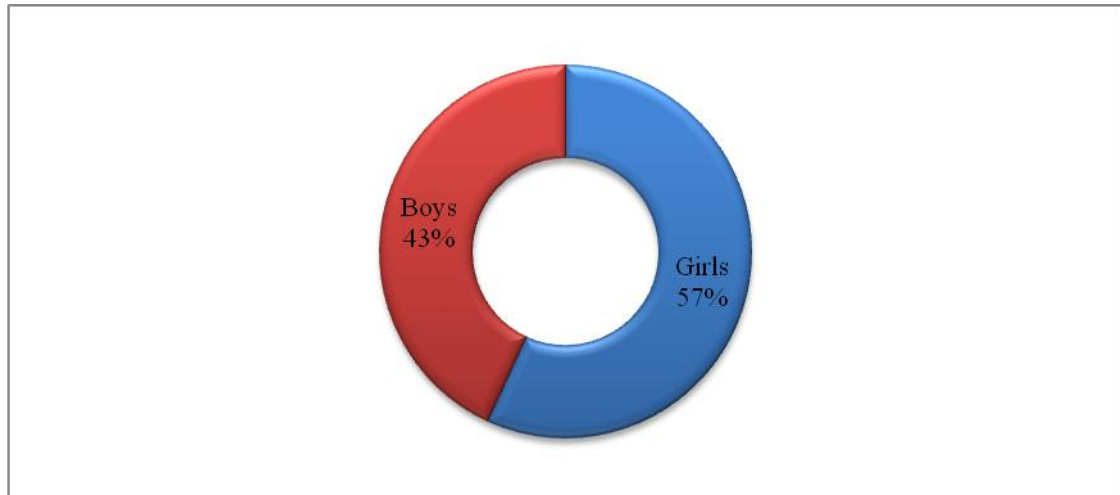


Figure: 4.1: Distribution of students by gender

In the sample of students, 57 percent are girls and 43 percent are boys. These numbers indicate that school enrollment of girls in Bangladesh is higher than that of boys in primary schools.

### 4.2.3 Education Level of Students' Fathers

Table 4.2 illustrates the education level of students' fathers.

Table 4.2: Education level of Fathers of students

| Education level of Students' Father | N | % |
|---|---|---|
| Uneducated | 34 | 8.7 |
| Primary | 100 | 25.5 |
| Class Eight | 61 | 15.6 |
| SSC | 95 | 24.2 |
| HSC | 26 | 6.6 |
| Bachelor | 45 | 11.5 |
| Masters | 31 | 7.9 |
| Total | 392 | 100 |

A quarter of the students' fathers (25.5%) had completed their primary education. A few (6.6%) completed their higher secondary education; 11.5 percent have a Bachelor's degree and 7.9 percent completed their Masters. A significant proportion (8.7%) among the fathers of students was found to be without literacy.

**4.2.4 Education Level of Students' Mothers**

Table 4.3 shows the education level of students' mothers.

Table 4.3: Education level of mothers of students

| Education Level | N | % |
|---|---|---|
| Uneducated | 41 | 10.5 |
| Primary | 112 | 28.6 |
| Class Eight | 69 | 17.6 |
| SSC | 96 | 24.5 |
| HSC | 39 | 9.9 |
| Bachelor Degree | 24 | 6.1 |
| Masters | 11 | 2.8 |
| Total | 392 | 100.0 |

A little over a quarter (28.6%) of the mothers of students completed their primary education. A small proportion (6.1%) had completed a Bachelor's degree; almost a quarter (24.4%) completed SSC and only 2.8 percent completed their Masters. A total of 10.5 percent of the mothers were found to be without literacy skills.

**4.2.5 Occupations of the Mothers of Students**

Figure 4.2 shows the occupations of mothers of the students.
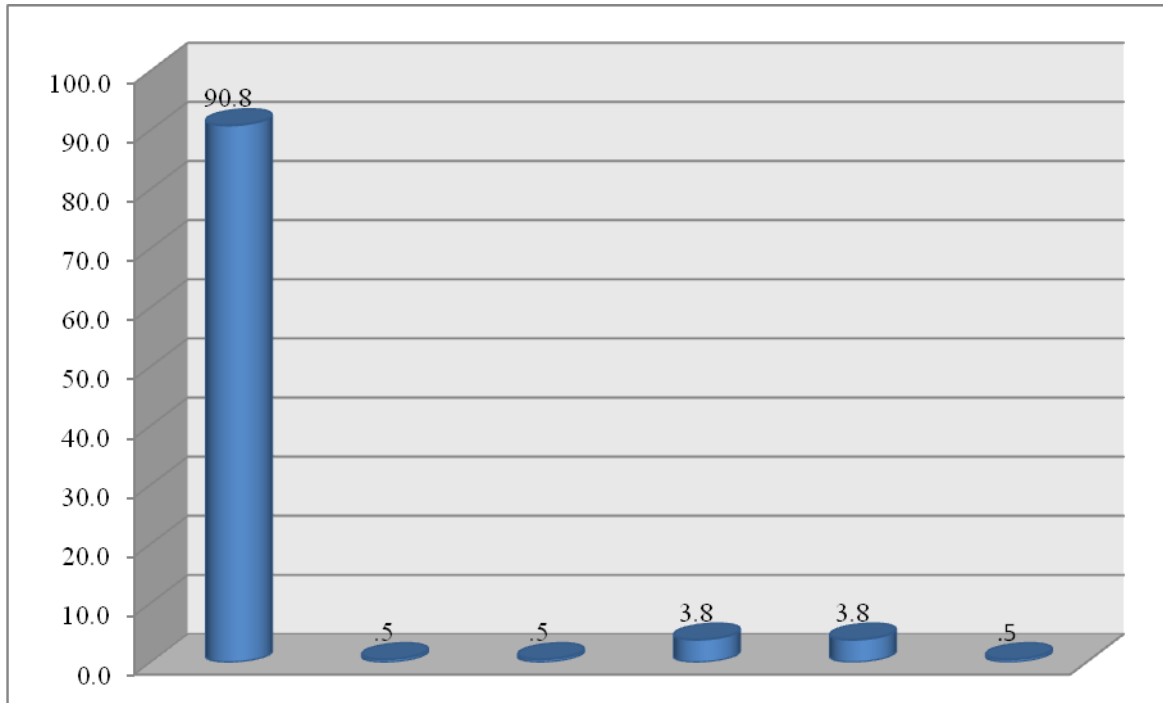


Figure: 4.2: Distribution of the occupation of students' mothers

It can be seen that the overwhelming proportion (90.8%) are housewives. A few (3.8%) are teachers. Only about five percent have other occupations such as NGO worker and in business. It is worth mentioning here that only the mothers' occupation has been recorded because of the availability of data. In the FGD session with parents, all the participants were mothers and that is why mothers' occupation was collected easily from them. Besides this, it is assumed that mothers' occupation sometimes can be a better representation of the socio-economic status of families and it normally has a greater influence on children's educational performance.

**4.2.6 Income of the Students' Families**

Figure 4.3 shows the monthly family income of the sample of students.
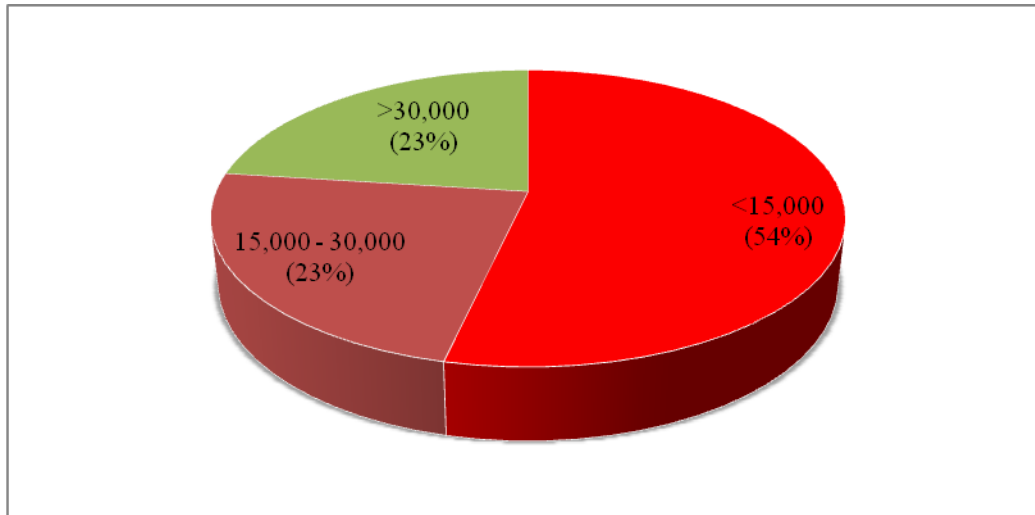


Figure: 4.3: Distribution of family income of the students

About half (53.6%) of the students' family income level lies between 15,000 (USD 175) to 30,000 taka (USD 350); the income level of almost a quarter (23%) is more than 30,000 taka (USD 350) per month.

**4.3 Nutrition Related Knowledge of the Students**

In this section, information about the nutritional knowledge of the students is presented. Information was collected on students' knowledge and awareness about a balanced diet, different qualities of foods (energy-providing, body-building, providing essential vitamins and micro-nutrients, etc.) with the information checklist interview from the sample students. A composite score of students' nutrition knowledge was calculated for each respondent.

### 4.3.1 Students' Nutritional Knowledge on Balanced Diet

Figure 4.4 shows the knowledge of students on balanced diet.
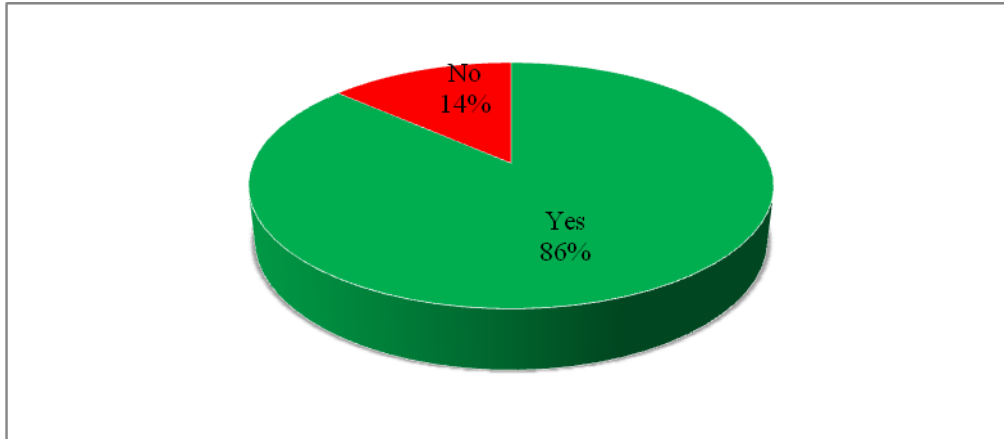


Figure: 4.4: Distribution of students' knowledge on balanced diet

About 86 percent of the students are familiar with the concept of a balanced diet. On the other hand, 14 percent do not have knowledge or awareness about a balanced diet. Actually, the students were asked whether they are familiar with balanced diet or not and in this way the knowledge of the students on a balanced diet was determined.

## 4.3.2 Students' Nutritional Knowledge on Energy Yielding Foods

Figure 4.5 shows the nutritional knowledge of students on energy yielding foods.
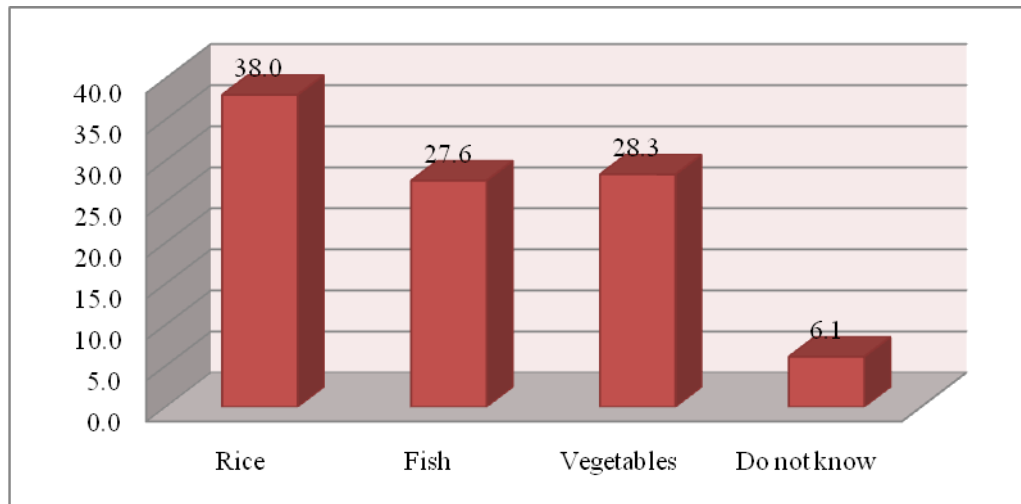


Figure: 4.5: Distribution of students' nutritional knowledge on energy yielding foods

The above figure depicts that about 6.1 percent of the students do not know anything about energy yielding foods. On the other hand, about 38 percent of school students know about rice, 27.6 percent know about fish and 28.3 percent know about vegetables as energy yielding food. Here also, the students were asked about their familiarity with energy yielding foods and in this way knowledge of the students on energy yielding foods was assessed.

### 4.3.3 Students' Nutritional Knowledge on Body Building Foods

Figure 4.6 shows the nutritional knowledge of the students on body building foods.
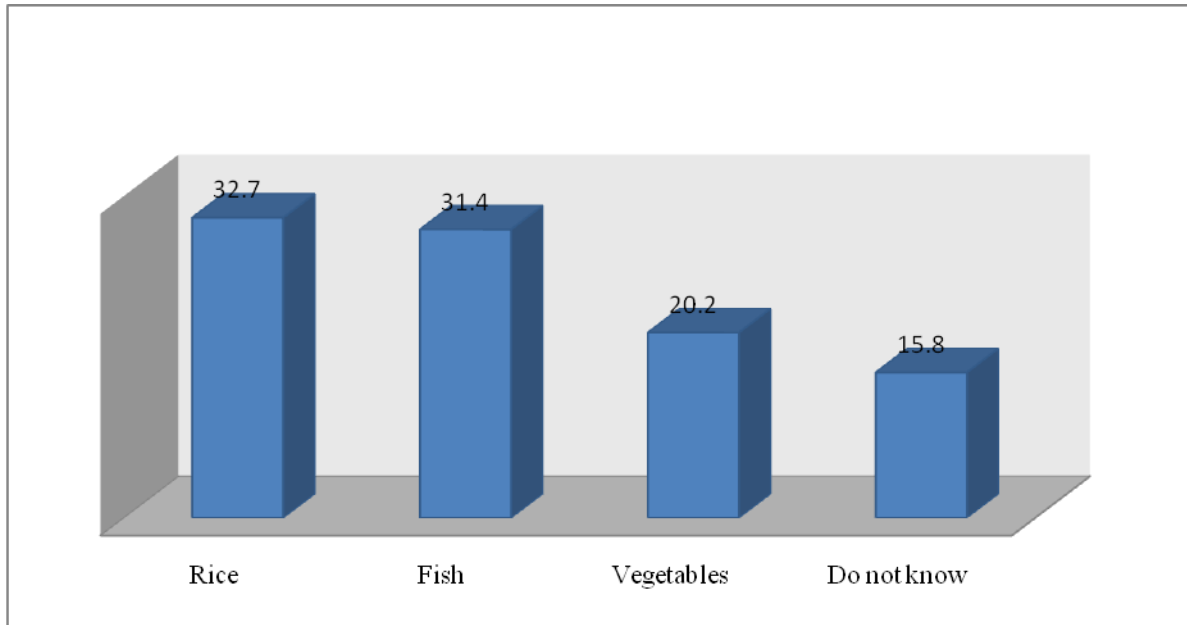


Figure: 4.6: Distribution of students' nutritional knowledge on body building foods

It appears that 15.8 percent of the students do not know about body building food. However, 31.4 percent knows about fish and 20.2 percent knows of vegetables as body building foods.

**4.3.4 Students' Nutritional Knowledge on Vitamin-A Rich Food**

The following figure 4.7 shows the nutritional knowledge of students on vitamin-A rich foods.
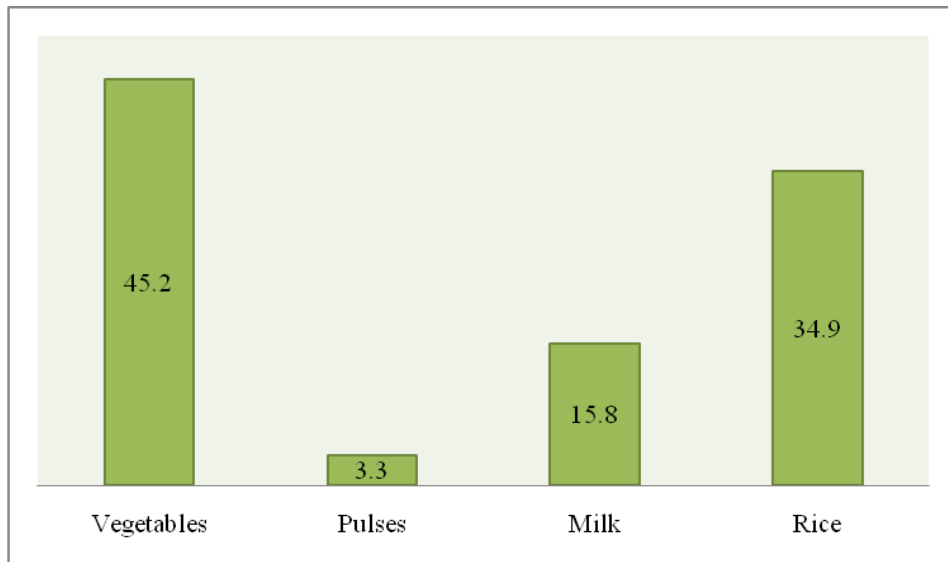


Figure: 4.7: Distribution of students' nutritional knowledge on vitamin-A rich food

Figure 4.7 reveals that one-third (35%) of the students do not know about vitamin-A rich food. However, about 45 percent of students know about vegetables, 15.8 percent know about milk and 3.3 percent know about pulses as vitamin-A rich foods.

**4.3.5 Students' Nutritional Knowledge on Iron-Rich Foods**

The following figure 4.8 shows the nutritional knowledge on iron rich foods of the students.
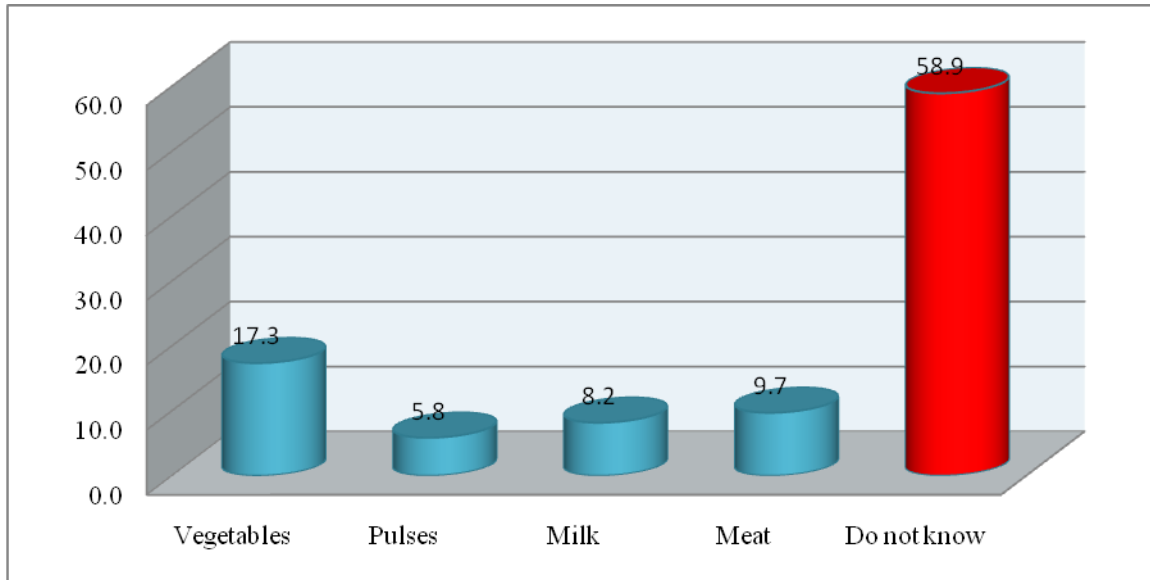


Figure: 4.8: Distribution of students' nutritional knowledge on iron-rich foods

It is seen that more than half (58.9%) of the students do not know about iron rich foods. As more than half of the students are girls who are in the puberty stage, for them iron rich foods are very important. Only 17 percent of the students know about vegetables, 8.2 percent know about milk and 9.7 percent know meat as iron rich food.

**4.3.6 Nutritional Knowledge Score of the Students**

Table 4.4 shows the nutritional knowledge score of the students. The nutritional knowledge score was calculated by assessing their knowledge on nutrition related content in their textbooks. They were asked seven questions on nutrition related issues. Each question provided one mark. They were grouped according to their answers.

Table 4.4: Distribution of students by their nutritional knowledge score

| Group | N | % |
|---|---|---|
| Low (1–3 marks out of 7) | 151 | 39 |
| Medium (4–5 marks out of 7) | 208 | 53.1 |
| High (>5 marks out of 7) | 33 | 8.4 |
| Total | 392 | 100.0 |

It shows that about 40 percent of the students obtained a low score on their overall knowledge about nutritious food. A little over half of the students (53.1%) have a medium level of nutritional knowledge. Only 8.4 percent students achieved a high level of nutritional knowledge.

## 4.4 Nutritional Status and Anthropometric Information of the Students

### 4.4.1 Prevalence of Malnutrition among Students

Table 4.5 shows the prevalence of malnutrition (stunting and thinness) among students.

Table 4.5: Prevalence of malnutrition among students

| Indicators | Number of students | Malnutrition (%) | Normal (%) |
|---|---|---|---|
| Stunting | 119 | 30.4 | 56.4 |
| Thinness | 156 | 39.8 | 44.4 |

Table 4.5 illustrates that 30.4 percent of the students are stunted and nearly 40 percent of them are thin. It reveals that more than one third of the sample students are malnourished being affected by stunting and thinness, prime indicators of malnutrition. Stunting represents

the long term malnourished status of students and thinness represents the short term malnourishment effect (WHO, 2017).

### 4.4.2 Prevalence of Stunting among Students

Table 4.6 illustrates the prevalence of stunting among students.

Table 4.6: Prevalence of stunting among students

| Indicators (Z-score) | N | % |
|---|---|---|
| Severely stunted ($< $-3SD) | 8 | 2.2 |
| Moderately stunted(-3SD to – 2SD) | 28 | 7.4 |
| Mildly stunted (-2SD to -1SD) | 85 | 21.7 |
| Normal height (>-1SD to 1SD) | 219 | 56.4 |
| Above normal (>+1SD) | 52 | 13.3 |

From Table 4.6, it can be seen that one third of the sample students are suffering from different categories of stunting whereas about half of the students (56.4%) are of normal height. A small proportion (13.3%) is above normal. It reveals that the malnutrition situation of the primary school students is still a matter of great concern.

### 4.4.3 Prevalence of Stunting of Students by Gender

Table 4.7 shows the prevalence of stunting of students by gender.

Table 4.7: Prevalence of stunting among students by gender

| Gender | Severely Stunted | Moderately Stunted | Mildly Stunted | Normal Height | Tall | Total |
|--------|------------------|--------------------|----------------|---------------|------|-------|
| Girl | .9% | 3.1% | 14.8% | 66.4% | 14.8% | 100.0% |
| Boy | .6% | 10.7% | 30.8% | 46.7% | 11.2% | 100.0% |

It appears that the majority of girl students (66.4%) belong to normal height whereas around 18 percent are stunted. On the other hand, a good number of boy students (about 41%) are stunted whereas 46.7 percent are of normal height. This analysis shows that more of the boys are malnourished than the girls. It might be assumed that girl students are more regular in taking food and have a more disciplined life style. Besides this, the physical growth of girl students is more prevalent than the boy students at this age.

**4.4.4 Prevalence of Stunting of Students by Division**

Table 4.8 shows the prevalence of stunting of the students by division.

Table 4.8: Prevalence of stunting of students by division

| Division | Severely Stunted | Moderately Stunted | Mildly Stunted | Normal Height | Tall | Total |
|---|---|---|---|---|---|---|
| Dhaka | 0.0 | 4.0% | 25.0% | 62.0% | 9.0% | 100.0% |
| Chattogram | 1.9% | 12.6% | 21.4% | 58.3% | 5.8% | 100.0% |
| Barishal | .8% | 5.1% | 21.2% | 53.4% | 19.5% | 100.0% |
| Rajshahi | 0.0 | 2.8% | 18.3% | 59.2% | 19.7% | 100.0% |

It can be seen that the majority of students (62% and 59.2% respectively) are normal in Dhaka and Rajshahi divisions and in these two divisions there are no severely stunted students. On the other hand, Chattogram (58.3%) and Barishal (53.4%) have somewhat lower proportions with normal height. However, Chattogram was highest (about 35%) in proportion of stunted growth among the four divisions.

**4.4.5 Thinness (BAZ) of the Students**

Table 4.9 shows the prevalence of thinness (BAZ) among students.

Table 4.9: Prevalence of thinness (BAZ) among students

| Indicators (Z-score) | N | % |
|---|---|---|
| Severely thinness ( < -3SD) | 21 | 5.4 |
| Moderate thinness (-3SD to <2SD) | 135 | 34.5 |
| Normal (>-1SD to +1SD) | 174 | 44.4 |
| Overweight (>+1 SD to 2SD) | 46 | 11.7 |
| Obese (>+2 SD) | 16 | 4.1 |

Table 4.9 reveals that a good number of students (about 40%) are thin whereas about 44.4 percent students are of normal weight. About 5.4 percent of the students are severely thin and about 34.5 percent of students are moderately thin. However, 11.7 percent of the students are overweight and 4.1 percent of them are obese.

### 4.4.6 Thinness of Students by Gender

Table 4.10 shows the prevalence of thinness of students by gender.

Table 4.10**:** Prevalence of thinness of students by gender

| Gender | Severely Thinness | Moderately Thinness | Normal weight | Overweight | Obese | Total |
|--------|-------------------|---------------------|---------------|------------|-------|-------|
| Girl | 4.9% | 31.8% | 47.5% | 10.3% | 5.4% | 100.0% |
| Boy | 5.9% | 36.1% | 42.0% | 13.6% | 2.4% | 100.0% |

About 47.5 percent of students are of normal weight among the girl students whereas 42 percent of boys are normal. Among the girl students, 4.9 percent are severely thin and 31.8 percent of students are moderately thin. Among the boy students, about 42 percent are of normal weight, 5.9 percent of them are severely thin, and 36.1 percent of students are moderately thin. It can be seen that the thinness status of girl students is somewhat better than that of boy students.

### 4.4.7 Thinness of Students by Division

Table 4.11 shows the prevalence of thinness of students by division.

Table 4.11: Prevalence of thinness among students by division

| Division | Severely Thinness | Moderately Thinness | Normal weight | Overweight | Obese | Total |
|----------|-------------------|---------------------|---------------|------------|-------|-------|
| Dhaka | 2.0% | 36.0% | 45.0% | 12.0% | 5.0% | 100.0% |
| Chattogram | 9.7% | 43.7% | 39.8% | 5.8% | 1.0% | 100.0% |
| Barishal | 2.5% | 19.5% | 51.7% | 18.6% | 7.6% | 100.0% |
| Rajshahi | 8.5% | 39.4% | 42.3% | 8.5% | 1.4% | 100.0% |

Table 4.11 shows that a good number of students of all the four divisions are thin in different categories. In Dhaka division, about 45 percent of the students are of normal weight whereas about 38 percent of students are suffering from different categories of thinness. In Chattogram division, about 39.8 percent of the students are of normal weight whereas about 53 percent of students are affected by different categories of thinness. In Barishal division, about 51.7 percent of the students are of normal weight whereas about 22 percent students are suffering from different categories of thinness and in Rajshahi division; about 42.3 percent of the students are of normal weight whereas about 48 percent of students are in different categories of thinness.

**4.5 Academic Performance of the Primary School Graduates**

**4.5.1 Performance of the Students in the Performance Test**

Table 4.12 shows the grades and scores of students in the performance test administered to them.

Table 4.12: Scores of students in the performance test

| Grade and Score | N | % |
|---|---|---|
| A+ (80-100) | 38 | 9.7 |
| A(70-79) | 58 | 14.8 |
| A-(60-69) | 93 | 23.7 |
| B(50-59) | 88 | 22.4 |
| C(40-49) | 72 | 18.4 |
| D(33-39) | 19 | 4.8 |
| F (<33) | 24 | 6.1 |
| Total | 392 | 100 |

Table 4.12 describes the overall performance of the sample of students in the performance test.

In this test, a plurality of almost a quarter of the students (23.7%) got A- in the examination. Only 10 percent of students got A+ in the test and about 14.8 percent students got A; 22.4 percent got B and 18.4 percent got C. About a total of 6.1 percent students failed the test. The above results indicate an average performance where the maximum number of students passed but their overall result was not satisfactory.

**4.5.2 Performance of Students by Gender**

Table 4.13 shows the academic performance of students by gender.

Table 4.13: Performance of students by gender

| Gender | Excellent | Better | Good | Average | Below Average | Fail | Total |
|--------|-----------|--------|------|---------|---------------|------|-------|
| Girls | 10.3% | 16.1% | 26.0% | 24.2% | 19.3% | 4.0% | 100.0% |
| Boys | 8.9% | 13.0% | 20.7% | 20.1% | 28.4% | 8.9% | 100.0% |

It can be seen from table 4.13 that the performance of girl students was better than that of boys. Among the girl students, 10.3 percent have excellent performance, 16.1 percent of them have better performance, 26 percent students have good performance, 24.2 percent have average performance, 19.3 percent have below average performance and only 4 percent failed the test. On the other hand, among the boy students, 8.9% percent have excellent performance, 13 percent of them have better performance, 20.7 percent have good performance, 20.1 percent student have average performance, 28.4 percent have below average performance and 8.9 percent students failed the test.

**4.5.3 Academic Performance According to Division**

Table 4.14 shows the performance of students according to division.

Table 4.14: The performance of students according to division

| Division | Excellent | Better | Good | Average | Below Average | Fail | Total |
|---|---|---|---|---|---|---|---|
| Dhaka | 2.0% | 10.0% | 12.0% | 21.0% | 43.0% | 12.0% | 100.0% |
| Chattogram | 6.8% | 15.5% | 32.0% | 27.2% | 16.5% | 1.9% | 100.0% |
| Barishal | 18.6% | 14.4% | 18.6% | 18.6% | 22.0% | 7.6% | 100.0% |
| Rajshahi | 9.9% | 21.1% | 36.6% | 23.9% | 7.0% | 1.4% | 100.0% |

From table 4.14, it can be seen that the students of Barishal division received the highest grades (18.6%) among all the four divisions whereas students of Chattogram division received 6.8 percent excellent grades; students of Rajshahi division got 9.9 percent excellent grades and students of Dhaka division got only 2% excellent grades. On the other hand, students of Rajshahi and Chattogram divisions had a minimum level (1.4% and 1.9% respectively) of failure in the test whereas the students of Dhaka division had the highest level of failure (12%).

### 4.5.4 Performance of the Students by Different Subjects

Table 4.15 shows the performance of students by subjects in the primary curriculum.

Table 4.15: Distribution of students by their performance test by subjects

| Grade | Bangla (%) | English (%) | Mathematics (%) | Bangladesh and Global Studies (%) | General Science (%) | Religion (%) |
|---|---|---|---|---|---|---|
| A+(80-100) | 31.1 | 17.1 | 7.7 | 14.5 | 22.2 | 36.7 |
| A(70-79) | 18.1 | 5.9 | 11.7 | 16.3 | 15.6 | 0.0 |
| A-(60-69) | 20.9 | 21.4 | 13.5 | 34.7 | 31.6 | 19.4 |
| B(50-59) | 11.5 | 23.5 | 12.2 | 15.1 | 13.0 | 0.0 |
| C(40-49) | 9.9 | 17.9 | 20.2 | 14.8 | 12.2 | 21.2 |
| D(33-39) | 3.3 | 2.0 | 6.1 | 2.8 | 2.3 | 0.0 |
| Fail (<33) | 5.1 | 12.2 | 28.6 | 1.8 | 3.1 | 22.7 |

Table 4.15 shows the maximum number (36.7%) got A+ in Religion followed by about 31.1 percent in Bangla and only a few students (7.7%) obtained A+ in Mathematics. A good number of students (22.2%) got A+ in general science followed by 17.1 percent achieving A+ in English and 14.5 percent A+ in Bangladesh and Global Studies. On the other hand, a good number of students (28.6%) failed in Mathematics followed by 22.7 percent failure in Religion.

**4.5.5 Details of Performance in Bangla**

Figure 4.9 shows the detailed performance of students in Bangla.
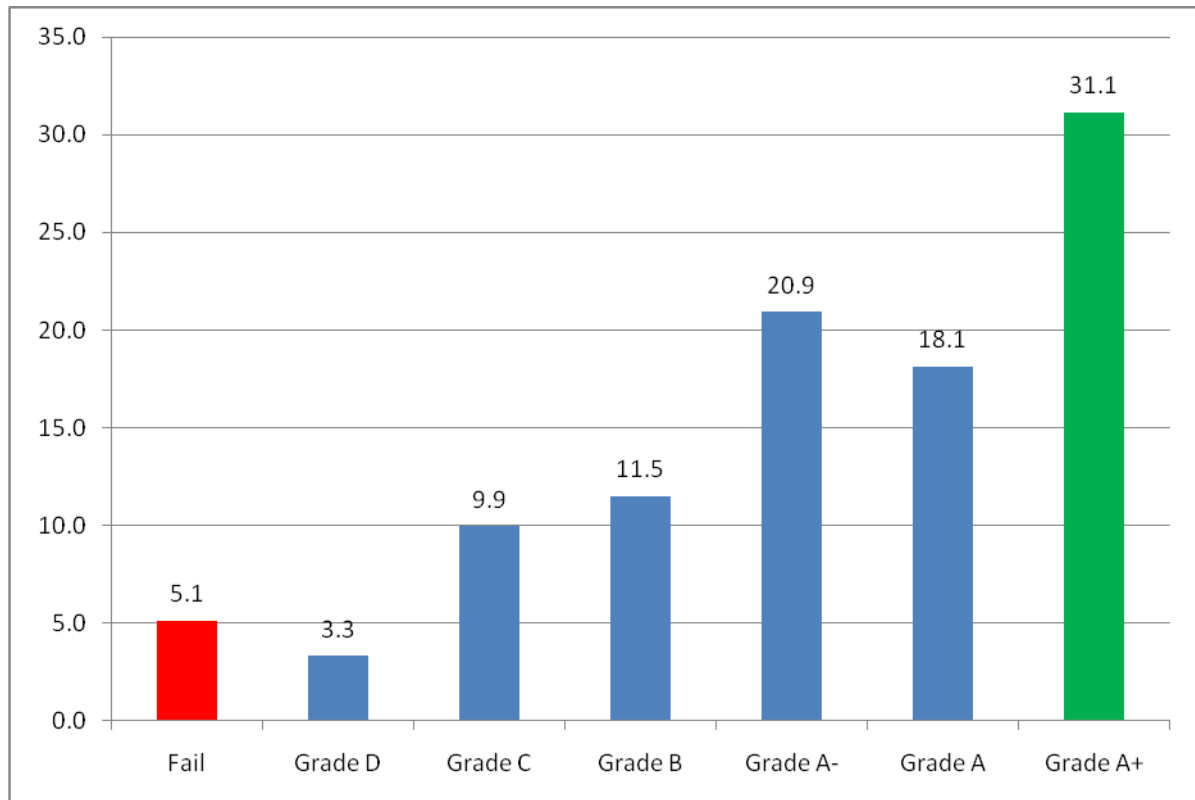


Figure: 4.9: Details of performance in Bangla

A good number of students (31%) got A+ followed by 18.1 percent A; 20.9 percent secured A-, 11.5 percent received B, 9.9 percent C, 3.3% D and 5.1 percent failed.

### 4.5.6 Details of Performance in English

Figure 4.10 shows the details of performance of students in

English.
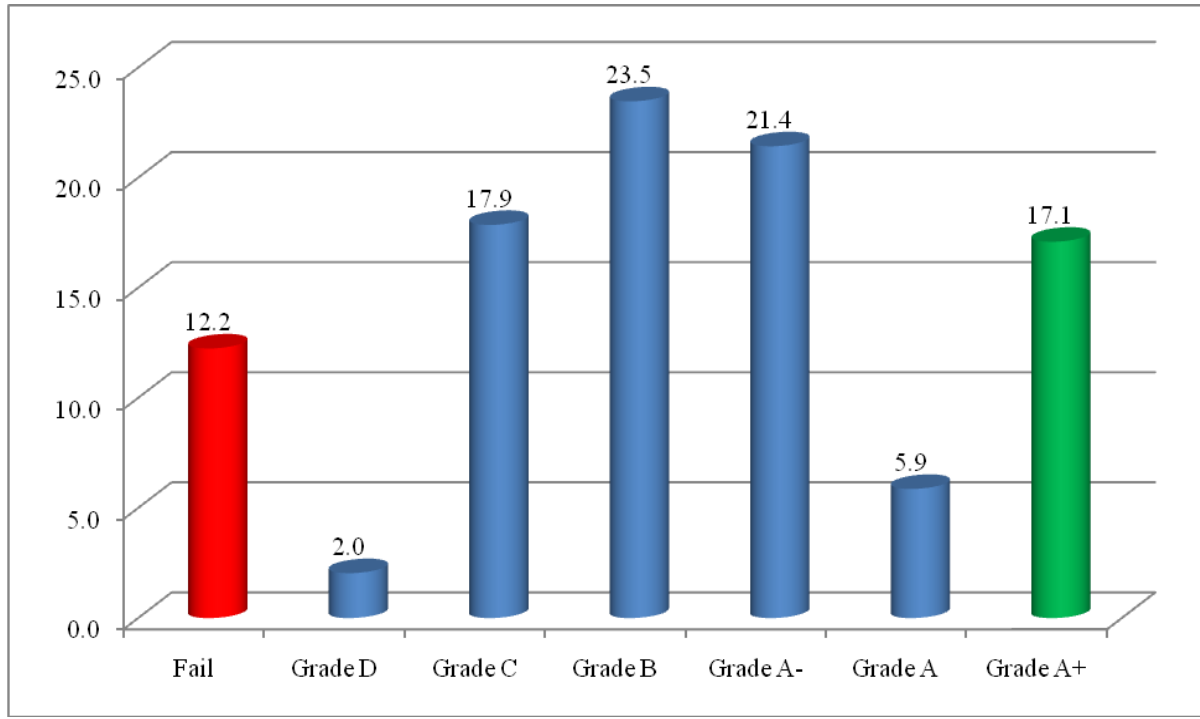


Figure: 4.10: Detail performance in English

This figure indicates that a significant number of students (12.2%) failed in English whereas

17.1 percent got an excellent grade, 5.9 percent got A, 21.4 percent got A-, 17.9 percent got

C, 2 percent got D and the highest 23.5 percent got B grade in the performance test.

**4.5.7 Details of Performance in Mathematics**

Figure 4.11 shows the detailed performance of students in Mathematics.
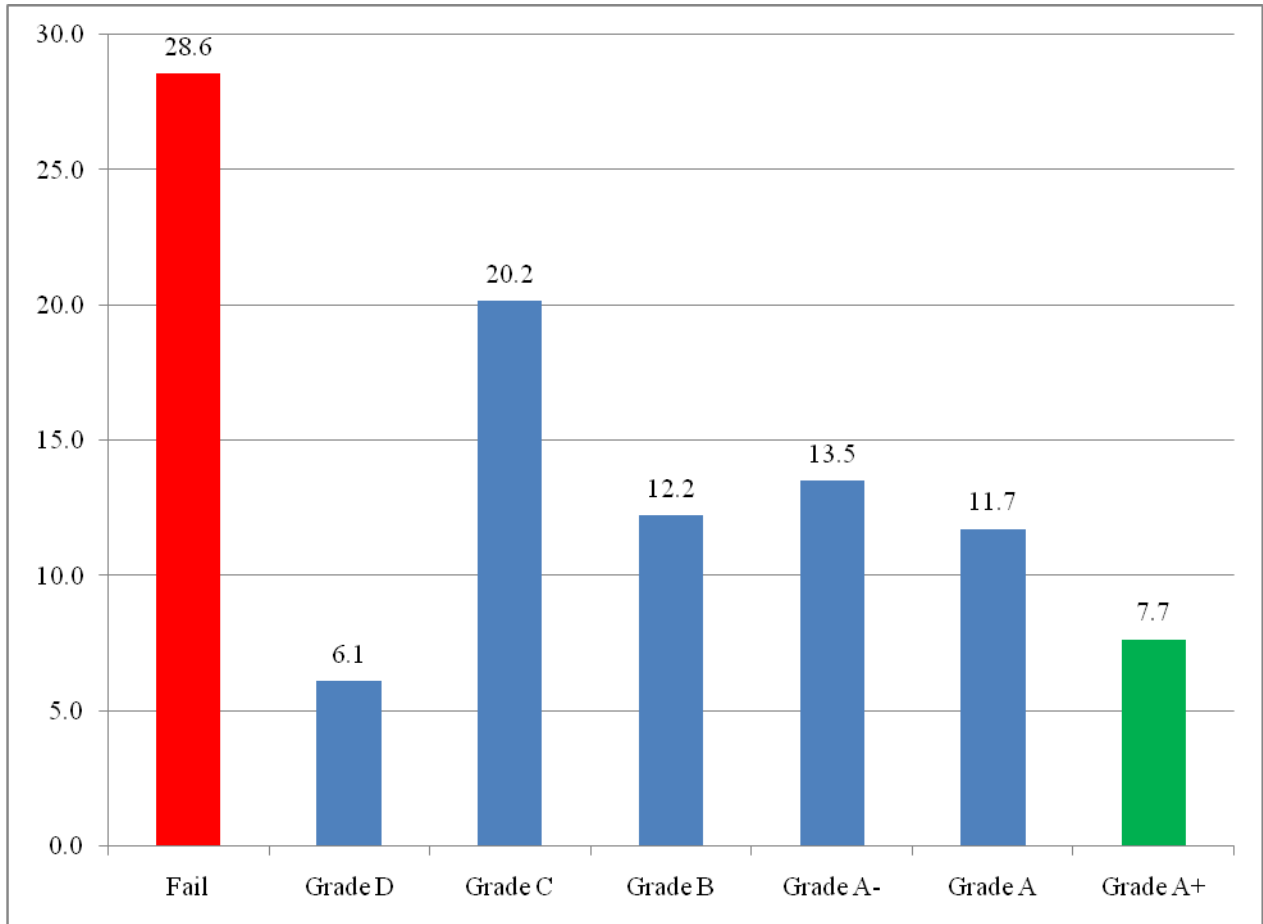


Figure: 4.11: Details of performance in Mathematics

A substantial number of students (28.6%) failed in Mathematics, followed by 20.2 percent securing C grade. Only 7.7 percent got an excellent grade, 11.7 percent got A, 13.5 percent got A-, 12.2 percent got B and 6.1 percent got D grade in the performance test. It reveals that the students are generally weak in Mathematics.

**4.5.8 Detailed Performance Statuses in Bangladesh and Global Studies**

Figure 4.12 shows the detailed performance of students in Bangladesh and Global Studies.
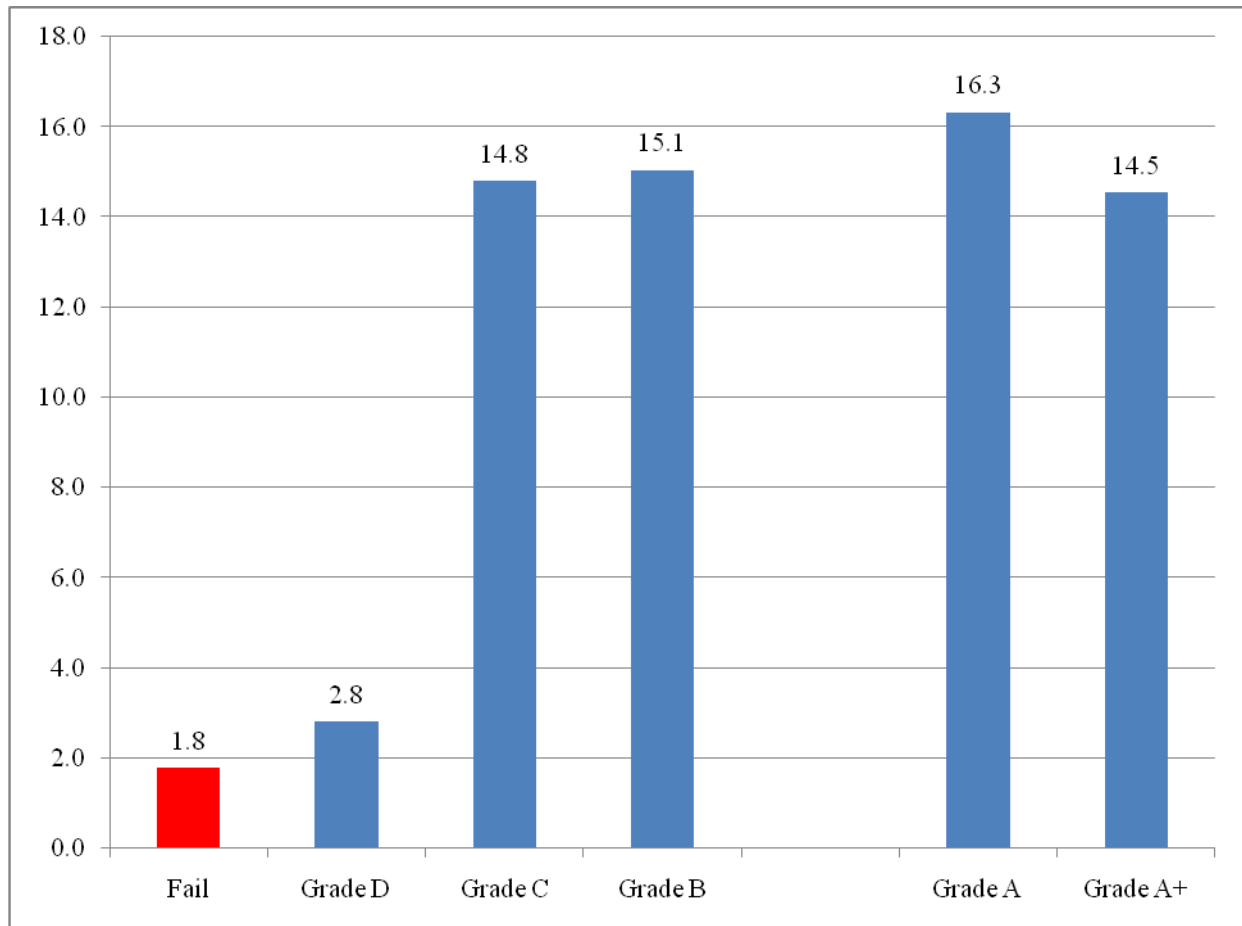


Figure: 4.12: Detailed Performance in Bangladesh and Global Studies

This figure shows that a good number of students (16.3%) got A followed by 14.5 percent with A+, 15.1 percent with B, 14.8 percent with C, 2.8 percent with D and 1.8 percent of them failed.

## 4.5.9 Detailed Performance in Religion

Figure 4.13 shows the detailed performance of students in Religion.
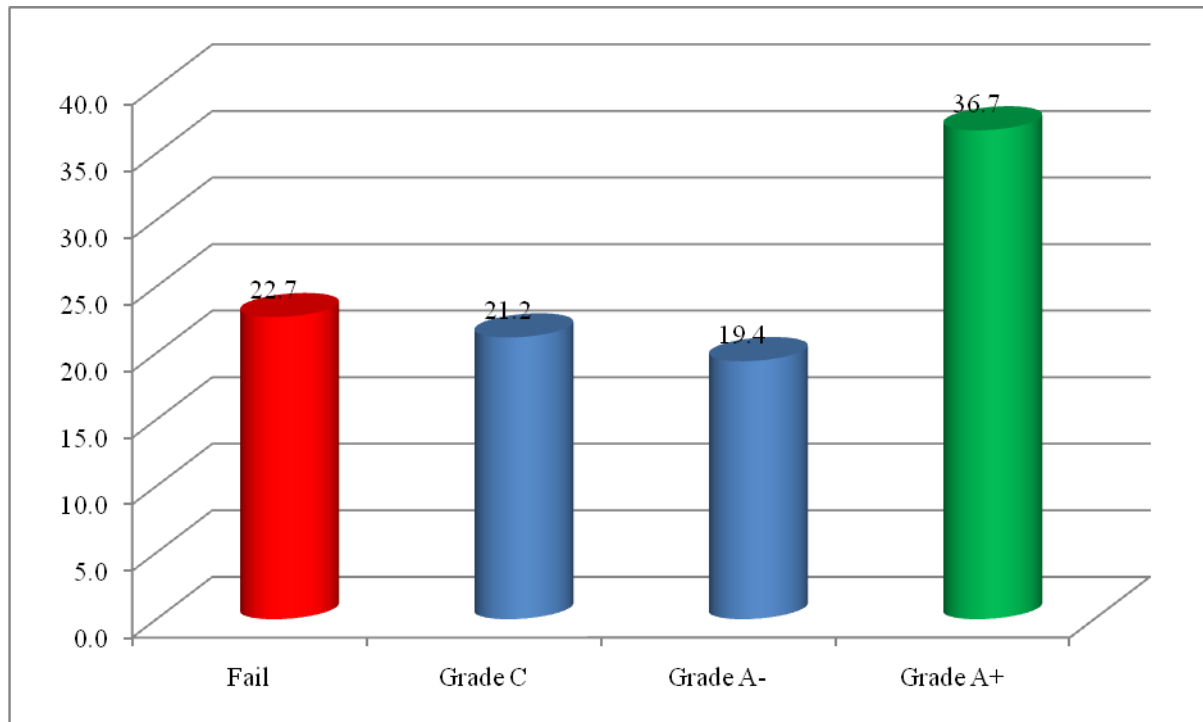


Figure: 4.13: Detailed performance in Religion

Over one-third (36.7%) students obtained A+ followed by 19.4 percent A-, 11.5 percent B, 21.2 percent C and a substantial number (22.7%) who failed in the test. It can be seen that there is a bi-polar distribution with a majority doing well in Religion and at the same time a good number of students failing in the subject.

## 4.5.10 Details of Performance in Science

Figure 4.14 shows the details of performance of the students in Science.
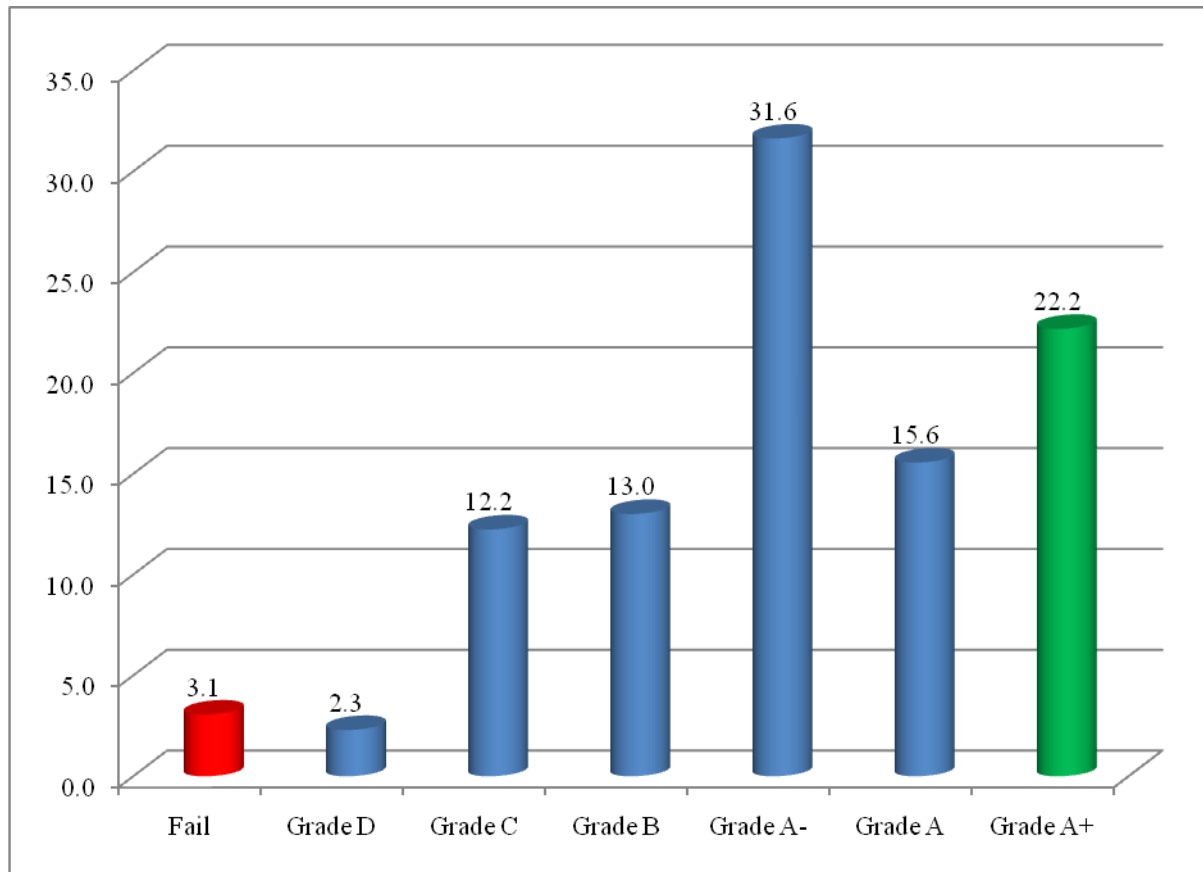


Figure: 4.14: Details of Performance in Science

It can be seen that 22.2 percent students got A+ followed by 15.6 percent A, 13 percent B, 12.2 percent C, 2.3 percent D and 3.1 percent who failed. However, the highest proportion (31.6%) got A-.

**4.6 Nutritional Status of Students and Their Academic Performance**

In this section, the relationship between individual indicators of nutrition status (stunting - HAZ and thinness- BAZ) and their academic performance is presented.

**4.6.1 Nutritional Status (HAZ) of the Students by Their Performance in the Performance Test**

Table 4.16 shows the relationship between stunting (HAZ) and the performance of the students in the performance test

Table 4.16: Relationship between stunting (HAZ) and academic performance of students

| Nutritional Status(HAZ) | Performance Test Score | | | | | | Total (%) |
| --- | --- | --- | --- | --- | --- | --- | --- |
| | Excellent (%) | Better (%) | Good (%) | Average (%) | Below Average (%) | Fail (%) | |
| Stunted | 5.0 | 9.2 | 26.9 | 26.1 | 24.4 | 8.4 | 100.0 |
| Normal | 10.0 | 16.3 | 21.3 | 22.2 | 24.4 | 5.9 | 100.0 |
| Tall | 19.2 | 21.2 | 26.9 | 15.4 | 15.4 | 1.9 | 100.0 |

$\chi^2$ =19.038 and p<0.05(p=0.04)

Table 4.16 portrays a strong association (chi-square is 19.038 and P value is p<0.05) between nutritional status (Height for age Z-score) of the students and their performance in the performance test score. It can be observed that, among the stunted students, only 5 percent have an excellent performance in the test followed by 9.2 percent with better performance, 26.9 percent with good performance, 26.1 percent with average performance, 24.4 percent with below average performance and 8.4 percent students failing in the test. Among the normal height students, 10.0 percent have excellent performance followed by 16.3 percent with better performance, 21.3 percent with good performance, 22.2 percent with average performance, 24.4 percent with below average performance and 5.9 percent students failing

in the test. Among the tall students, 19.2 percent students have excellent performance, 21.2 percent have better performance, 26.9 percent students have good performance, 15.4 percent students have average performance, and 15.4 percent have below average performance and only 1.9 percent students failed in the test. This result clearly indicates that those having better nutritional status their performance in the performance test are also better and those having poor nutritional status their performance are also poor in the test.

### 4.6.2 Thinness (BAZ status) of Students and Their Academic Performance

Table 4.17 shows the relationship between thinness status (BAZ) and the performance of the students in the performance test.

Table 4.17: Relationship between BAZ status and student academic performance

| Nutritional Status (BAZ) | Performance Test Score | | | | | | Total (%) |
|---|---|---|---|---|---|---|---|
| | Excellent (%) | Better (%) | Good (%) | Average (%) | Below Average (%) | Fail (%) | |
| Thinness | 5.1 | 10.3 | 27.6 | 25.6 | 23.7 | 7.7 | 100.0 |
| Normal weight | 11.5 | 16.7 | 23.0 | 20.7 | 23.6 | 4.6 | 100.0 |
| Overweight | 10.9 | 19.6 | 19.6 | 21.7 | 21.7 | 6.5 | 100.0 |
| Obese | 31.3 | 25.0 | 6.3 | 12.5 | 18.8 | 6.3 | 100.0 |

$\chi^2$ = 22.664 and p > 0.05(p=0.09)

Table 4.17 portrays a relationship between thinness status (BMI for age Z-score) of the students and their performance test scores. From the above table, among the thinner students (5.1%) have excellent performance in the test, 10.3 percent of them have better performance,

27.3 percent students have good performance, 25.6 percent students have average performance, 23.7 percent have below average performance and 7.7 percent students failed in the test. Among the normal weight students, 11.5 percent have excellent performance, 16.7 percent of them have better performance, 23.0 percent students have good performance, 20.7 percent have average performance, 23.6 percent have below average performance and 4.6 percent students failed in the test. Among the overweight students, 10.9 percent have excellent performance, 19.6 percent of them have better performance, 19.6 percent have good performance, 21.7 percent have average performance, 21.7 percent have below average performance and 6.5 percent students failed in the test. Among the obese students, 31.3 percent have excellent performance, 25.0 percent of them have better performance, 6.3 percent students have good performance, 12.5 percent students have average performance, 18.8 percent have below average performance and 6.3 percent students failed in the test. It is clearly evident that those having better nutritional status in terms of BAZ measure, their performance in the tests are also better and vice versa.

## 4.7 Performance Test and Nutritional Knowledge Scores of the Students

Table 4.18 portrays a relationship between nutritional score (based on their nutritional knowledge) of primary school students and their performance in the test score.

Table 4.18: Performance test and nutritional knowledge score of the students

| Nutritional Knowledge Score | Performance Test Score | | | | | | Total (%) |
|---|---|---|---|---|---|---|---|
| | Excellent (%) | Better (%) | Good (%) | Average (%) | Below Average (%) | Fail (%) | |
| Low | 2.0 | 9.9 | 23.8 | 26.5 | 30.5 | 7.3 | 100.0 |
| Medium | 9.1 | 18.3 | 26.0 | 21.2 | 19.7 | 5.8 | 100.0 |
| High | 48.5 | 15.2 | 9.1 | 12.1 | 12.1 | 3.0 | 100.0 |

$\chi^2 = 78.054$ and $p < 0.05$ (p=0.00)

It can be seen from the table that about 48.5 percent students who have high level of nutritional knowledge had achieved excellent performance in the performance test followed by 15.2 percent of them with better performance and 9.1 percent with good performance. However, 2.1 percent showed below average performance and 3 percent students failed in the test.

On the other hand, among those with a low level of nutritional knowledge, only 2.0 percent had excellent performance in the test followed by 9.9 percent with better performance, 23.8 percent with good performance, 26.5 percent with average performance. However, 30.5 percent obtained below average performance and 7.3 percent students failed in the test. Among students with medium nutrition knowledge scores, Majority students (26.0 percent) showed good performance. Only 19.7 percent had below average performance and 5.8

percent failed in the test. This result clearly indicates that the students who have scored better in the nutrition test also did better in the performance test.

## 4.8 Socio-economic Aspects and Performance of the Students

In this section, the association of student academic performance and aspects of socio economic status of students indicated by their mothers' education level, mothers' occupation and family income is presented.

## 4.8.1 Student Performance Test Score and Mother's Education Level

The following table shows the relation between student's performance test scores and mother's education level.

Table 4.19: Student performance test score and mother's education level

| Education Level | Performance Test Score | | | | | | Total (%) |
|---|---|---|---|---|---|---|---|
| | Excellent (%) | Better (%) | Good (%) | Average (%) | Below Average (%) | Fail (%) | |
| Uneducated | 2.4 | 12.2 | 17.1 | 19.5 | 34.1 | 14.6 | 100.0 |
| Primary Passed | 2.7 | 13.4 | 17.0 | 30.4 | 28.6 | 8.0 | 100.0 |
| Class 8 Passed | 4.3 | 14.5 | 29.0 | 27.5 | 17.4 | 7.2 | 100.0 |
| SSC Passed | 12.5 | 12.5 | 33.3 | 19.8 | 19.8 | 2.1 | 100.0 |
| HSC Passed | 15.4 | 20.5 | 17.9 | 17.9 | 23.1 | 5.1 | 100.0 |
| Honor's Passed | 45.8 | 12.5 | 25.0 | 4.2 | 12.5 | 0.0 | 100.0 |
| Masters Passed | 18.2% | 45.5% | 18.2% | | 18.2% | 0.0% | 100.0% |

$\chi^2 = 89.462$ and $p < 0.05$ (p=0.00)

It appears from above table that the students whose mothers are Bachelor degree holders, 45.8 percent of them had excellent performance in the test followed by 12.5 percent with better performance, 25 percent with good performance, 4.2 percent with average performance. However, 12.5 percent students showed below average performance but no student failed in the test. On the other hand, of students whose mothers are uneducated, only 2.4 percent had excellent performance in the test followed by 12.2 percent with better

performance, 17.1 percent with good performance and 19.5 percent with average performance. But, 34.1 percent students showed below average performance and 14.6 percent failed in the test. Similarly, among the students whose mothers are masters' degree holders, a good number (18.2%) had excellent results in the performance test followed by 45.5 percent better performance and 18.2 percent good performance. Only 18.2 percent students showed below average performance with no student failed in the test. Among the students whose mothers have an HSC pass certificates, majority students (71.7%) were successful in the test having good marks whereas only 23.1 percent had below average performance and 5.1 percent students failed in the test. Of the students whose mothers are with SSC pass, similar result was found in the performance test of majority students. Only 19.8 percent students had shown below average performance and 2.1 percent failed in the test. Similar results were also found with students whose mothers are grade 8 passed and whose mothers have only primary education. These results clearly indicate that mothers' educational level is critical for students achieving good academic performance.

**4.8.2 Student Academic Performance and Mother's Occupation**

Table 4.20 portrays a relationship between mother's occupation and student academic performance.

Table 4.20: Student performance test and mother's occupation

| Occupation Category | Performance Test Score | | | | | | Total (%) |
|---|---|---|---|---|---|---|---|
| | Excellent (%) | Better (%) | Good (%) | Average (%) | Below Average (%) | Fail (%) | |
| Housewife | 8.1 | 13.8 | 24.4 | 23.3 | 24.2 | 6.2 | 100.0 |
| NGO Worker | 0.0 | 0.0 | 50.0 | 50.0 | 0.0 | 0.0 | 100.0 |
| Business | 0.0 | 50.0 | 0.0 | 0.0 | 50.0 | 0.0 | 100.0 |
| Job holder | 13.3 | 26.7 | 26.7 | 20.0 | 6.7 | 6.7 | 100.0 |
| Teacher | 46.7 | 26.7 | 6.7 | 0.0 | 13.3 | 6.7 | 100.0 |

$\chi^2$ = 41.650 and p < 0.05 (p=0.02)

Of students whose mothers are teachers, 46.7 percent have excellent performance in the test followed by 26.7 percent with better performance, 6.7 percent with good performance, 13.3 percent with below average performance and 6.7 percent students failing in the test. On the other hand, among the students whose mothers are NGO workers, none has excellent and better performance, but students are equally divided in performance with 50 percent having good performance and 50 percent with average performance. However, among the students whose mothers are job holders (employees) only 13.3 percent have excellent performance in the test, 26.6 percent have better performance, 26.7 percent students have good performance,

20 percent have average performance, 6.7 percent have below average performance and 6.7 percent students failed in the test. Among the students whose mothers are doing business, no student has excellent performance in the test, 50 percent have better performance, about 50 percent have below average performance and none failed in the test. Among the students whose mothers are home makers, only 8.1 percent students have excellent performance in the test, 13.8 percent of them have better performance, 24.4 percent students have good performance, 23.3 percent students have average performance, and 24.2 percent have below average performance and 6.2 percent students failed in the test. This result indicates that mothers' occupations which are non-traditional (i.e., other than housewife), influence the academic performance of the students in a positive way.

### 4.8.3 Performance Test Score and Family Income of the Students

Table 4.21 portrays a relationship between family income and student performance in performance test scores.

Table 4.21: Student performance score and family income

| Family Income Level | Performance Score | | | | | | Total (%) |
|---|---|---|---|---|---|---|---|
| | Excellent (%) | Better (%) | Good (%) | Average (%) | Below Average (%) | Fail (%) | |
| <15000 tk | 3.3 | 11.9 | 24.3 | 27.1 | 26.7 | 6.7 | 100.0 |
| 15000 - 30000 tk | 12.0 | 19.6 | 20.7 | 19.6 | 21.7 | 6.5 | 100.0 |
| >30000 tk | 22.2 | 16.7 | 25.6 | 14.4 | 16.7 | 4.4 | 100.0 |

$\chi^2$= 35.494 and p < 0.05 (p=0.00)

It appears from the table that the students who have better family income, their performance is also relatively better. There is clearly a positive relationship between family income and academic performance of students.

**4.9 Impact of Nutritional Status, Socio-economic Background and Nutrition Related Knowledge on Student Academic Performance**

The relative degree of association of different variables and student academic performance are presented in this section on the basis of multiple regression calculation.

Table 4.22 shows the multiple regression analyses results that show the relative impact of nutritional status, socioeconomic background and nutrition related knowledge score on the performance test score.

Table 4.22: Impact of nutritional status, socioeconomic background and nutrition related knowledge score on student performance score

| Coefficients | | | |
|---|---|---|---|
| | B | Std. Error | Sig. |
| (Constant) | 42.339 | 2.293 | .000 |
| Height-for-age | 1.450 | .665 | .030 |
| BMI-for-age | .204 | .519 | .694 |
| Family income | .000 | .000 | .062 |
| Mother's education level | .826 | .188 | .000 |
| Nutrition related knowledge score (Out of 7) | 2.836 | .586 | .000 |

The potential predictors were height for age z-score (HAZ), BMI for age z-score (BAZ), family income, mother's education level and nutrition related knowledge score for performance test score.

The multiple regression model with all five predictors produced $R^2 = 0.188$, $F(5,386) = 17.928$, in the table 4.22 shows that height for age z-score had significant ($p<.05$) impact on receiving higher performance test scores. This indicates that if the students' height-for-age increases 1 unit, their average performance score will increase 1.45 units.

It also shows that there was no significant ($p>.05$) impact of BMI for age on performance test score, i.e., students with higher scores on this scale were not expected to have better performance in the performance test or students with less score on this scale were not expected to have poor performance in the performance test, after controlling the other variables in the model. The family income had positive impact in receiving higher scores but the relationship was not significant ($p>.05$).

Mother's education level had significant ($p<.05$) impact which indicated that students with higher scores on this scale were expected to have better performance in the performance test, after controlling of the other variables in the model. This also indicates if the mothers' educational level increases 1 unit then student test score will increase 0.826 units.

Table 4.22 also shows that nutrition knowledge had a very significant ($p<.05$) impact on academic performance which indicated that students with higher scores in the nutrition related knowledge were expected to have better performance in the performance test, after controlling of the other variables in the model. If the student's nutrition related knowledge score increases 1 unit, their performance test score will increase 2.836 units. Nutrition related knowledge indirectly connected with nutrition status and it has the highest impact on the performance test score followed by height for age (HAZ).

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## 4.10 Qualitative Data Analysis

Complementing quantitative data, pertinent qualitative information was gathered from primary school teachers, parents and education experts using an interview schedule and FGD guidelines. School teachers and parents are important actors in respect of decisions and practice about issues related to student nutrition as well as their academic performance. Education experts are appropriate sources for expert opinion regarding nutritional impact on academic performance of students. A total of 16 interviews and 4 FGDs were carried out to learn about perceptions of primary school teachers, parents and education experts regarding the issue. All the respondents generally agreed that nutrition substantially influences student's overall development as well as academic achievement. Findings were extracted from interviews and FGDs and data were analyzed thematically according to the approach suggested by Braun and Clarke (Using Thematic Analysis Method, 2019). The following themes were generated to support and supplement findings extracted from quantitative measures (Braun & Clarke, 2019).

1. School Attendance and Class Participation

2. Adaptive Behavior and Socialization

3. Cognitive Functioning and Mental Ability

4. Academic Performance and Cycle Completion

5. Co-curricular Activities and Team-work

The above mentioned themes are derived from UNESCO-guided quality education indicators, which have been found useful to evaluate academic performance of students (EFA Global Monitoring Report, 2014).

**4.10.1 School Attendance and Class Participation**

Through the current research, it has been revealed that nutrition and parental awareness towards nutritional value have a great influence on school attendance as well as class participation. Students from low-income families who cannot afford much nutritious food are more likely to be irregular in school. Even though they come to school, they remain very passive in classroom teaching-learning process. As pointed out by interviewee D:

> Most of the students who tend to be absent from school are from very poor families. They have few chances of taking breakfast before coming to school in the morning. We find some students who are physically week cannot come to school regularly. Even if they come, they cannot participate actively in the classroom teaching-learning process or in group activities. I believe that school authority can increase attendance rate by promoting small amount of nutritious food as well as raising awareness of the importance of nutrition.

Good nutrition plays a vital role in terms of school enrolment. A number of students in developing countries come to school without taking any breakfast. When students attend school without taking breakfast, their performance goes down by around 0.1 standard deviation equivalent to 4 percentile points but it involves only those who are from malnourished or poorer families. The general tendency of undernourished pupils according to their enrolment occurs in school later than those who are well nourished (Jukes, 2002).

Several respondents pointed out that apart from nutrition, sometimes family-awareness regarding the importance of education is also a factor in students' irregularity in school. A teacher interviewee said:

> Most of the mothers are not educated. Sometimes they are reluctant to send their kids to school, though their financial status is good. Mother 'sensitization regarding education may be one of the significant variables in changing this situation. In addition, collaboration between school and parents should be strengthened in this regard.

As school attendance on a regular basis in an indicator of quality education, most of the interviewees opined that community awareness for schooling can be built-up through school-community interaction. Hence parental motivation is also important for school attendance apart from nutrition issues. A head teacher suggested:

> At first, parents have to understand the value of education. Their lack of interest sometimes de-motivates their kids to come to school every day. If they do not come to school, how can we measure their learning in relation to nutrition? So, I believe only nutritious food cannot be the main factor of school attendance and class participation, we need to retain our student in the school and class by our teaching quality as well by creative learning friendly school environment if we truly want their desirable academic performance.

### 4.10.2 Adaptive Behavior and Socialization

Many research findings show that there is a positive correlation between nutrition status and behavior (Jukes, 2002 & Lahey and Rosen, 2010). A number of studies also indicate that behavior and socialization skills greatly affect students' academic performance. In the present research, it has been revealed that shortage of nutritious meals leads students to exhibit mal-adaptive behavior which has an influence on her/his classroom performance as well as learning achievement. Most of the teachers and parents agreed that if the families can provide proper food for their students, they are likely to demonstrate positive social behavior during the teaching-learning practices in the classroom and beyond in their interaction with their peers. An interviewee emphasized balanced diet awareness for socially acceptable behavior in this way:

> Students need to have sufficient food (balanced diet) every morning for gaining energy for the whole day. If they feel hungry, they sometimes misbehave with friends in the class and make chaos in the group activities. These results in being inattentive to teachers' instruction for class work.

However, family background sometimes is a variable in students' behavior and their acquiring of socialization skills. Lack of social values and ethics also affects student learning style and academic accomplishment. An interviewee teacher stressed:

> Student performance depends upon many factors including family status. Some low achiever students are found in the class those who come from broken family. One of our students ($5^{th}$ grader female student) was stable and doing well in school examinations. After her mother got divorced, her father left them and she then started being irregular in the school and quite often she was inattentive to learning.

### 4.10.3 Cognitive Functioning and Mental Ability

It has been established that nutrition has a significant impact on intellectual functioning and mental capacities. Nutritious foods enable the human brain to be more responsive and muscle tones to be more functional. Cognitive skills play an inevitable role in academic performance of students and it is influenced by the nutritional status of children, as noted earlier; the triangular relationships have been emphasized by respondents of interviews and FGDs. A teacher said:

> Food containing protein and vitamins are very effective for physical growth and mental development of the young learners. The students who are week or lacking of sufficient nutritious foods regularly cannot actively participate in classroom activities. They miss teachers' instruction and cannot follow the classroom rules properly. They often remain passive listeners. Especially in Mathematics class, the students are more likely to be inactive and face difficulties while teachers ask them to solve any mathematical problem. They do not even try to understand how the problem can be solved. Their responses sometimes are unclear and call for remedial measures.

One of the education experts expressed his opinion that nutrition is associated directly with brain development, because scientific evidence shows that the brain needs a variety of nutrients to be able to develop and function optimally. To concentrate, focus, remember and regulate our emotions we need protein, unsaturated fats, complex carbohydrates and sugars (in grains, fruits and vegetables), as well as a host of trace elements such as iron, potassium,

and selenium. Sufficient protein is essential because growing bodies need protein more than any other nutrient (besides clean water) and proteins are synthesized into dopamine and nor epinephrine which are essential chemicals for quick reaction time, thinking and working memory.

On the other hand, students having good nutrition status exhibit vigorous motivation and willingness to perform every single task asked for in class activities. Since Mathematics and English are generally considered more difficult subjects for students than others, these two need to be carefully handled by teachers, especially in the case of students from low income families and who are first generation learners. According to an assistant teacher:

> Only nutritional items and sufficient meals every times cannot ensure students' better performance in Primary Science and other difficult subjects. The students, who secure high marks in the examinations, are found to be from higher educated and conscious families who take care of their children in terms of lesson preparation, tutors' guidance, coaching support and so on. However, some needy students also perform better in my class when the mothers have good education and they look after their children's study at home.

Another education expert opined:

> There is a relationship between nutrition and academic performance. Nutrition works for students' overall development including mental and physical development and therefore, those students who lack intake of balanced food would be in a vicious cycle of underdevelopment leading to students' poor academic performance.

By birth, some students possess high intelligence and others are deficient in this respect. This also affects individuals' academic accomplishment. However, proper nutrition has influence on intellectual and mental ability which fosters academic progress of students with different levels of intellectual capability.

A head teacher made the point this way:

> We are responsible for all categories of students regardless of low-income family or low intelligence quotient (IQ). We should nourish each student for the fullest development of their potentials. If we can really work sincerely to stimulate our students properly, students with low IQ can also be good achievers. Moreover, students' performance and success depend upon teachers' teaching strategies as well as parental guidance.

It has been noted by respondents of interviews and FGDs that in their experience high performing students in the class and high achieving students in the examination are not always from high-income family.

### 4.10.4 Examination Performance and Cycle Completion

Almost all the interviewees agreed with the point that malnourished students show lower performance in the examinations and tend to drop out of school before completing the cycle. One of the teachers said: "Those who are malnourished could not perform well in their exam and most often they are more likely to be dropped from the school before completing the primary cycle."

One of the education experts asserted, "I strongly believe that the nutrition level of students has a positive impact on the academic performance of students of primary age group."

The education experts also argued that Bangladesh has made substantial economic progress and is now a lower middle-income country, but an estimated 28 million of its population of 161 million remain in extreme poverty. Near-universal enrolment in primary education has been achieved, but the quality of teaching is poor, as are literacy scores. Many students drop out before secondary school, reflecting issues such as early marriage for girls' and the boys' need to contribute to family income. Their high levels of stunting; wasting and micronutrient deficiency among students exacerbate the effects of poverty.

Bangladesh has introduced the School Feeding Program (SFP) as one of the sub-components of PEDP-3 which is to be continued and expanded under PEDP-4. SFP has

wider educational and nutritional objectives and provides support for various activities to raise community awareness about the link between nutrition and quality of education. It contributes, along with other agencies, to an "essential learning package" that links education, school health, nutrition and hygiene; it also aims to support the strengthening of a national SF strategy. School feeding in turn has to be seen within the context of national strategies for education, health, nutrition and social safety nets. The Mid-term Evaluation of PEDP-3 indicated the beneficial outcome of SFP in the academic performance of primary education students. The benefits included gains in: enrollment, attendance, grade completion and cycle completion by the students. More specifically, SFP has raised school enrolment by 14.2 percent, reduced the probability of dropping out of school by 7.5 percent, and increased school attendance by about 1.3 days a month. These results are obtained from econometric models that captured the impact of the SFP alone, isolating the effects of income and other factors (WFP, 2017).

SFP improves students' diets. Calories consumed from SFP biscuits are almost entirely (97 percent) additional to the child's normal diet. The child's family does not give him or her less food at home because the child would receive SFP biscuits at school. Even poor households do not substitute child calorie intakes for SFP biscuits. These findings are based on a specifically designed experiment and an econometric model to assess the impact of SFP on child energy intake (WFP, 2017).

An extremely high percentage of mothers report several positive effects of the SFP on their children. They note that children's interests in attending school and concentration on studies have increased; they are livelier and happier than before, and their incidence of illness has declined (WFP, 2017).

SFP improves child nutritional status. It increases the body mass index (BMI) of participating students by an average of 0.62 points. This represents a 4.3 percent increase

compared to the average BMI of school students in the control group - a sizable increase that is partly due to the fact that most participating students were malnourished to begin with (WFP, 2017).

### 4.10.5 Co-curricular Activities and Team-work

Co-curricular programs enhance students' psychomotor skills and socialization skills which are linked to their academic performance in the class and examination. Those who are proven good at sports and other social activities can also be good achievers in academic learning.

The majority of interviewees pointed out that there is a strong relationship between students' physical fitness and participation in the classroom teaching-learning process. They also mentioned that cultural involvement is also associated with students' creativity, particularly, in learning engagement and learning style. It is agreed by students that good nutrition status is helpful for improving students' creative functioning and the spirit of team-work. An assistant teacher suggested incorporating pertinent content related to nutrition and its importance for learning improvement. He said:

> If the family can be aware of the importance of nutrition in accelerating student's learning abilities, they can provide them with more nutritious meals. Then students can gain more energy not only for play activities in the full day school program, but also will engage in classroom activities and would be able to pay greater attention to the lessons.

# *Chapter 5*

# DISCUSSION

## 5.1 Prologue

The aim of this study was to determine the impact of nutritional status on academic performance of primary school completers in Bangladesh. The study attempts to answer all of the research questions that were posted. As an empirical study, it explored and tested the path and mechanism of influence of several independent variables affecting the dependent variable in the form of student academic performance as layout in the conceptual framework. Multiple regression analysis was applied to assess nutritional impact on student academic performance. The research findings are consistent with the findings of various previous researches in many countries as well as in Bangladesh. The discussion of the analyses and findings are organized under the following themes:

- Prevalence of Stunting and Thinness

- Demographic and Parents' Socio-economic Factors

- Nutrition Related Knowledge Score

- Relation between Nutritional Status and Academic Performance

- Significance of Nutrition on Academic Performance

The first three themes may be viewed as part of the 'enabling environment' or 'disabling environment' surrounding the key issue encapsulated in the last two themes.

## 5.2 Prevalence of Stunting and Thinness

In general, a significant proportion of the students of Bangladesh have a nutritional problem. The present study, consistent with other data, shows the prevalence of stunting and thinness among primary school completers were 30.4 percent and 40 percent respectively. Nutritional problems for young children including students at the primary school level are common in developing countries – such as neighboring South Asian countries and in other parts of the world. Comparative data from similar studies as outlined below places the Bangladesh situation in a context and in a specific environment.

Mazumder et al. (2014) conducted a study on the Nutritional assessment of primary school children at Mathbaria Upazila in Pirojpur district, Bangladesh. They found that the overall preponderance of stunting and thinness were 40 percent and 56 percent respectively.

A study by Pandel et al. (2000) on the health status of school children of 5-16 years of age found that the preponderance of stunting among the school children was high (26.3%). This present research also shows that 11.7 percent of the school children examined are overweight and 4.1 percent of them are obese.

Sachan et al. (2012) conducted a study on the nutritional status of school going adolescent girls in the Lucknow district of Uttar Pradesh, India. He found that the overall preponderance of thinness was 17.0 percent.

Anthropometric measures in Sub-Saharan Africa indicated serious problems. Goon et al. (2011) found that among urban primary school students of Makurdi in Nigeria, the majority of students exhibited Grade 1 thinness (77.3%), and severe malnutrition affected 31.3 percent of the students.

The present research showed that about 56.4 percent students of the sample are of normal height, 2.2 percent of them are severely stunted, about 7.4 percent of students are moderately stunted and 21.7 percent mildly stunted. Only 13.3 percent are above the normal level. This research finding is almost similar to a cross-sectional study conducted on 135 Jenukuruba tribal students in India belonging to 6+ to 10+ age group using a purposive sampling method. The results highlighted a high preponderance of mild (41.5%) and severe (6.7%) stunting. It also showed a greater prevalence of mild (40%) and severe (3.7%) wasting and a moderate underweight status of 45.2 percent of the subjects and 14.8 percent were identified as severe (Gangadhar and Prabhakar, 2009).

In the present study 39.9 percent students were found to be under-weight. These are similar to findings by CAB Uttar Pradesh (2015), Rashmi et al (2015) and Singh et al (2014). They found the prevalence of underweight of 27.2 percent, 20 percent and 28.9 percent respectively.

Like other South Asian counties, under nutrition condition of school children are among one of the major problems in Bangladesh. Although Bangladesh made significant progress reducing all anthropometric measures of nutrition in the 1990s, stunting, underweight, and wasting, improvement slowed noticeably after 2000. Stunting persistent to go down reflecting the gains of the 1990s but child underweight rates hardly changed, declining just 2 percentage points to 46 percent in the 7 years up to 2007 (Bangladesh Demographic Health Surveys, 2004 and 2007).

## 5.3 Parents' Socio-economic and Demographic Factors

Academic performance depends on many things such as a cluster of school- related variables, home variables such as parents' educational qualification and family income and most

importantly the nutritional status of children themselves. This research indicates the strong positive association between socio-economic factors, especially, the educational background of parents and student performance. It is also noted that children of working mothers perform better than children of housewife mothers. This is a pattern seen in other countries. Cabrera et al (2016) found that the level of parent's education, parent's expectation about the academic performance of their children and overall socio-economic status of families played a vital role in academic performance of children at school.

## 5.4 Nutrition Related Knowledge Score

Nutritional knowledge is another parameter that influences academic performance of students and is likely to relate to their nutritional status. It is assessed by asking students nutrition related questions based on the Class V textbook content. A majority of students' (53.1%) have nutrition knowledge at the medium level; only a few students' (8.4%) have a high level of nutrition knowledge. About 39 percent students' have low nutrition knowledge. From the analysis and findings, it is clear that those students whose nutritional knowledge scores are high also have higher scores in tests of performance. The regression table shows that if the students' nutritional score increases by 1 unit, their performance test score goes up by 2.836 units (p<0.05).

This report found a positive correlation between height for age z-score (stunting) and academic performance which was statistically significant (p<0.05). Multiple regression analyses were conducted to examine the relationship between performance test scores and various potential predictors. The potential predictors were Height for Age (HAZ), BMI for Age (BAZ), family income, mother's education level and nutritional knowledge score. Height for age had significant (p<.05) positive impact with performance test scores, after controlling

all the other variables in the model. This model also indicates that if the students' height-for-age increases by 1 unit, their performance test score will increase by 1.45 units.

## 5.5 Relation between Nutritional Status and Academic Performance

In the present study nutritional status was found to be significantly ($p=0.04$) related to the academic performance of the sampled school children. Again a similar pattern is seen in other countries.

A study by Naik et al. (2013) showed a highly significant and positive relationship between nutritional status and academic achievement. Similarly, another study conducted by Rashmi et al. (2016) on 582 students from class 1-7 in rural Bangalore concluded that the nutritional status of the children is strongly connected with their academic performance. Essien et al. (2012) also observed that malnutrition was negatively and significantly related to academic performance.

## 5.6 Importance of Nutrition on Academic Performance

Nutrition has a great influence on students' thinking skills, cognitive abilities, reasoning skills, adaptive behavior, and so on. Most of the respondents to the interviews and FGDs have agreed to the point that nutrition significantly influences student's overall development as well as academic performance.

Parental awareness about the value of nutrition has a great influence on school attendance as well as class participation. Students from low-income families who cannot afford much nutritious food are more likely to be irregular in school. Similar findings have been seen in other countries. For example, in the Canary Islands, Cabrera et al (2016) show that the level of parent's education and parents' expectation of the academic performance of their children

played a vital positive role in the academic performance of students at school. Many research findings showed that there is a positive correlation between nutritional status and behavior. A number of studies also indicated that behavior and socialization skills greatly affect students' academic performance. In the present research, it has been revealed that a shortage of nutritious meals leads students to exhibit mal-adaptive behavior which has an influence on her/his classroom performance as well as learning achievement.

Nutrition has a significant impact on intellectual functioning and mental capacities. Nutritious foods enable the human brain to be more responsive and muscle tone to be more functional. This research is consistent with other findings (Wood cited by Kretsch et al. 2001) that there is a direct correlation between poor nutrition and lower school performance. In addition, micro-nutrients, such as iron also play an important role in brain function. Erickson (2006) identified key components in food intake required to keep the brain functioning properly, such as meat, fish, milk, and cheese etc. which contain proteins. Protein deficiency, also known as Protein Energy Malnutrition, leads to poor school performance by students by causing them to be lethargic, withdrawn, and passive. All of these conditions also affect social and emotional development, which in turn affect school performance. There is a strong relationship between students' physical fitness and participation in the classroom teaching-learning process. Cultural involvement is also associated with students' creativity, i.e. their learning style. Co-curricular programs enhance students' psychomotor skills and socialization skills which are linked to their academic performance in class and in examinations. Those who are proven good at sports and other social activities are also good achievers in the classroom and in examinations. Similar findings have been reported by Zacherman (2010) who shows extracurricular activities such as stage performance, sports, student newspaper work, literary work, acting and drama, music and cultural activities play a positive role in improving academic performance. The

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study based on a sample of 51,874 students from institutions throughout the United States showed that there is a strong relationship between involvement in co-curricular activities and academic performance among college students.

The present study is not without its limitations. It may be argued that the academic performance of students measured by a specially constructed assessment tool and anthropometric measurement approaches might not capture all the dimensions of academic performance and nutritional status of children and their actual interaction. The small sample size and the use of purposive sampling in this study could also limit generalization of the study findings to the broader population of primary school completers in the country. Finally, there might be errors or biases related to recall of information by respondents. However, the clear similarities with findings from other countries and societies as laid out in the chapter show that the situation in Bangladesh parallels that of other countries and the findings of this research replicate those of other similar studies.

Nonetheless, from the above findings, it is possible to derive a common understanding that the nutritional status of children affects educational performance. Good nourishment has positive effects and malnourishment of children has negative effects. Hence, it can be safely concluded that there is a need to improve the nutritional level of primary school students in order to enhance educational performance and the quality education as a whole.

## *Chapter 6*

## MAJOR FINDINGS, RECOMMENDATIONS AND CONCLUSION

### 6.1 Prologue

On the basis of analysis and interpretation of data presented in chapter 4 and discussed in chapter 5, this chapter recapitulates the summary of the major findings along with recommendations and conclusions.

### 6.2 Major Findings

This sub-section describes the major findings in five areas according to the original research questions.

**Nutritional Status of the Primary School Graduates**

- The prevalence of stunting and thinness were 30.4 percent and 40 percent respectively among primary school completers. Both stunting and thinness represent the malnutrition of primary school students including primary school graduates as reported in this research. These two indicators demonstrate respectively the long term and short term nutritional status of students.

- The study revealed that 56.4 percent of primary school completers have normal height for their age, 21.7 percent are mildly stunted, 7.4 percent are moderately stunted and, 2.3 percent of them are severely stunted.

- Among primary school completers, 44.4 percent have normal weight for their height; however, 5.4 percent of them are severely thin, 34.5 percent are moderately thin, 11.7 percent are overweight and 4.1 percent are obese.

**Result of Academic Performance**

- The overall result was calculated on 100 marks drawn from six subjects (Bangla, English, Mathematics, Science, Bangladesh and Global Studies and Religion). The results indicated that about 10 percent of students obtained grade A+, 23.7 percent A-, 22.4 percent B, 18.4 percent C and 6.1 percent failed in the test.

- The subject-wise result in the performance test showed that the largest number (36.7%) obtained A+ in Religion whereas only a few students (7.7%) got A+ in Mathematics. The scores in other subjects fell in the middle, 31.1 percent students got A+ in Bangla and 17.1 percent A+ in English.

- The highest number of students (28.6%) failed in Mathematics and a few students (1.8%) failed in Bangladesh and Global Studies; also a considerable number of students (22.7%) failed in Religion, though a high number also obtained A+ in Religion.

**Relationship between Nutrition and Academic Performance**

- The stunted (5%) students demonstrated lower performance than normal students (10%). Taller students performed better than normal height students. Only 1.9 percent of the taller students failed in written tests. Over-nourished students (31.3%) have higher performance scores than normally nourished students (11.5%).

- There was a relationship between the nutritional knowledge score of primary school students and their performance in the test. High proportions (48.5%) of students who have excellent performance in the performance test also have high scores in nutritional knowledge. On the other hand, of those who have lower scores in nutritional knowledge, only 2.0 percent have excellent test performance and 7.3 percent failed in the written test.

- There is a positive correlation among all the predictors with performance test score. Height for age had the highest significant (p<.05) positive correlation with the performance test, when all the other variables in the model are controlled. The result also revealed that if the student's height for age increased by 1 unit, their test score increased by 1.45 units. Height for age has more influence than BMI for age in indicating students' academic performance.

**Socio-economic Effects on Academic Performance**

- There is a relationship between the education level of primary school students' mothers and the pupils' performance in the performance test. Among students whose mothers have a college degree at honours level, 45.8 percent achieved an excellent performance in the test. On the other hand, among the students whose mothers were

uneducated, only 2.4 percent have excellent performance in the test. The mother's education level had a significant (p<.05) impact on test scores when other factors are controlled in the model. If the mothers' educational level increases by 1 unit, the student test score will increase by 0.826 units.

- There are significant correlations between the occupation of mothers of primary school students and their performance in the tests. Among students whose mothers are teachers, 46.7 percent have excellent performance. On the other hand, the students whose mothers are homemakers, only 8.1 percent achieved excellent performance.

- The relationship between the economic status of the family of primary school students and their performance in the tests provided is significantly positive. Among students whose family income level was above 30,000 taka (USD 350) per month, 22.2 percent have excellent performance; however, for students whose family income level was 15,000 (USD 175) to 30, 000 taka (USD 350), only 12 percent have excellent performance in the test.

**Importance of Nutrition in Academic Performance**

Parental awareness about the value of nutrition has a great influence on school attendance as well as class participation. Students from low-income families who cannot afford sufficient nutritious food are more likely to be irregular in school attendance. Even if they come to school, they are likely to remain passive in the classroom.

The present research clearly revealed that shortage of nutritious meals leads students to exhibiting mal-adaptive behavior which has an influence on her/his classroom performance as well as learning achievement.

This study pointed out and confirmed other findings that students affected by malnourishment show lower performance in examinations and tend to drop out before completing the primary education stage.

This study confirmed for the Bangladesh sample a strong relationship between students' physical fitness and participation in the classroom teaching-learning process, which has been observed in other countries. It was also evident that involvement in cultural activities, and creative endeavours improved learning style and learning engagement of students. It is agreed by most respondents that good nutrition status is helpful for improving students' creative functioning and the spirit for team-work.

## 6.3 Recommendations

The study findings clearly and definitively show a strong positive relationship between the nutritional status of children and their effective participation in school and good academic performance. While various other factors, such as socio-economic variables, parents' awareness of the value of nutrition and students' knowledge of nutrition contribute to better educational performance, the nutritional status of the pupils as reflected in their stunting and thinness status enhances or undermines the effects of other factors.

The following recommendations are made on the basis of the findings of the study to enhance the effects of student nutritional status in combination with other factors that have a bearing on students' educational performance.

- It is recommended that school-based feeding programmes, already serving almost a quarter of primary school students, be expanded so that these can play an important and effective role in improving the nutritional status of school going students while reducing dropout rates and enhancing their academic performance.

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- Nutrition education should be strengthened in the curricular content in order to make a difference in healthy eating choices and habits. Students from an early stage should receive nutrition education that would teach them the skills to make healthy food choices at home and school. Families may receive nutrition information in the form of bulletins throughout the school year to help them reinforce what is taught at school. NCTB should take steps to review, update and improve, as necessary, nutrition related knowledge in the primary school curriculum.

- All teachers and parents should be given health and nutritional education sessions by health experts to reinforce healthy eating habits among students. Class teachers may discuss with parents about the health status of students during parent teacher meetings and suggest appropriate measures about diet and school lunch. There is a need to encourage parents to provide an adequate diet for their children that is in line with the recommended daily allowances for both boys and girls.

- Studies similar to the present one need to be carried out with larger samples in different parts of the country to establish the pattern of nutrition of school age children and the effects on their academic achievement.

- The government should pay due attention to implementing nutrition screening programs and intervention strategies to improve both children's health and growth and their academic performance. A school health service should be introduced, a part of which would be monitoring health and growth status of primary school children. Weight and height measurements are easy and inexpensive to apply and can be used as monitoring tools.

- BANBEIS can play a role in maintaining a student growth and health database that would enable policy makers to consider appropriate measures and strategies for improving health, wellbeing and learning achievement of Bangladeshi primary school students.

## 6.4 Concluding Remarks

The importance of good nutrition and its impact on academic performance is well-established. Both in developed and developing countries, many studies have been conducted on this subject. However, not enough empirical investigations have been undertaken in the specific context of Bangladesh. By exploring and investigating the situation in Bangladesh, it is hoped that a greater understanding and awareness about the interaction of nutrition, children's health and wellbeing and their school performance will be generated. As a result, appropriate policy measures and program strategies are likely to be considered by the government and all other stakeholders associated with primary education in Bangladesh.

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# Annexure A

বিভাগ: বরিশাল

জেলা: পিরোজপুর (মঠবাড়িয়া)

স্কুল নং: ☐

০১. মঠবাড়িয়া মডেল স: প্রা: বিদ্যালয়

০২.ওয়াহেদাবাদ স: প্রা: বিদ্যালয়

ক্লাশ রোল নং: ...........................

STUDENT ID: .....................     (স্কুল কোড+রোল নং)

১। শিক্ষার্থীর নাম ওফোন নং:

২। বিদ্যালয়ের ৫ম শ্রেণীতে অনুষ্ঠিত পরীক্ষায় (১ম ও ২য় সাময়িক) প্রাপ্ত নম্বর:

৩। **ANTHROPOMETRIC DATA:**

| Age (Year) | Height (CM) | Weight (KG) |
|---|---|---|
|  |  |  |

**SOCIO-ECONOMIC DATA:**

৪। পিতার শিক্ষাগত যোগ্যতা:.............................

৫। মাতার শিক্ষাগত যোগ্যতা:.............................

৬। পিতার পেশা: ☐

৭। মাতার পেশা: ☐

পেশা কোড:

১= কৃষি (ফসল), ২= মাটি কাটা, ৩= গৃহস্থালী, ৪= এনজিও কর্মী, ৫= রিক্সা/ভ্যান চালক, ৬= গাড়ি চালক, ৭= ক্ষুদ্র ব্যবসা, ৮=বেকার,

৯= চাকুরী, ১০= জেলে, ১১= শিক্ষক, ১২= অন্যান্য

৮। পরিবারের মাসিক আয়:................................

## পুষ্টিগুণ সম্পর্কিত তথ্য (NUTRITIONAL KNOWLEDGE):

০৯। সুষম খাদ্য কী তুমি তা জানো? ☐

কোড: (১=হ্যাঁ,২=না)

১০। কি কি খাবার খেলে গলগন্ড রোগ হয় না? ☐

কোড: (১=আয়োডিনযুক্ত লবন,শাক-সবজী/ ফল-মূল, সামুদ্রিক মাছ, ২=কিছু কিছু জানি, ৩=জানি না)

১১। কোন খাবারটি দেহে শক্তি দেয়? ☐

কোডঃ (১=ভাত,২= মাছ, ৩= শাক-সবজী, ৪=জানিনা

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১২। শরীর বৃদ্ধির জন্য কোন খাবার প্রয়োজন?

কোডঃ (১=ভাত,২= মাছ, ৩= শাক-সবজী, ৪=জানি না)

১৩। রোগ প্রতিরোধের জন্য কোন খাবারগুলো প্রয়োজন?

কোডঃ (১=শাক-সবজী, ফল-মূল,২= ডিম, দুধ মাছ, ৩= মাছ, মাংস, ৪= জানি না)

১৪। কোন খাবারটি ভিটামিন এ সমৃদ্ধ খাবার?

কোডঃ (১=শাক-সবজী,২= ডাল, ৩= দুধ, ৪= চাল, ৫=জানি না)

১৫। কোন খাবারটি আয়রন সমৃদ্ধ খাবার?

কোডঃ (১=শাক-সবজী,২= ডাল, ৩= দুধ, ৪= চাল, ৫=মাংস, ৬=জানি না)

১৬। তুমি কি নিয়মিত দাঁত ব্রাশ, নখ কাটা ও পরিস্কার কাপড় পড়?

কোডঃ (১=হ্যাঁ,২=না)

১৭। তুমি কি নিয়মিত (৩ মাস পর পর) কৃমি নাশক ঔষধ খাও?

কোডঃ (১=হ্যাঁ,২=না)

## ১৮। শিক্ষাগত কর্মদক্ষতা (EDUCATIONAL PERFORMANCE):

| বিষয় | Bangla | English | Mathematics | Science | Bangladesh and Global Studies | Religion And moral | Total Score |
|---|---|---|---|---|---|---|---|
| প্রাপ্ত নম্বর | | | | | | | |

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পূর্ণমান: ১০০                                           সময়: ০২
ঘন্টা

ক্লাশ রোল নং: ...........................................

শিক্ষার্থীর নাম ও ফোন নং:...........................

## বাংলা (২৫)

১। নিচের অংশটুকু আগে ভালোভাবে পড়। তারপর প্রশ্ন দুটি পড়। এবার প্রতিটি প্রশ্নের ঠিক উত্তরটির বাম

পাশে টিক চিহ্ন দাও। (০২)

সুন্দরবন। নামেই কেবল সুন্দর নয়, দেখতেও অপরূপ। বাংলাদেশের দক্ষিণ-পশ্চিমে রয়েছে বঙ্গোপসাগর।

তারই কোল ঘেঁষে বিশাল জায়গা জুড়ে আছে এই সুন্দরবন। এই বনে সুন্দরী গাছ বেশি বলেই এর নাম রাখা

হয়েছে সুন্দরবন। এখানে রয়েছে নানা ধরনের পশুপাখি। সুন্দরবনের রয়েল বেঙ্গল টাইগার জগৎ বিখ্যাত।

(ক) সুন্দরবন বাংলাদেশেরকোথায় অবস্থিত?

    ক. যেখানে সুন্দরী গাছ রয়েছে

    খ. বঙ্গোপসাগরের কোল ঘেঁষে

    গ. বঙ্গোপসাগরের পশ্চিমে

    ঘ. বঙ্গোপসাগরের দক্ষিণে

**(খ) সুন্দরবন নামটি কেন রাখা হয়েছে?**

  ক. বনে রয়েল বেঙ্গল টাইগার থাকে বলে

  খ. বনটি দেখতে অপরুপ সুন্দর বলে

  গ. বনে ডোরাকাটা সুন্দর হরিণ বেশি বলে

  ঘ. বনে অনেক সুন্দরী গাছ আছে বলে

**২। নিচের অংশটুকু আগে ভালোভাবে পড়। তারপর প্রশ্ন দুটি পড়। এবার প্রতিটি প্রশ্নের ঠিক উত্তরটির বাম পাশে টিক চিহ্ন দাও। (০২)**

শীত এসেছে। সেই সাথে এসেছে শীতের পাখিরা। এই পাখিরা দল বেঁধে, ঝাঁকে ঝাঁকে উড়ে এসেছে দূর দেশ থেকে। শীতের পুরোটা সময় এরা বাংলাদেশে থাকবে। পাখিদেরও দলনেতা আছে। সে অন্য পাখিদের পথ দেখিয়ে নিয়ে যায়। শীতের পাখিরা বাংলাদেশে আসে আশ্রয়ের সন্ধানে। এরা আমাদের অতিথি, তাই এদের দেখাশুনা করা আমাদের দায়িত্ব।

**(ক) অতিথি পাখিরা কখন বাংলাদেশে আসে?**

  ক. বসন্তের শুরুতে

  খ. বসন্তের শেষে

  গ. শীতের শুরুতে

  ঘ. শীতের শেষে

**(খ) পাখিদের দলনেতা কী করে?**

      ক.  পাখিদের খাবার যোগায়

      খ.  পাখিদের পথ দেখায়

      গ.  পাখিদের বাসা খুঁজে

      ঘ.  পাখিদের সাথে খেলে

**৩। নিচের ছবিটি ভালভাবে দেখ। তারপর কী দেখলে তা পাঁচটি বাক্যে বর্ণনা কর। (০৫)**



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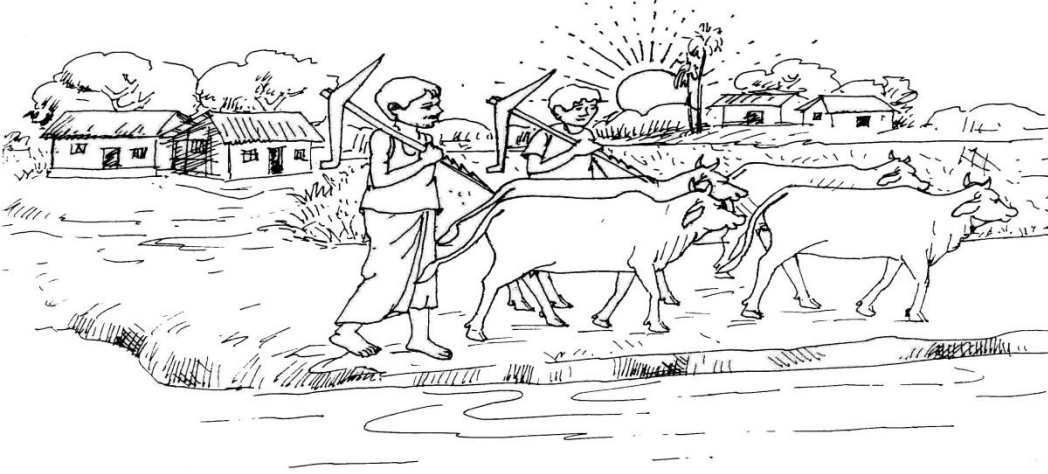
**৪। পাঁচটি বাক্যে তোমার নিজ বাড়ির বর্ণনা দাও। (০৫)**

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৫। তোমার নিজের সম্পর্কে তথ্য দিয়ে নিচের ফরমটি পূরণ কর। (০৬)

নাম             : ....................................................

মায়ের নাম       : ....................................................

বাবার নাম       : ....................................................

গ্রাম/মহল্লা  : ........................................................

ডাকঘর          : ....................................................

উপজিলা/থানা     :....................................................

জিলা            : ....................................................

জন্ম তারিখ      : ....................................................

৬। তোমার বিদ্যালয়ের প্রধান শিক্ষকের/শিক্ষিকার কাছে তিন দিনের ছুটি চেয়ে একটি দরখাস্ত লেখ (৪/৫টি

বাক্যের মধ্যে)। (০৫)

# ইংরেজি (১৫)

১। নিচের অংশটুকু মনোযোগ দিয়ে পড়। এবার প্রশ্ন দুটির ঠিক উত্তর বাম পাশে গোল দাগ দিয়ে দেখাও।

(০৪)

Ruma is a girl of class V. She lives in Pabna with her family. She goes to school everyday. She is a good student. Ruma has a cat. It is brown. She loves it very much.

**i) Where does Ruma live?**

    a. Dhaka

    b. Comilla

    c. Pabna

    d. Khulna

**ii) What does Ruma love?**

    a. Gray dog

    b. Brown cat

    c. Yellow bird

    d. White cat

২। নিচের অংশটুকু মনোযোগ দিয়ে পড়। এবার প্রশ্ন দুটির ঠিক উত্তর বাম পাশে টিক চিহ্ন দিয়ে দেখাও। (০৪)

Seven days makes a week. Today is Monday. It is holiday. Mina's mother gave her some money. She plans to go for shopping. She will buy books, a pencil and a doll. Her friend Robin will accompany her.

**i) Which is the holiday?**

    a. Sunday

    b. Monday

    c. Tuesday

    d. Friday

**ii) What will Mina buy from the shops?**

    a. Books, a pencil and a doll

    b. Dolls, a book and an eraser

    c. Books, a khata and a pen

    d. Erasers, a Pen and a pencil

৩। নিচের ছবিটি ভাল করে দেখ। তারপর ছবিটির বর্ণনা দিয়ে ইংরেজিতে পাঁচটি বাক্য লেখ। (০৭)



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# গণিত (২৫)

১ ও ২ নম্বর প্রশ্নের ঠিক উত্তর দুটির বাম পাশে টিক চিহ্ন দাও। (০২)

১। নিচের কোন সারিতে ছোট থেকে বড় সংখ্যাগুলি পরপর সাজানো আছে?

ক. ৫৫৫৫, ৯৮৭, ৭৮০৫, ৩৫৯০

খ. ৭৮০৫, ৯৮৭, ৫৫৫৫, ৩৫৯০

গ. ৭৮০৫, ৫৫৫৫, ৩৫৯০, ৯৮৭

ঘ. ৯৮৭, ৩৫৯০, ৫৫৫৫, ৭৮০৫

২। ২, ৩, ০, ৮ অংকগুলি ব্যবহার করে গঠিত চার অংকের বৃহত্তম সংখ্যা কোনটি?

ক. ৮৩২০

খ. ৮৩০২

গ. ৮০৩২

ঘ. ৮০২৩

৩। চিহ্ন দেখে নিচের অংকগুলি কর। (০৪)

| ক) ৫৫০২৫ | খ) ৮৬০৩ | গ) ৮৬৪ | ঘ) ১৪২১ ÷ ৭ |
|---|---|---|---|
| ৪১৮০ | - ৫১৯ | × ২০৬ | |
| + ৩৪৪ | _____ | _____ | |
| _____ | | | |

**৪. সরল করঃ (০২)**

৩৬ ÷ ১২ × (৬৪ ÷ ৮ - ২) + ৯

৫। খালেক সাহেব প্রতি মাসে আয় করেন ৮৫০০ টাকা। তিনি বাড়ি ভাড়া দেন ৩০০০ টাকা। অন্যান্য খরচ করেন ২০৭৫ টাকা। তার মাসে কত টাকা জমা থাকে? (০৩)

৬। কোন বাড়িতে ১৫ জন লোকের ৩০ দিনের খাবার আছে। ঐ বাড়িতে মাসের প্রথম ৫ দিন পর আরও ১০ জন লোক এলো। প্রত্যেকে যদি সমান খাবার খায়, তাহলে বাকি খাবারে তাদের কতদিন চলবে? (০৩)

৭। আসমা মোট ৮০০ নম্বরের পরীক্ষায় ৬৪০ নম্বর পেয়েছে। সে শতকরা কত নম্বর পেয়েছে? (০৩)

৮। সাজ্জু ও রাজ্জুর গত বার্ষিক পরীক্ষার বাংলা, গণিত, ইংরেজি, সমাজ ও বিজ্ঞান বিষয়ে প্রাপ্ত নম্বরের লেখচিত্র নিচে দেওয়া হল। এটি ভাল করে মনোযোগ দিয়ে দেখ। তারপর নিচের প্রশ্নগুলির উত্তর দাও। (০৩)
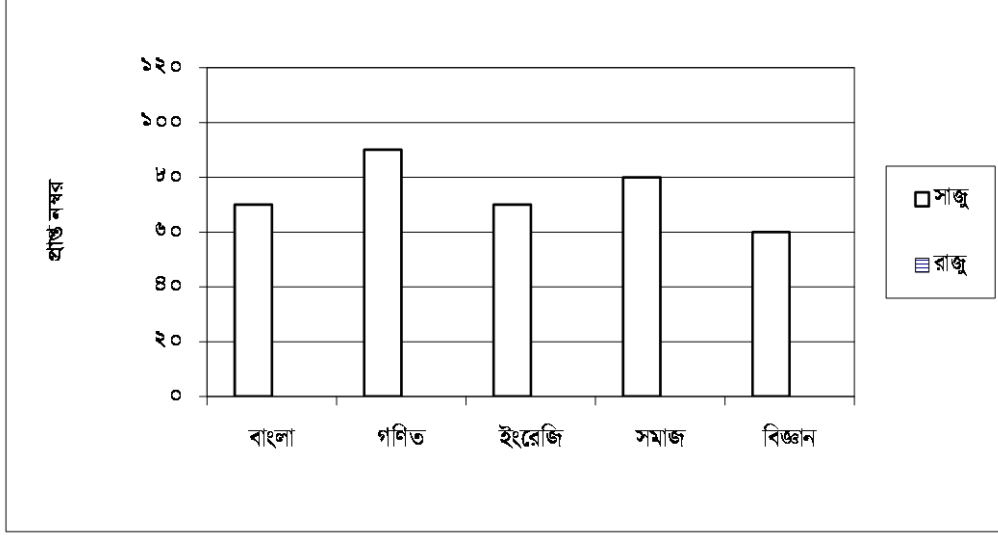
**প্রশ্ন**

ক) গণিতে কে বেশি নম্বর পেয়েছে? ------------------------------------------------------------

খ) কোন বিষয়ে দু'জনই সমান নম্বর পেয়েছে? --------------------------------------------

গ) সাজু ও রাজু বাংলায় যথাক্রমে কত নম্বর পেয়েছে? ----------------------------------------

নিচের ৯, ১০ ও ১১ নম্বর প্রশ্নের ঠিক উত্তর তিনটির বাম পাশে টিক চিহ্ন দাও। (০৩)

৯। ৫ ঘন্টা ২৫ মিনিটে কত সেকেন্ড?

ক. ১৯৫০০ সেকেন্ড

খ. ১৫৯০০ সেকেন্ড

গ. ১০০৫৯ সেকেন্ড

ঘ. ১০০৯৫ সেকেন্ড

১০। নিচের পেন্সিলটির দৈর্ঘ্য কত?



ক. ৭.৫ সেন্টিমিটার

খ. ৯ সেন্টিমিটার

গ. ২.৫ সেন্টিমিটার

ঘ. ৬.৫ সেন্টিমিটার

**১১। নিচের চিত্রে কয়টি ত্রিভুজ ও কয়টি আয়তক্ষেত্র রয়েছে?**
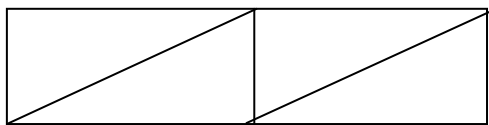


ক. ২ টি ত্রিভুজ ও ১ টি আয়তক্ষেত্র

খ. ৩ টি ত্রিভুজ ও ৩ টি আয়তক্ষেত্র

গ. 4 টি ত্রিভুজ ও ৩ টি আয়তক্ষেত্র

ঘ. 4 টি ত্রিভুজ ও ২ টি আয়তক্ষেত্র

১২।  ডান দিকের শব্দের সাথে বাম দিকের জ্যামিতিক চিত্রের রেখা টেনে মেলাও। (০২)

|         বামদিক         |         ডানদিক         |
|                        |                        |
|       [rectangle]      |          বৃত্ত          |
|                        |                        |
|       [triangle]       |        বর্গক্ষেত্র        |
|                        |                        |
|        [square]        |        আয়তক্ষেত্র        |
|                        |                        |
|       [circle]         |         ত্রিভুজ          |

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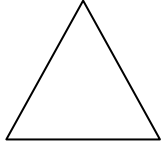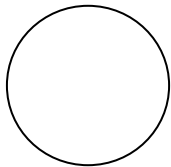
# বাংলাদেশ ও বিশ্বপরিচয় (১৫)

**১।** একটি পরিবার কীভাবে সুখী ও সুন্দর হয়ে উঠতে পারে?

    **ক.** বাবা-মা নিজ দায়িত্ব পালন করলে

    **খ.** চাচা-চাচী নিজ দায়িত্ব পালন করলে

    **গ.** ছেলে-মেয়েরা নিজ দায়িত্ব পালন করলে

    **ঘ.** পরিবারের সবাই নিজ দায়িত্ব পালন করলে

**২।** পরিবারের সদস্য হিসাবে তোমার দায়িত্ব ও কর্তব্য কী?

    **ক.** প্রতিবেশীর সংগে সম্পর্ক রাখা

    **খ.** সহপাঠীর সংগে সম্পর্ক রাখা

    **গ.** নিজের জিনিসপত্র গুছিয়ে রাখা

    **ঘ.** নিয়মিত বিদ্যালয়ে যাওয়া

**৩।** সমাজের সদস্য হিসাবে তোমার প্রধান দায়িত্ব কী?

    **ক.** সমাজের আইন-কানুন মেনে চলা

    **খ.** নিয়মিত খেলাধূলায় অংশ নেওয়া

    **গ.** ভাইবোনদের কাজে সহযোগিতা করা

    **ঘ.** মা-বাবার কাজে সহযোগিতা করা

৪। নিজের বাড়িতে খুব জোরে রেডিও, টিভি বা ক্যাসেট বাজালে কী হতে পারে?

   **ক.** প্রতিবেশীর সুবিধা হতে পারে

   **খ.** প্রতিবেশীর অসুবিধা হতে পারে

   **গ.** প্রতিবেশীর সাথে সুসম্পর্ক হবে

   **ঘ.** প্রতিবেশীর কাজে আগ্রহ বাড়বে

৫। দেশের নাগরিক হিসাবে তোমাদের প্রধান কর্তব্য কী?

   **ক.** মা-বাবার কথা মেনে চলতে শেখা

   **খ.** শিক্ষকের কথা মেনে চলতে শেখা

   **গ.** দেশের আইন মেনে চলতে শেখা

   **ঘ.** প্রতিবেশীর কথা মেনে চলতে শেখা

৬। নির্বাচনের সময় রাষ্ট্রের নাগরিক হিসাবে ভোট দেওয়ার অধিকার কাদের?

   **ক.** প্রাপ্ত বয়স্কদের

   **খ.** অপ্রাপ্ত বয়স্কদের

   **গ.** শুধু ছেলেদের

   **ঘ.** সব নাগরিকের

৭। আমাদের বিজয় দিবস কোনটি?

    ক.  ১৪ ডিসেম্বর

    খ.  ২৫ মার্চ

    গ.  ২১ ফেব্রুয়ারি

    ঘ.  ১৬ ডিসেম্বর

৮। বাংলাদেশের প্রধান যাতায়াত পথ কোনটি?

    ক.  রেলপথ

    খ.  আকাশপথ

    গ.  জলপথ

    ঘ.  স্থলপথ

৯। আমাদের দেশে সবচেয়ে বেশি বৃষ্টিপাত কোথায় হয়?

    ক.  শ্রীমঙ্গল

    খ.  কক্সবাজার

    গ.  চাঁদপুর

    ঘ.  দিনাজপুর

১০। শিক্ষক-শিক্ষিকাদের সাথে তোমাদের কিরূপ আচরণ করা উচিত?

ক. শ্রদ্ধা, সম্মান ও ভালোবাসার

খ. শ্রদ্ধা, ভালবাসা ও শাসনের

গ. পারস্পরিক শ্রদ্ধা ও বিনয়ের

ঘ. শাসন, স্নেহ ও ভালোবাসার

১১। ছোট ভাই-বোনদের সাথে তোমাদের কিরকম ব্যবহার করা উচিত?

ক. শ্রদ্ধা ও সম্মান করা

খ. আদর ও শাসন করা

গ. কৌতুক ও সম্মান করা

ঘ. স্নেহ ও কৌতুক করা

১২। মালদ্বীপের শিশুরা কোন খাবার বেশি খায়?

ক. মাছ ও পাঁউরুটি

খ. মাংস ও নারিকেল

গ. মাছ ও নারিকেল

ঘ. পাঁউরুটি ও মিষ্টি

১৩। বাংলাদেশের শিশুদের সাথে নেপালের শিশুদের যেসব খেলাধূলার মিল রয়েছে সেগুলি কী কী?

ক. এক্কাদোক্কা, চাগুড় ও কাবাডি

খ. কানামাছি, জিহ্বা ও ফুটবল

গ. এক্কাদোক্কা, ফুটবল ও লুডু

ঘ. কানামাছি, কাবাডি ও এক্কাদোক্কা

১৪। একদিন বিদ্যালয় থেকে বাড়ি ফিরে দেখলে তোমার ছোট বোন খুব অসুস্থ। ঘন ঘন পাতলা পায়খানা আর বমি করছে। সঙ্গে মাথা ব্যথার লক্ষণও দেখা যাচ্ছে। এই অবস্থায় প্রথমে তুমি কি করবে?

ক. মাথায় ঠাণ্ডা পানি দেব

খ. খাবার স্যালাইন দেব

গ. মাথা ব্যথার ওষুধ দেব

ঘ. দ্রুত হাসপাতালে নেব

১৫। জনসংখ্যার ঘনত্ব বাড়লে সমাজে কী পরিবর্তনের সম্ভাবনা দেখা দেয়?

ক. মাথাপিছু আয় বাড়ার সম্ভাবনা

খ. মাথাপিছু আয় কমার সম্ভাবনা

গ. মাথাপিছু জমি বাড়ার সম্ভাবনা

ঘ. লেখা পড়ার মান বাড়ার সম্ভাবনা

# প্রাথমিক বিজ্ঞান(১৫)

১। সুষম খাদ্য বলতে কী বুঝ?

ক. যে খাদ্যে পরিমাণ মত সকল খাদ্য উপাদান আছে

খ. ক্ষুধা নিবারণের জন্য আমরা যে সব খাদ্য খাই

গ. বেঁচে থাকার জন্য আমরা যে সব খাদ্য খাই

ঘ. যে সব খাবার আমাদের খেতে ভাল লাগে

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০২।  কিশোর-কিশোরীদের বাড়তি খাবার খেতে হয় কেন?

    **ক.**  এসময় শরীরের বৃদ্ধি তাড়াতাড়ি হয় বলে

    **খ.**  এসময় পড়াশুনার চাপ বেড়ে যায় বলে

    **গ.**  এসময় বাড়িতে বেশী কাজ করতে হয় বলে

    **ঘ.**  এসময় বেশি খেলাধূলা করতে হয় বলে

০৩। কী করলে কৃমি সংক্রমণ থেকে রক্ষা পাওয়া যায়?

    **ক.**  প্রতিদিন সাবান দিয়ে গোছল করলে

    **খ.**  প্রতিদিন জামা কাপড় পরিষ্কার রাখলে

    **গ.**  সর্বদা বিশুদ্ধ খাবার পানি পান করলে

    **ঘ.**  স্বাস্থ্যসম্মত পায়খানা ব্যবহার করলে

০৪। কী করলে চর্মরোগ হবে না?

    **ক.**  বাড়িঘর পরিষ্কার-পরিচ্ছন্ন রাখলে

    **খ.**  শরীর ও জামা-কাপড় পরিষ্কার রাখলে

    **গ.**  খাবার পরিষ্কার-পরিচ্ছন্ন জায়গায় রাখলে

    **ঘ.**  নিকট পরিবেশ পরিষ্কার-পরিচ্ছন্ন রাখলে

০৫। কোন মাধ্যমের সাহায্যে বন্ধুর সাথে সবচেয়ে তাড়াতাড়ি যোগাযোগ করা যায়?

    ক.  টেলিফোন

    খ.  টেলিভিশন

    গ.  টেলিগ্রাম

    ঘ.  চিঠিপত্র

০৬। কোন গাছের ডালপালা নেই?

    ক.  লাউ

    খ.  শিম

    গ.  কচু

    ঘ.  বেগুন

০৭। কোনটি অপুষ্পক উদ্ভিদ?

    ক.  সন্ধ্যামালতী

    খ.  চালকুমড়া

    গ.  অপরাজিতা

    ঘ.  পাতাবাহার

০৮। ফুটন্ত পানির কেটলির ঢাকনা উপরের দিকে উঠে কোন শক্তির কারণে?

    ক.  বিদ্যুৎ শক্তি

    খ.  চুম্বক শক্তি

গ.  বাষ্পীয় শক্তি

ঘ.  আলোক শক্তি

০৯। গাড়ি টানবার শক্তি গরু কোথা থেকে পায়?

ক.  স্থিতি শক্তি থেকে

খ.  পেশী শক্তি থেকে

গ.  তাপ শক্তি থেকে

ঘ.  চুম্বক শক্তি থেকে

১০। তথ্য যোগাযোগ বলতে কী বুঝায়?

ক.  তথ্যের আদান-প্রদান

খ.  তথ্যের শ্রেনীকরণ

গ.  তথ্যের সংগ্রহকরণ

ঘ.  তথ্যের প্রক্রিয়াকরণ

১১। উন্নত কৃষি প্রযুক্তি কী কী?

ক.  ট্রাক্টর ও জৈবিক সার

খ.  লাঙ্গল ও পাওয়ার ট্রিলার

গ.  রাসায়নিক সার ও কাস্তে

ঘ.  ট্রাক্টর ও পাওয়ার ট্রিলার

১২। কীভাবে সুস্থ ও সবল দেহ গড়ে ওঠে?

    **ক.** নিয়মিত শরীরচর্চা ও দামি খাবার খেলে

    **খ.** নিয়মিত শরীরচর্চা ও বেশি ভাত খেলে

    **গ.** নিয়মিত শরীরচর্চা ও বেশি আমিষ খেলে

    **ঘ.** নিয়মিত শরীরচর্চা ও পুষ্টিকর খাবার খেলে

১৩। কেন আমরা শর্করা জাতীয় খাবার খাই?

    **ক.** দেহের ক্ষয়পূরণের জন্য

    **খ.** দেহের অস্থি বৃদ্ধির জন্য

    **গ.** দেহের শক্তি যোগানোর জন্য

    **ঘ.** দেহের মাংসপেশী গঠনের জন্য

১৪। কোন ধরনের টিউবওয়েলের পানি পান করা নিরাপদ?

    **ক.** যে টিউবওয়েলের চারপাশ কাঁচা ও পায়খানার কাছে

    **খ.** যে টিউবওয়েলের চারপাশ পাকা ও পায়খানার কাছে

    **গ.** যে টিউবওয়েলের চারপাশ কাঁচা ও পায়খানা থেকে দূরে

    **ঘ.** যে টিউবওয়েলের চারপাশ পাকা ও পায়খানা থেকে দূরে

**১৫। ডায়রিয়া রোগ কীভাবে ছড়ায়?**

    **ক.** ডায়রিয়া আক্রান্ড রোগীর সেবার মাধ্যমে

    **খ.** বাসি পচা খাবার ও বাতাসের মাধ্যমে

    **গ.** দূষিত পানি ও বাসি-পচা খাবারের মাধ্যমে

    **ঘ.** হাঁটাচলার সময় জীবানু সংক্রমণের মাধ্যমে

    **ঙ.**

# ধর্ম ও শিক্ষা (০৫)

আল্লাহর রাসুল হযরত মোহাম্মদ (সঃ) এর জীবন সম্পর্কে পাঁচটি বাক্য লেখ।

অথবা

মহাপুরুষ যীশু খ্রীষ্ট এর জীবন সম্পর্কে পাঁচটি বাক্য লেখ।

অথবা

মহাপুরুষ গৌতম বুদ্ধ এর জীবন সম্পর্কে পাঁচটি বাক্য লেখ।

অথবা

মহাপুরুষ শ্রীরামকৃষ্ণ এর জীবন সম্পর্কে পাঁচটি বাক্য লেখ।

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# Annexure C

## Interview Schedule for teachers

শিক্ষকের নাম:                                   বিদ্যালয়ের নাম:

১. সুস্থ জীবনের জন্য পুষ্টির গুরুত্ব সম্পর্কে কিছু বলুন। পুষ্টি সংক্রান্ত আপনারা কোন প্রশিক্ষণ পেয়েছেন কিনা? সে প্রশিক্ষণ আপনারা কিভাবে শ্রেণিকক্ষে বা শিক্ষার্থীদের ক্ষেত্রে প্রয়োগ করে থাকেন?

২. পুষ্টি বা সুষম খাদ্য কীভাবে ছেলেমেয়েদের মেধা বিকাশে বা পড়ালেখায় ভালো ফল করতে সহায়তা করে? আপনাদের বিদ্যালয়ে যদি কোন এমন কোন দৃষ্টান্ত বা ঘটনা থেকে থাকে, অনুগ্রহ করে বলুন।

৩. বিদ্যালয়ে নিয়মিত উপস্থিতি বা সহপাঠীদের সঙ্গে পারস্পরিক মেলামেশার ক্ষেত্রে পুষ্টি কীভাবে ভূমিকা রাখে? অনুগ্রহ করে একটু ব্যাখ্যা করে বলুন।

৪. পুষ্টিকর খাবার গ্রহণ শ্রেণিতে অধিক মনোযোগী হতে বা শিখন-শেখানো কার্যক্রমে শিক্ষার্থীদের কীভাবে সহায়তা করে? এক্ষেত্রে আপনাদের অভিজ্ঞতা থাকলে একটু বিস্তারিত বলুন।

৫. শিক্ষার্থীদের পাঠ্যবইয়ে পুষ্টি সম্পর্কিত বিষয়বস্তু কি পুষ্টিজ্ঞান লাভের জন্য যথেষ্ট সহায়ক বলে মনে করেন? যদি না করেন, তাহলে আর কোন কোন বিষয়ে কী কী বিষয়বস্তু অন্তর্ভুক্ত করা যেতে পারে?

৬. পুষ্টিজ্ঞান শিক্ষার্থীদের বা অভিভাবকদের মাঝে বিস্তারের ক্ষেত্রে বিদ্যালয় বা শিক্ষকদের ভূমিকা কেমন হওয়া উচিত বলে আপনারা মনে করেন?

# Annexure D

## Education Expert Interview (Guiding Questions)

1. Do you think there is a relation/association between nutrition and academic

   performance?

   If yes, please explain it.


2. Do you think nutrition is the only factor for academic performance?

If no, what are the other factors?

3. Do you think family income, parents' education and parents' occupation are among

   the factors that affects on school performance?

   If yes, please explain.


4. What is the importance of nutrition in the academic performance of the primary

   school graduates?

# **Annexure E**

## FGD Guideline/Questionnaire

১. পুষ্টি বা সুষম খাদ্য বলতে আপনারা কী বোঝেন? সুস্থ জীবনের জন্য পুষ্টির গুরুত্ব সম্পর্কে কিছু বলুন।

২. পুষ্টিকর খাবারের তালিকায় কী কী অন্তর্ভুক্ত থাকা উচিত বলে মনে করেন? সেসব খাবারের গুনাগুণ সম্পর্কে কিছু বলুন।

৩. পুষ্টি বা সুষম খাদ্য কীভাবে ছেলেমেয়েদের মেধা বিকাশে বা পড়ালেখায় ভালো ফল করতে সহায়তা করে? আপনাদের এলাকায় যদি কোন এমন কোন দৃষ্টান্ত বা ঘটনা থেকে থাকে, অনুগ্রহ করে বলুন।

৪. বিদ্যালয়ে নিয়মিত উপস্থিতি বা সহপাঠীদের সঙ্গে পারস্পরিক মেলামেশার ক্ষেত্রে পুষ্টি কীভাবে ভূমিকা রাখে? অনুগ্রহ করে একটু ব্যাখ্যা করে বলুন।

৫. পুষ্টিকর খাবার গ্রহণ শ্রেণিতে অধিক মনোযোগী হতে বা শিখন-শেখানো কার্যক্রমে শিক্ষার্থীদের কীভাবে সহায়তা করে? এক্ষেত্রে আপনাদের অভিজ্ঞতা থাকলে একটু বিস্তারিত বলুন।

৬. শিক্ষার্থীদের পাঠ্যবইয়ে পুষ্টি সম্পর্কিত বিষয়বস্তু কি পুষ্টিজ্ঞান লাভের জন্য যথেষ্ট সহায়ক বলে মনে করেন? যদি না করেন, তাহলে আর কোন কোন বিষয়ে কী কী বিষয়বস্তু অন্তর্ভুক্ত করা যেতে পারে?

৭. পুষ্টিজ্ঞান শিক্ষার্থীদের বা অভিভাবকদের মাঝে বিস্তারের ক্ষেত্রে বিদ্যালয়, শিক্ষক বা কমিউনিটির ভূমিকা কেমন হওয়া উচিত বলে আপনারা মনে করেন?