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Assessment of Undernutrition in Relation to Protein Intake under 5 years old at Preschools in Dhaka City

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Abstract: A number of factors influence linear growth, and one of the main causes of stunted growth in children is malnutrition. Finding the food intakes linked to stunting in the area of Mohammadpur, Dhaka, preschoolers was the aim of this study. To gain insights into children's eating habits and the role of parental involvement in their growth in Bangladesh, this project will conduct interviews with parents and preschool-aged children. The aim is to predict which food habits may hinder growth in the near future and identify the underlying reasons behind them. By interviewing parents, valuable information about the dietary practices and food choices made within the household will be found. This includes understanding the types of foods provided to children, mealtime routines, and the strategies parents employ to encourage healthy eating. Additionally, the interviews will explore the factors that influence parents decisions regarding food, such as cultural traditions, economic constraints, and knowledge about nutrition. Furthermore, engaging directly with preschool-aged children will be enabled to gain insights into their food preferences, attitudes towards different foods, and their experiences during mealtimes. This can help identify any specific challenges or barriers that children may face when it comes to consuming nutritious foods. Through this comprehensive approach, the project aims to make predictions about which food habits may negatively impact children's growth in the near future. By analyzing the gathered data, it can be identified patterns and trends in the children's eating habits that may contribute to poor growth outcomes. For example, they may uncover patterns of limited vegetable intake, excessive consumption of processed foods, or inconsistent mealtime routines. Ultimately, this research aims to contribute to improved nutrition and overall growth outcomes for preschool-aged children. The results highlight the need for focused public health initiatives and community-based education programs that prioritize mothers' education on nutrition and health, as well as the provision of socioeconomic resources to help mothers meet their children's nutritional needs and avoid malnutrition. The current annual average rate of reduction is 2.7%, and this will need to be increased to 3.3% to achieve the target. This is not a phenomenal increase compared with the current rate of reduction, but it will require concerted planning and efforts. From an economic perspective, the cost to Bangladesh of not investing in accelerating this reduction will be huge in terms of lost gross domestic product and income. From a health perspective, it is essential to improve linear growth of children so that the negative effects of excess ponderal growth and resulting overweight and obesity are attenuated.

Keywords: *Undernutrition, BMI, Linear Growth, Stunting, Wasting, Interventions, Protein*.

INTRODUCTION

General

Undernutrition represents an insufficient intake of calories and nutrients that results in illness and in extreme cases, death [4]. Malnutrition among children poses a serious health threat to survival and it is linked to 3.1 million child deaths globally [5].Wasting and stunting is a severe type of malnutrition that causes extreme thinness and weakness in children. It can be deadly and hampers their growth, development, and learning. UNICEF reported that before COVID-19, about 47 million children were already affected by wasting [2]. Stunting is estimated to be responsible for 1.2 million deaths globally for children under five years of age [6].Stunting and wasting are significant hurdles to reaching the Sustainable Development Goals (SDGs) 2, 3, and 8, as they have a negative impact on both individual productivity and future economic growth potential [3]. Children suffering from stunting and wasting have poor physical and cognitive development. As a result, such individuals may have lower physical stamina, more destitute systems of immunity, and worse cognitive abilities as adults, which lowering their level of efficiency and lowering chance of realizing their full potential. Furthermore, stunting and wasting perpetuate a cycle of poverty and inequality. Malnourished children are more likely to experience educational difficulties and struggle to acquire necessary skills, limiting their access to better job opportunities and higher incomes in the future. To overcome these challenges and accomplish the SDGs, it is crucial to address the root causes of stunting and wasting. This involves implementing comprehensive strategies that prioritize access to nutritious food, improve healthcare and sanitation systems, promote breastfeeding and optimal infant and young child feeding practices, and enhance nutrition education and awareness. Among developing countries, it is estimated that approximately 13 million children who are below five years of age die annually, of which malnutrition is among the leading causes [6]. In Bangladesh, malnutrition among children seems to be the primary cause of to serious health and welfare difficulties. Stunting, the most common kind of childhood malnutrition, is a noteworthy social healthcare risk in many low- and middle-income nations [1].

Definition of Undernutrition

Undernutrition is the state in which a person consumes less energy and nutrients than what their body requires to stay healthy. Malnutrition and undernutrition are often used interchangeably in the literature. Malnutrition, in its strictest definition, includes both undernutrition and overnutrition [8]

Undernutrition is commonly understood to be a lack of either protein or calories (i.e., total food consumption). Mineral and vitamin deficits are typically regarded as distinct conditions. But vitamins and minerals are also likely to be lacking when there are not enough calories. Although undernutrition and malnutrition are sometimes used synonymously, undernutrition is a specific kind of malnutrition.[9]

Undernutrition denotes the insufficient intake of macro nutrients which is lack of major protein components in body that terrifies the future endeavors of a country and threatens a child's life and puts it into a stake.

Classification of Undernutrition

Undernutrition can be broadly classified into four categories: underweight, stunting, wasting, and vitamin and mineral deficiencies. Children in particular are far more susceptible to illness and death when they are undernourished.

We call low weight-for-height wasting. It typically denotes extreme weight loss that has occurred recently because the person may not have eaten enough food or may have had an infectious ailment like diarrhoea that contributed to their weight loss. Although there is a greater chance of death for a young child who is moderately or severely wasted, treatment is available.[8]

***Table 1**: WHO BMI classification*

Range of BMI	Weight definition
<17	Thinness
<18.5	Underweight
18.5-24.9	Normal Weight
≥25.0	Overweight
≥30.0	Obese

***Table 2:** WHO Asian-BMI classification*

Range of BMI	Weight definition
<18.5	Underweight
18.5-22.9	Normal Weight
23-24.9	Overweight
25-29.9	Obese
≥30.0	Obese

A low height relative to age is called stunting. It is the outcome of persistent or recurring undernutrition, which is typically linked to low socioeconomic status, inadequate mother health and nutrition, recurrent illnesses, and/or improper early feeding and care of infants and young children. Children that are stunted are unable to develop to their full physical and intellectual potential.

Underweight refers to children who are underweight for their age. A youngster who is underweight could be stunted, wasted or both. [8]

Measurements for Undernutrition

Along with age and sex, weight and length (height) are the most often used anthropometric measurements. These measurements go towards creating indices and indicators that characterise a person's or a population's nutritional state. Additional body circumferences (mid upper arm, head, chest, belly, etc.) and skin folds (biceps, triceps, sub-scapular, etc.) are also utilised as indicators of body composition. [7]

Weight for age Z score (WAZ), length / height for age Z score (LAZ / HAZ), and weight for length / height Z score (WLZ / WHZ) are the three fundamental indicators utilised in childhood.[7]

Weight for age is the difference between a kid's weight and the weight of a child in the reference population who is the same age. It can be expressed as a percentage or a Z score.[7]

Weight for age can be described as a child's weight in relation to another child's weight in the reference population. It can be expressed as a percentage or a Z score in relation to the reference population's median. Children who weigh less than average for their age are referred to as "underweight" qualitatively.[7]

A kid's height or length in relation to the length or height of a child of the same age in a reference population is known as "height for age" (or "length for age"). This can be stated as a percentage or a Z score in relation to the reference population's median. Qualitatively, children that are short for their age are called "stunted." [7]

Insufficient Protein Intake Causes Undernutrition

A child's physical and mental healths are enhanced by the essential amino acids found in protein. If a child doesn't get enough protein in their diet, they could exhibit the symptoms such aswearines, poor focus, delay: development, decreased immunity, and more.[10]

Energy balance has long been known to have a significant impact on the sufficiency of amino acids in the diet, but in recent years, its significance has largely been downplayed. Unintentional fluctuation in energy intake and consequent energy balance are important practical difficulties that could account for a large portion of the apparent variability in protein requirements. Nitrogen balance (NB) can be influenced by variations in energy intakes and expenditures in energy balance subjects. Therefore, a framework for assessing research on protein or amino acid adequacy in relation to the level of energy intake needs was developed. It is likely untrue that the type of energy consumed affects how well proteins are utilized, as fat is just as effective as carbohydrates in sustaining NB during energy maintenance. A more challenging conceptual problem has to do with. [11]

Millward and Rivers (1988) reevaluated the current metabolic models for the needs of amino acids. The need for amino acids in metabolism was examined in light of both required metabolic consumption and flexible routes for amino acid oxidation. With the exception of the requirement that the level of one amino acid match its concentration in a quantity of tissue protein equal to the required nitrogen loss, the required demand pattern was thought to be unknown from the ground up. It was anticipated that the adaptive demand pattern would change in response to the quantity and periodicity of food protein intake, which affected the diurnal cycle of gains and losses' amplitude. Research on animals revealed a regulatory effect of protein intake on anabolism, or the anabolic urge; benefits seemed to come from intakes. [12]

The WHO/FAO (2002) Expert Consultation on Protein and Amino Acid Requirements evaluated the Working Group's suggestions and approved the PDCAAS approach with some minor adjustments to the calculating method, but it also brought up a number of other concerns. The process involved calculating scoring patterns, estimating the digestibility of amino acids using faecal and ileal methods, calculating the amino acid score for a dietary protein mixture, reducing the bioavailability of lysine in processed proteins, truncating the amino acid score and resulting in the PDCAAS value, and using protein digestibility as the first limiting factor in determining the total amount of available dietary nitrogen. These issues were deemed very significant in connection to the regulatory aspects of food protein quality, and a fresh independent expert study strongly advised that they be resolved immediately. [13]

Objectives

- **General Objectives**

To assess the severity and geographical distribution of undernutrition and to identify individuals or population groups at risk of stunting and wasting.

- **Specific Objectives**

i. To understand the reasons behind these potentially detrimental food habits.
ii. To assess the rate of stunting and wasting.
iii. To assess fathers' education and occupation.
iv. To assess mothers' education and occupation.
v. To assess factors associated with stunting and occupation.
vi. To uncover factors that influence unhealthy eating behaviors.
vii. To provide valuable insights for designing targeted interventions and educational programs.
viii. To empower parents with knowledge and resources to make informed choices and create an environment conducive to healthy eating habits for their children.
ix. Relate the effects of undernutrition with consumption of protein food.
x. The number of children in a household, the age of the children, the time between births, the immunization status of the children, and the recurrent hookworm situations

Hypothesis

Social and dietary factors are associated with stunting and wasting.

LITERATURE REVIEW

Energy scarcity, which is one of the main causes of stunted child growth along with illness, is often the driving force behind malnutrition in global contexts of poverty [14]. Reduced linear growth is a consequence of zinc and protein deficiencies, which are linked to poverty. Zinc is present in chicken and red meat, but there are no tissue stores in humans. Consequently, a child's linear growth slows down when their nutritional intake is insufficient [15]. When a deficit in other micronutrients, like as vitamin A or iron, is significant, it can lead to growth flattering[16].

According to one study, consuming a lot of animal products reduced the likelihood of the so-called "mother-child double burden," which is when overweight mothers and stunted children live together in the same home. Thus, reducing childhood stunting by consuming enough animal products is essential to resolving the issue of the mother-child double burden [17] .

Following its November 2016 flotation, **Egypt's** currency had an almost 50% decline in value relative to the US dollar. Egyptians' lives are more difficult as a result of the liberalization of the economy, despite the fact that prices for products and food have increased dramatically in recent years [18]. Evaluating the connection between stunting and food habits is crucial, particularly in light of the recent floating of the Egyptian pound. By recognizing the trends and contributing variables to stunting, nutrition programs may be able to identify and assist those who are at risk for malnutrition.

In 2017, there were an estimated 151 million children worldwide who suffered from linear growth failure [20]. Early childhood stunting, which is a symptom of chronic undernutrition, is a serious public health issue in developing nations [21]. One of the main causes of illness and mortality in newborns and children is linear growth failure, which is brought on by poor nutrition and infections [20,22]. Early-life growth failure can have a lasting negative impact on future generations [23]. Numerous investigations have been carried out about the function of micronutrients in children's linear growth [24].

Unfortunately, there hasn't been much research done in impoverished nations on how children's linear growth is impacted by their consumption of high-quality protein and protein-energy [25, 26]. Children in **Ethiopia** frequently have linear growth failing [21,

[27].Children's growth depends on vital amino acids and protein [28, 29, 30]. Figure 1 illustrates the complex relationship between children's growth and high-quality protein intake, especially when it comes to restricting important amino acids like lysine and tryptophan. Inflammation and decreased appetite are two effects of childhood morbidity that might lower nutrient intake, which includes low-fat protein and energy. It may also result in modifications to the way caregivers feed their children, which may have an impact on nutrient intakes [31].

Compared to adults, children are more vulnerable to malnutrition involving high-quality proteins [28, 29]. This is likely because children need more protein for a variety of physiological processes and more protein when they are sick. High concentrations of high-quality protein are found in food products derived from animals [32, 33, and 34]. However, the majority of protein consumed in underdeveloped nations like Ethiopia comes from plant-based sources, which are low in several vital amino acids like tryptophan and lysine [35, 36].

Stunting is a physical growth issue that is typically linked to dietary consumption. Children's growth will be disrupted by inadequate consumption of macro and micronutrients, particularly throughout the growth period, which will lead to stunting [37]

Inadequate protein and energy consumption, as well as specific illnesses, are the causes of low protein energy. If a child's body weight is less than 80% of their age-appropriate body height index, they are referred to as lacking in protein and energy (HAZ). The most serious and common nutritional shortage, particularly in babies, is a lack of energy and protein [38]

In 2013, the Basic Health Research of Indonesia (Riskesdas) revealed that 37.2% of **Indonesian** children were stunted, a rise from 36.5 percent in 2010 and 36.8% in 2007. 18.0% severe stunting and 19.2% stunting make up the prevalence of stunting. In Gorontalo, the under-five stunting rate was 31.7% in 2016 (20.5% stunting and 11.2% severe stunting) [39]. The purpose of this study was to examine the protein and energy consumption of stunted children in Ilotidea hamlet, Tilango, Gorontalo, based on data.

Long-term or inadequate nutrient deficiency can cause stunting and can happen both in utero and during childhood [41, 42]. Stunting's immediate effects include a higher chance of contracting infectious infections [42], delayed cognitive development [43], and higher morbidity [44]. Stunting has long-term effects that include decreased adult height and lean body mass, worse cognitive function between the ages of 6 and 11, and lower total educational achievement [45].

Disease and/or insufficient nutritional intake are the causes of wasting [46]. Wasted children need immediate medical attention as well as nutritional support because they have a markedly elevated chance of dying [41, 47]. In young children, wasting frequently leads to delayed physical development and a compromised immune system [41].

In **Africa**, the prevalence of wasting and stunting is currently 27% and 41%, respectively. Stunting and wasting have become less common in Eastern Africa, including Somalia, since 2000. As of right now, 32.6 and 5.2% of children in the region are stunted and wasted, respectively. Waste and stunting can coexist [41], and the burden is greatest in places where there are still conflicts [48]. Children under five are especially vulnerable to malnutrition in Somalia because of humanitarian crises brought on by natural catastrophes and civil unrest. Although it is challenging to track dietary indicators in such situations [49], certain areas of Somalia frequently carry out biennial cross-sectional surveys that include child anthropometric measurements [50].

A study conducted in 2007 and 2010 using pooled cross-sectional surveys revealed that roughly 21% and 31%, respectively, of children aged 6 to 59 months were wasted and stunted [46]. According to WHO classifications, Somalia's prevalence of stunting and wasting would be categorized as "high" or "very high" based on this study [51]. Although there were more current data from biannual cross-sectional surveys, they did not show findings at the national level.

Between 1990 and 2015, the global prevalence of underweight and wasting was 25% and 9%, respectively [64]. Geographically, South Asia and Africa have the greatest rates of child malnutrition worldwide, making up almost one-third of all undernourished children. In Africa, 23.5% of children under five were underweight, and 9.4% of wasting children [64]. In contrast to stunting, which, although a malnutrition indicator, has been reported to have decreased in Nigeria from 42% in 2003 to 37% in 2013, wasting and underweight have increased in Nigeria over the past ten years, rising from 11% in 2003 to 18% in 2013 and from 24% in 2003 to 29% in 2013 [65] worldwide between 1990 and 2015 by 37% [64]. This study was necessary because of the rising rates of underweight and wasting among the nation's under-five children, which point to a deteriorating nutritional insufficiency.

In order to give updated national estimates of stunting, wasting, and other nutritional deficits, the **Somalia** Micronutrient Survey (SMS) [52] was conducted in 2019. We sought to determine the possible risk factors of stunting and wasting in children 0–5 months and 6–59 months of age using anthropometric data acquired from children as well as data on other household members and features. To address childhood undernutrition, a thorough understanding of the risk factors for wasting and stunting in both age groups will form the foundation for the creation of targeted treatments and policies.

The double burden of malnutrition (DBM) is recognized to be experienced by populations where under- and overnutrition coexist [53]. It is particularly common in the Pacific, South-East Asia, and sub-Saharan Africa [55]. Since the global burden of malnutrition has not decreased quickly, it is advisable to gather population-specific data in order to better understand the dynamics of nutrition worldwide and to enable the communities'nutritionalneeds must be appropriately met [54,56].

Malnutrition trends in children over five are a problem that is being disregarded. According to the World Health Organization (WHO), 90% of the 1.8 billion children in the world between the ages of 5 and 15 live in low- and middle-income countries (LMICs) [57]. The lack of a common term to describe children between the ages of 5 and 15 demonstrates the narrow focus on younger children and the neglect of this age group. However, children between the ages of 5 and 10 are frequently referred to as school-going children [58], while adolescents are defined by the WHO as children between the ages of 10 and 19; early adolescents are those between the ages of 10 and 14 and late adolescents are those between the ages of 15 and 19 [59]. If DBM is present in this age range then how much is a question that hasn't been sufficiently investigated.

According to a 2011 report by the United Nations Children's Fund (UNICEF), adolescence offers a second chance to enhance children's nutritional condition and avert the long-term health effects of malnourishment [60]. However, nutritional difficulties

arise at every stage of a person's life cycle; as a result, nutritional requirements at every stage, particularly for school-age children and adolescents, must be evaluated and suitably addressed [59]. Throughout this age range, people continue to develop mentally and physically and have the opportunity to correct dietary inadequacies, which helps to avoid growth, development, and cognitive success from being hampered [61].

It is well known that the early adolescent stage is when significant physical and developmental changes take place. This includes secondary sexual traits, growth spurts, the development of sex organs, and, as recent neuroscientific research has shown, a considerable increase and reconfiguration in the neural network [60].The theory known as developmental origins of adult health and disease, or DOHaD, is a more recent one that suggests chronic illnesses in adulthood are linked to undernutrition in early life [62]. There is currently a dearth of information on children and adolescents enrolled in school, and as child survival rates rise, more children are beginning their second decade of life, necessitating attention to their health and nutritional requirements.

The WHO suggests planning and strategic guidelines for child health initiatives in the South-East Asian Region (SEAR), but only for teenagers [61]. In order to create strategic guidelines for enhancing adolescent health, the World Health Organization first conducted pertinent evaluations under national, regional, or global categories. These reviews were then followed by surveys in those regions to determine lessons learned and recommendations for future actions. After considering advice from subject-matter specialists, they eventually created the guidelines [62]. Other LMICs should use this procedure to find the gaps and implement the required corrective actions.

It is imperative that children who are older than five years old be assessed for undernutrition, overnutrition, and nutritional deficiencies. For the purpose of synthesizing the evidence and identifying gaps in the nutritional status and dietary intake patterns of school-age children and early adolescents (ages 5 to 15) in other LMICs, this systematic review might be utilized as an example [63].

In **Nigeria**, this study used data from the 2013 National Demographic and Health Survey (NDHS) to characterize the distribution of wasting and underweight by severity status throughout critical periods of child growth and to identify common predictors for wasting/severe wasting and underweight/severe underweight among Nigerian children aged 0-59 months. Consequently, supplying data on the interventions and policy measures that can be developed and put into practice to help Nigeria meet the Global Nutrition Target set by the World Health Assembly (WHA) to attain a 30% decrease in low birth weight by 2025 and to reduce and maintain childhood wasting to less than 5% [69].

The causes of wasting and underweight are multifaceted and include infections and eating practices for children, as well as impacts from the community, household, environment, socioeconomic, and cultural spheres. 208 hospitalized children in southwest Nigeria [66], The results showed that the presence of infections, non-exclusive breastfeeding, low maternal education, diarrheal episodes, father's education, and family size (>6) were significant predictors of underweight and wasting. However, because the data employed in this small-scale research were not nationally representative, their breadth was constrained. As a result, conclusions drawn from these kinds of studies could not be applied to all Nigerians. Addressing underweight and wasting in children at a young age given the increased risk of morbidity and mortality in children with poor energy supply, growth is extremely important.

In **Pakistan**, 44% of children under five were found to be stunted 31% to be underweight, and 15% to be wasted [70]. Furthermore, the 2018 Pakistani National Nutrition Survey revealed that nearly one-third of children under the age of five were underweight (28.9%), 17.7% were wasting, and 40% of children under the age of five were determined to be stunted [71]. Undernutrition affects children in Pakistan across all age groups [72,73]. Publications from the State Bank of Pakistan indicate that one in ten children in Pakistan suffers from wasting, and almost half of children under five are stunted [74]. Pakistan is one of the seven nations responsible for two thirds of the world's undernourished population [74,75]. Pakistan is ranked 77th out of 113 nations in the world for the prevalence of malnutrition. Pakistan has the greatest rate of stunting among children in the South Asian region, and when compared to other southern countries, Pakistan has the highest rate of child wasting [76,77], and [78].

The percentage of people who are stunted increased from 41.6 to 43.7% 5 between 2001 and 2011, despite the fact that the frequency of stunting decreased from 48 to 36.3% between 1965 and 1994. In 2018 [71], it remained at the 40.2% global critical threshold. It is anticipated that the annual reduction rate would be 0.5%, which will not result in a notable decrease in Pakistan's stunting rate [71]. Additionally, the prevalence of wasting rose from 8.6% to 15.1% between 1997 and 2011. The percentage of people who waste has increased to 17.7% [71] in 2018. The PDHS 2017–18 [71]report states that between 2012–13 and 2017–18, the prevalence of stunted fell from 45 to 38%. A comparable pattern of underweight and waste was also noted. From 2012–13 to 2017–18 [71], the percentages of underweight and wasting decreased from 30 to 23% and 11 to 7%, respectively. The percentage of stunted, underweight, and wasted children has decreased over the past ten years, but the rate of change is too sluggish to meet SDG 2.2's goal of eradicating malnutrition by 2025. As such, the researcher must investigate the causes contributing to this decline. Researchers studying public health must determine the obstacles preventing Pakistan from achieving the SDG 2.2 target and then provide evidence-based, practical recommendations to policy makers [79].

The causes of childhood malnutrition were identified by the Pakistan National Nutrition Survey[71] as an inadequate diet, recurrent infections, poor breastfeeding habits, a delayed introduction of supplementary foods, and a diet lacking in protein. Malnutrition is viewed from both a clinical and a bio-social perspective because it is caused by a number of sociodemographic factors [71]. According to Sand et al. [80], there is a strong correlation between stunting and mother literacy, poor income, and overcrowding in the Province of Sindh, Pakistan. Previous research has demonstrated a substantial correlation between malnutrition and the following factors: wealth index, mother education, rural settlement, birth order number, and body mass index [81,82].

The decrease of malnourishment in the form of low weight, wasting, and stunting is one of the objectives of the World Health Organization's Global Target 2025 [83]. Globally, in 2019, there were 144 million stunted children (21.3%), 38.3 million overweight people (5.6%), and 47 million wasting people (6.9%). Underdeveloped nations have higher rates of childhood malnutrition [84–88]. India, Bangladesh, and Pakistan are the three South Asian nations where 50% of undernourished children reside

[89]. 17% of wasted children and 27% of stunted children worldwide resided in low-income nations [89].Among 2019, the prevalence rates of stunting, overweight, and for wasting among children under five years old in Asia were 69%, 54%, and 45%, respectively [89]. Most children reported as stunted were in South Asian countries, specifically Pakistan, then India [90].

The Joint FAO/WHO Expert Committee on Nutrition was established in 1949 by the UN Food and Agriculture Organization (FAO) and the World Health Organization (WHO). They recommended an investigation during their first meeting, noting that kwashiorkor was common in developing nations. To carry out a survey in Africa, WHO dispatched John Fleming Brock (1905–1983), while FAO sent Marcel Autret (1909–2001) [91]. Brock and Autret [91] reported that while kwashiorkor was found throughout the entire continent of Africa, it was completely absent from the Masai and Batussi tribes, who are major producers of cow's milk. Following up, a survey by Autret and Moisés Béhar (1922–2015) revealed that kwashiorkor was widespread throughout Central America [92]. It was also demonstrated by John Conrad Waterlow (1916–2010) and Arturo Vergara that kwashiorkor was very common in Brazil [93].

During its third session in the **Gambia** in 1952, the Joint FAO/WHO Expert Committee on Nutrition discussed malnutrition in mothers, babies, and children. It was during this conference that the phrase "protein malnutrition" was first used. The first meeting on protein malnutrition took place in Jamaica the following year [94]. Waterloo stressed the significance of subclinical disease, even though the clinical and pathological aspects of kwashiorkor and marasmus were the primary subjects of discussion: "I realize very well that we are concerned not only with the very sick and the dying, but perhaps much more with mild or chronic, so-called "marginal" states of malnutrition in infants and children. "Acute kwashiorkor is not nearly as serious a condition as this one [94].

William Cumming Rose (1887–1985), an American biochemist who conducted groundbreaking research on essential amino acids, was among the 29 nutritionists, doctors, and scientists present at the second symposium on protein malnutrition, which took place in Princeton, New Jersey in 1955 [95]. Protein synthesis is dependent on having all of the essential building ingredients, as stated by Rose. When one of them is removed, the others are essentially rendered worthless [96]. The conference's primary findings were that the amount and quality of protein determines how much the human body needs. It was suggested that milk be used as a reference protein to ascertain the amino acid needs of newborns and early children.Two approaches were put forth to address the lack of protein in the diet: one was to produce complementary protein-rich foods that are safe, affordable, easy to store, biologically effective, and palatable; the other was to take a regional approach to promote the production and consumption of fish or vegetable products as an addition to the local staple [97].

Many scientists started researching childhood malnutrition during this time in research facilities all over the world: Numerous reports of child starvation were made possible by these different locations. Derrick B. Jelliffe, a pediatrician who practiced from 1921 to 1992, highlighted that kwashiorkor was only the most severe form of protein deficiency and that many other small children with subclinical protein malnutrition fell within the same category [98].

In response to the suggestions made at the Princeton meeting for the creation of an independent body that would offer protein knowledge, the UN Protein Advisory Group (PAG) was established in 1955 [99]. Benjamin Stanley Platt (1903–1969), Nevin Scrimshaw, L. Emmett Holt Jr. (1895–1974), and W. Henry Sebrell Jr. (1901–1992), the director of the National Institutes of Health, were among the group's members.

In 1960, the third conference on protein deficiency was convened in **Cuernavaca, Mexico**, with the goal of incorporating social science knowledge to comprehend dietary practices across cultural boundaries [100]. The malnutrition in children reported "where diets are habitually poor in protein but provide calories in quantities that vary from gross inadequacy to excess" is referred to as "protein-calorie malnutrition" [100]. It was anticipated that certain communities would object to the introduction of meals high in protein due to cultural customs and beliefs.Therefore, the conference's main topics were nutrition education, social scientists' involvement, techniques for analyzing eating habits, and strategies for introducing novel foods. Federico Gómez Santos suggested defining the prevalence of protein-calorie malnutrition using weight-for-age-based growth failure [100].

Compared to other age groups, children under five years old, who are among the most susceptible, require a larger food intake for healthy growth and development. Numerous elements that are related to children under five years old's nutritional status have been identified by earlier research. The results are less constant, though, and nutritional status has an impact on the main factor's difference Food security, feeding habits, cleanliness, hygiene, health care, understanding of nutrition, economic level, and parental traits are regarded as the indirect factors that are also significant risk factors of wasting, even though the causes of wasting differ from nation to nation [102-106].

UNDERNUTRITION IN DIFFERENT REGION OF BANGLADESH

In different region of **Bangladesh**, children between the ages of 12 and less than 24 months had the highest frequency of stunting (42.4%) The percentage of stunted male children (35.7%) exceeded the percentage of stunted female children (31%). The division of Khulna had the lowest percentage of stunted children (26.1%), while Sylhet had the highest percentage (40.1%). In the wealthiest homes, the prevalence rate of stunted children was just 20.2%, however among the poorest households, the rate rose to 43.6%. Children who were stunted were least common in households that used flush latrines (26.5%). As anticipated, children of mothers with a secondary education completion rate of 17.9% had the lowest prevalence of stunting, whereas children of mothers with no formal education had the highest prevalence rate of 43.3%. Paternal education showed similar outcomes, with only 20.9% of children whose fathers had finished secondary education being stunted.

The percentage of wasted male children (13.1%) was much higher than the percentage of wasted female offspring (9.5%). Sylhet division has the highest percentage of wasted children (14.3%), followed by Barisal division (12.4%) and Chittagong division (11.9). Children of mothers without a high school diploma had the lowest proportion of wasting prevalence (7.3%), while children of moms with a secondary degree had the greatest percentage (13.9%). Fathers without formal education also had the largest percentage of children that were wasting (12.9%). Children from the wealthiest households wasted only 6.7% of their children, compared to 14.2% of the children from the poorest households. It

was calculated that 17.14% of wasted youngsters came from households without a toilet [107].

Bangladesh has been particularly concerned about child undernutrition because it has one of the highest rates of stunting and wasting in the world. Our study's goal was to investigate the socioeconomic factors that contribute to stunting and wasting in young children (under two years old). In order to identify the risk factors linked to childhood stunting and wasting, this study used two distinct binary logistic regression models to examine a nationally representative sample of 7,230 children ranging in age from 0 to less than 24 months. According to our findings, 11% of children are wasted and 33% of youngsters are stunted. According to our data, children aged 12 to 24 months showed a decline in their height-for-age-z-score and weight-for-height-z-score when compared to children younger than 6 months. Children who were female had far lower rates of stunting and compared to male children, female children had much reduced odds of wasting and stunting. According to a study, kids from affluent families had a reduced chance of stunting and lost growth than kids from poorer homes. Stunting was found to be significantly predicted by parental education. The odds of stunting were 1.26 times higher for children residing in the Sylhet division compared to those in the Dhaka division [OR = 1.26; 95% CI: 1.02–1.55].

In Bangladesh, as in other low- and middle-income nations, undernourishment of children continues to be a serious public health issue and a leading cause of death for children under five. Between 2004 and 2015, Bangladesh saw a drop in the death rate of children under five, from 88 to 38 per 1,000 live births [108]. The infant mortality rate has significantly decreased over time, although it is still relatively high (United Nations Children's Fund (UNICEF), 2016). The time between 0 and 24 months is crucial for guaranteeing children's healthy development and general wellbeing. Early-life nutritional deficits impede the best possible physical and cognitive development, with long-term effects that last into adulthood.

Stunting appears to be highly common among children living in slum communities around the nation. In Bangladesh as in other places, poverty and illiteracy are linked to stunting; yet, 21% of children from households in the wealthiest quintiles are also stunted. Stunting affects about one-third of children whose moms are literate. Thus, the exact cause of stunting remains unknown; however, data from Bangladesh indicates that low birthweight (LBW), inadequate maternal nutrition, extreme food insecurity, inappropriate supplemental feeding, poverty, illiteracy, and inadequate sanitation and hygiene practices are among the factors linked to the condition [109].

METHODOLOGY

SUBJECTS & METHODS

After getting the permission from the school authority following all the necessary formalities such as a written application, a scheduled date will be administrated of collected data using predesigned attached questionnaires, a preliminary test copy, piloting and a consent paper. There will be no forceful implications on surveyed person. Anthropometry will be collected by standard formula, social lifestyle data will be collected by a trained nutritionist. Data will be analyzed using SPSS 24 and an AI neural network, related statistical test will be done for data analysis.

Experimental site: The experiment was carried out at Angels' Garden Preschool in Dhaka, Bangladesh.

Experimental Design and layout: The experiment is a cross sectional study and was laid out in Cluster Randomised Trials (CRT). The total number of surveyed children was 120 and 3 days recall method.

Data Collection Instruments

A comprehensive examination of various literatures was conducted before developing a semi-structured questionnaire. The UNICEF digital weighting scale (SECA), which has a capacity of 150 kg and a precision of 0.1 kg, was used to measure weight. A height measuring length board with a sliding head piece and scale that has a 2 meter measuring capacity was used to measure height.

Data Collection Procedure

For the purpose of gathering data, five teachers, two sisters from the mentioned school were hired. The survey was translated from its original English version into Bangla, the local tongue. Pretesting of the questionnaire was done at Angels' Garden Preschool, which is in the study region. After then, the necessary adjustments and revisions were made before gathering data. Parents and other caregivers provided information on food habits, cleanliness, sociodemographic, and socioeconomic status.

Children were measured anthropometrically. A digital portable weighing scale that was calibrated to the nearest 0.1 kg was used to measure the weights, and a length board was used to measure the height to the nearest 0.1 cm in Frankfurt position. Children who wore loose clothing or school uniforms, were barefoot, and had empty pockets were all weighed.

Assurance of Data Quality

The supervisors and data collectors received three days of training. The training covered questionnaires, anthropometric measuring instruments, and consenting study participants. The lead investigator and supervisors oversaw the data collection process. Re-visits to the schools were conducted in order to fill up incomplete surveys. To minimize inaccuracies, a weighing scale was calibrated to zero before each measurement was taken.

Data collection and analysis: Survey sheets has been used to gather information about socio-demographics, daily eating habits, sanitation, hygiene and medical history. Microsoft Excel and SPSS-24 has been used to analyze the data and the data has been audio recorded as well as captured in still images..

Operational Definition

- Nutritional status: Describes a child's physical attributes, such as height and weight.
- Undernutrition, including wasting, stunting, and underweight, is referred to as malnutrition.
- Stunting: When a child's height Z-scores are less than two standard deviations from the median WHO reference values for that age.
- Underweight: when a child's weight for their age falls within two standard deviations (SD) of the median WHO reference values.
- Wasting: if a child's weight Z-score for height deviates more than two standard deviations from the median WHO reference values.

Time Fame (May 2023- January 2024) of the Work:

Sl. No	Action Plan	Duration
1.	Selection and getting permission to survey pre-schools	May/2023
2.	Data collection	October/2023 to November/2023
3.	Statistical analysis of data, thesis writing	Dec/2023
4.	Date of thesis submission	Jan/2024

Future outcomes, Socio-economic significance of the research and conclusion:

This report aims to discuss two key indicators (wasting and stunting) of malnutrition of 70 children in Dhaka City. These indicators provide valuable insights into a child's nutritional status, with each representing a distinct aspect of malnutrition. This report will define and explain each indicator, highlight their causes, and emphasize the potential risks associated with them. The consequences of these malnutrition indicators in children are far reaching and profound. Research efforts will be focused on improving access to nutritious food, promoting maternal health and education, and implementing effective interventions to prevent and treat malnutrition, ultimately ensuring that children have the opportunity to grow and develop to their full potential. Furthermore, the insights gained from this research will be instrumental in guiding government policies and initiatives. By understanding the problems associated with children's eating habits, policymakers can develop evidence-based strategies and interventions to promote healthy nutrition among preschool-aged children. This may include implementing nutritional education programs for parents, advocating for improved access to affordable and nutritious foods, and regulating food marketing targeted at children.

Development of the Questionnaires

Questionnaires were prepared based on respondents' growth condition & dietary behavior of children under 5 years old. History of different background and relevant information on the socio-economic status such as age, gender, education, occupation, family size, income, dietary pattern, general knowledge of mal planning nutritional value & life style patterns, food frequency, medical condition etc. were included.

Data Analysis

Data were collected through questionnaire method. The data set were first checked, revised & entered into the computer from the numerical codes on the form. The frequency distributions of the entire variables were checked by using SPSS.26.0 Windows Programme and related statistical test will be done for data analysis.

Limitations of the Study

1. Some of the respondents were unwilling to express their true dietary pattern.
2. Some of the respondents tried to hide their actual food intake.
3. A noticeable number of respondents experienced several health issues such as diarrhea, seasonal fever, hookworm's difficulty, loss of appetite etc.

RESULT

Within this result section, we unveil core insights derived from an extensive exploration into the assessment of undernutrition and prevalance among under 5 childrens in diffrent preschools in Dhaka City and the associated factors with a particularemphasis on age-specific patterns.

Table 1 *Nutritional Status and Health factors of Under 5 Children respondents*

MEASUREMENT	MINIMUM	MAXIMUM	MEAN (±SD)
Age	2	4	2.31 ± 1.31
Weight (kg)	9	21	14.31 ± 2.77
Height (cm)	66.04	114.30	101.12 ± 7.88
BMI	10.20	19.10	13.79 ± 1.83

The table presents a range of measurements encompassing age, weight, height, and BMI (Body Mass Index). It details the minimum and maximum values alongside their respective mean and standard deviation (±SD). Specifically, the age range spans from 2 to 4 years with an average of 4.31 ± 1.31 year. Weight fluctuates between 9 kg as the minimum and 21 kg as the maximum, averaging at 14.31 ± 2.77kg. Height ranges from 66.04 cm to 114.30 cm, having an average of 101.12 ±7.88cm. Additionally, the BMI values vary from 10.20 to 19.10, with an average BMI of 13.79 ± 1.83kg/$m^{2.}$

Table 2 *Comprehensive Food Consumption and various factors of Under 5 Children respondents*

TOTAL CONSUMPTION	MINIMUM	MAXIMUM	MEAN (±SD)
How much water do you drink daily (ml)?	720	2880	1457.14 ± 438.79
3 Days Meat Intake [g]	19	230	71.14 ± 42.22
3 days Amount of Protein [g]	76	273	147.16 ± 38.59
Oil Intake_litre	1	10	4.37 ± 1.90
Sugar Intake_g	0.5	5	1.66 ± 0.94
Salt Intake_g	0.5	5	1.54 ± 0.82

Table 2 provides details regarding daily consumption patterns, encompassing various dietary elements. The total consumption of water daily ranges from a minimum of 720 ml to a maximum of 2880 ml, with an average intake of 1457.14 ml and a standard deviation of 438.79. In terms of meat intake over a span of three days, the values range between 19 grams as the minimum and 230 grams as the maximum, averaging at 71.14 grams with a standard deviation of 42.22. The three-day average protein consumption spans from 76 grams to 273 grams, with an average intake of 147.16 grams and a standard deviation of 38.59. Additionally, the intake of oil, sugar, and salt ranges from 1 gram to 10 grams, 0.5 grams to 5 grams, and 0.5 grams to 5 grams, respectively. On average, the intake of oil is 4.37 grams with a standard deviation of 1.90, sugar intake is 1.66 grams with a standard deviation of 0.94, and salt intake is reported at an average of 1.54 grams with a standard deviation of 0.82.

Table 3 *Linear growth Chart of Under 5 Children respondents*

LINEAR GROWTH	MINIMUM	MAXIMUM	MEAN (± SD)
Stunting Growth_g [Yes=1 No=2]	1	2	1.90 ± 0.302

Wasting Growth_g [Yes=1 No=2]	1	2	1.91 ± 0.282

Table 3 outlines parameters related to linear growth, specifically focusing on stunting and wasting growth. Stunting growth is categorized with values of 1 for 'Yes' and 2 for 'No', ranging from a minimum of 1 to a maximum of 2, with a mean value of 1.90 and a standard deviation of 0.302. Similarly, wasting growth follows the same pattern with values of 1 for 'Yes' and 2 for 'No', ranging from 1 to 2, showing a mean value of 1.91 and a standard deviation of 0.282.

Table 4 *Vaccination status and their frequency of Under 5 Children*

VACCINATION	FREQUENCY	PERCENTAGE %	VALID PERCENTAGE %	CUMULATIVE PERCENTAGE %
Fully	49	40.8	70.0	70.0
Partially	4	3.3	5.7	75.7
Not yet	7	5.8	10.0	85.7
Not Intending	10	8.3	14.3	100.0

Table 4 illustrates vaccination statistics across different categories: "Fully," "Partially," "Not yet," and "Not Intending." The table details the frequency count and the corresponding percentages for each vaccination status concerning the total sample. For instance, the "Fully" vaccinated individuals amount to 49, constituting 40.8% of the total, 70.0% of the valid sample, and contributing to a cumulative percentage of 70.0%. Additionally, "Partially" vaccinated individuals total 4, representing 3.3% of the total, 5.7% of the valid sample, and contributing to a cumulative percentage of 75.7%. Moreover, 7 individuals, comprising 5.8% of the total, 10.0% of the valid sample, are categorized as "Not yet" vaccinated, contributing to a cumulative percentage of 85.7%. Finally, 10 individuals, accounting for 8.3% of the total, 14.3% of the valid sample, are labeled as "Not Intending" to get vaccinated, culminating in a final cumulative percentage of 100.0%.

Table 5 *Food Frequency Chart of under 5 respondents*

Food Item	Never n (%)	1-3 times per week	4-7 times per week	8+ times per week
Poultry chicken	13(10.8)	30(25)	17(14.2)	10(8.3)
Country chicken	42(35)	24(20)	2(1.7)	2(1.7)
Beef	64 (53.3)	3 (2.5)	3 (2.5)	0
Mutton	62 (51.7)	6 (5)	1 (0.8)	1 (0.8)
River fish	1(0.8)	43 (35.8)	25 (20.8)	1 (0.8)
Sea fish	44 (36.7)	25 (20.8)	1 (0.8)	0

Canned fish	66 (550	4 (3.3)	0	0
LEGUMES	26 (21.7)	28(23.3)	13 (10.8)	3 (2.5)
Poultry egg	8(6.7)	27 (22.5)	30 (25)	5 (4.2)
Non-factory egg	62 (51.7)	6 (5)	1 (0.8)	1 (0.8)
Omega-3 egg	64 (53.3)	3 (2.5)	3 (2.5)	0
Skimmed milk	50 (41.7)	13 (10.8)	5 (4.2)	2(1.7)
Whole milk	13(10.8)	30(25)	17(14.2)	10(8.3)
Powder milk	37(30.8)	15(12.7)	16(13.3)	2(1.7)
Butter	42(35)	24(20)	2(1.7)	2(1.7)
Yogurt	37(30.8)	32(26.7)	0	1 (0.8)
Cream	53(44.2)	16(13.3)	0	1 (0.8)

The table on Food Frequency delineates the consumption patterns of various food items based on the frequency of intake among surveyed individuals. Each food item is categorized by the frequency of consumption per week, ranging from "Never," "1-3 times per week," "4-7 times per week," to "8+ times per week," with the corresponding counts and percentages represented in parentheses. Notably, poultry chicken is consumed by 10.8% "Never," 25% "1-3 times per week," 14.2% "4-7 times per week," and 8.3% "8+ times per week." Similarly, other items like country chicken, beef, mutton, river fish, sea fish, canned fish, legumes, poultry egg, non-factory egg, Omega-3 egg, skimmed milk, whole milk, powder milk, butter, yogurt, and cream are detailed with their respective consumption frequencies.

Table 6 *Correlationship Analysis between Stunting and Various Factors*

variable 1	variable 2	Pearson correlation Coefficient (r)	P-value
Stunting	Age	-3.4**	0.004
Stunting	Height	0.57	0.63
Stunting	Weight	0.75	0.55
Stunting	BMI	0.03	0.8
Stunting	Gender	-0.04	0.69
Stunting	Meal Skip	0.31**	0.008
Stunting	Vaccine	-0.43	0

- **Correlation is significant at the 0.01 level (2-tail)**
- **Correlation is significant at the 0.05 level (2-tail)**

The table labeled "Correlation between Stunting and Various Factors" illustrates the correlations between stunting and different factors. The Pearson correlation coefficient (r) quantifies the strength and direction of the relationship between stunting and each variable, while the P-value assesses the significance of these correlations. Specifically, stunting exhibits a significantly negative correlation with age at -3.4** ($p = 0.004$), indicating a strong inverse relationship. Conversely, stunting showcases positive correlations with height (0.57, $p = 0.63$), weight (0.75, $p = 0.55$), BMI (0.03, $p = 0.8$), and gender (-0.04, $p = 0.69$), albeit the correlations are relatively weaker and lack statistical significance. Notably, stunting demonstrates a positive correlation with meal skipping (0.31**, $p = 0.008$), implying a noteworthy association between stunting and skipping meals. Additionally, the correlation between stunting and vaccination status is negative (-0.43, $p = 0$), suggesting a relationship where stunting tends to be less prevalent among vaccinated individuals.

Table 7 *Correlationship Analysis between Wasting and Various Factors*

Variable 1	Variable 2	Pearson Correlation Coefficient (r)	P-value
Wasting	**Age**	**0.01**	**0.91**
Wasting	**Height**	**-0.002**	**0.98**
Wasting	**Weight**	**0.11**	**0.32**
Wasting	**BMI**	**0.15**	**0.23***
Wasting	**Gender**	**0.1**	**0.4**
Wasting	**Meal Skip**	**0.17**	**0.13**
Wasting	**Vaccine**	**-1.31**	**0.28**

- **Correlation is significant at the 0.01 level (2-tail)**
- **Correlation is significant at the 0.05 level (2-tail)**

The table labeled "Correlation between Wasting and Various Factors" presents the correlations between wasting and different factors. The Pearson correlation coefficient (r) measures the strength and direction of the relationship between wasting and each variable, while the P-value assesses the significance of these correlations.Wasting exhibits negligible correlations with age (0.01, p = 0.91), height (-0.002, p = 0.98), weight (0.11, p = 0.32), and gender (0.1, p = 0.4), suggesting weak or no substantial relationships between these factors and wasting. There's a slightly stronger positive correlation observed between wasting and BMI (0.15, p = 0.23), but it does not reach statistical significance. Additionally, the correlation between wasting and meal skipping is moderate (0.17, p = 0.13), hinting at a potential association between wasting and skipping meals, although it falls short of statistical significance. Notably, the correlation between wasting and vaccination status stands out at a negative value (-1.31, p = 0.28), although it lacks significance, implying a potential inverse relationship between wasting and vaccination status.

Table 8 *Correlationship Analysis between Stunting and Protein Intakes of under 5 respondents*

Variable 1	Variable 2	Pearson Correlation Coefficient (r)	P-value
Stunting	Poultry Chicken	-1.34	0.26
Stunting	Country Chicken	-0.47	0.69
Stunting	Beef	0.09	0.45
Stunting	Mutton	-0.04	0.69
Stunting	River fish	0.05	0.66
Stunting	Sea fish	0.06	0.59
Stunting	Canned fish	-0.12	0.31
Stunting	Legumes	0.18	0.12
Stunting	Poultry Egg	-0.1	0.37
Stunting	Non-factory Egg	0.01	0.93
Stunting	Omega-3 Egg	-0.01	0.93
Stunting	Skimmed Milk	-0.006	0.95
Stunting	Whole Milk	-0.08	0.5

Stunting	Butter	-0.41	0.73

- **Correlation is significant at the 0.01 level (2-tail)**
- **Correlation is significant at the 0.05 level (2-tail)**

Table 8 reciprocates that Stunting is correlated with various Protein based foods as indicated by various factors where consumption of poultry chicken is marked as negative and country chicken refers the same. On the other hand, beef is considered to be positive where mutton again stays on the negative line. Consecutively Butter, Whole milk, Skimmed milk and Omega-3 eggs are showing negative corrrelation with Stunting where River fish, Legumes and Non-factory egg has positive influence of Stunting growth.

Table 9 *Correlationship Analysis between Wasting and Protein Intakes of under 5 respondents*

Variable 1	Variable 2	Pearson Correlation Coefficient (r)	P-value
Wasting	Poultry Chicken	-1.34	0.26
Wasting	Country Chicken	-0.33	0.78
Wasting	Beef	0.23*	0.04
Wasting	Mutton	-0.06	0.57
Wasting	River fish	0.2	0.85
Wasting	Sea fish	-1.6	0.16
Wasting	Canned fish	-0.14	0.23
Wasting	Legumes	0.2	0.08
Wasting	Poultry Egg	0.113	0.35
Wasting	Non-factory Egg	0.09	0.42
Wasting	Omega-3 Egg	0.08	0.46
Wasting	Skimmed Milk	0.1	0.4
Wasting	Whole Milk	0.003	0.98
Wasting	Butter	-0.08	0.51

- **Correlation is significant at the 0.01 level (2-tail)**
- **Correlation is significant at the 0.05 level (2-tail)**

Table 9 previews that Wasting is correlated with various protein based foods where Beef is significant to be correlated with Wasting. Poultry chicken and Mutton is inversely negative while taking butter in the queue. Sea fish is rarely eaten so it is understandable that the negative correlationship. This distribution highlighted the diverse food consumption of the respondents with a predominant presence of students and a varied representation across other food groups.

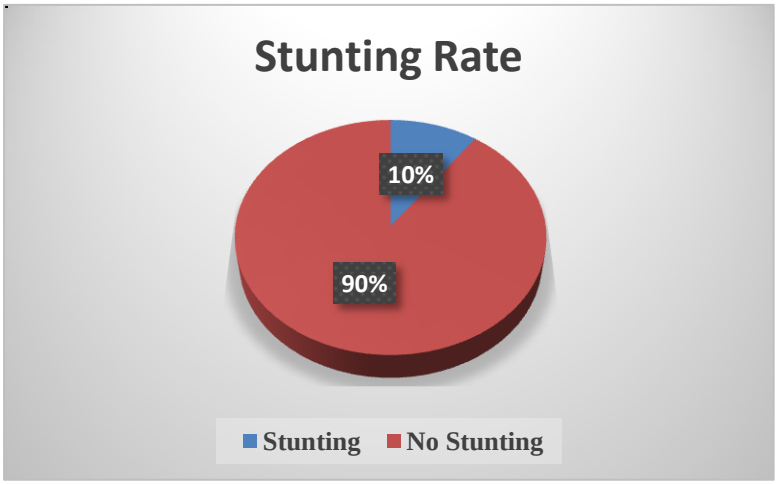

Figure 1: Stunting rate

Only 10% subjects were stunted.

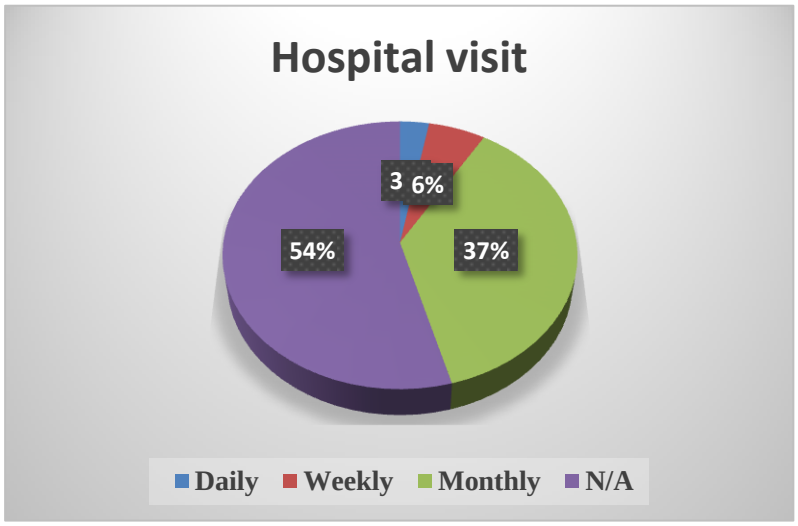

Figure 2: Hospital visit

About 37% study subjects visited hospital monthly.

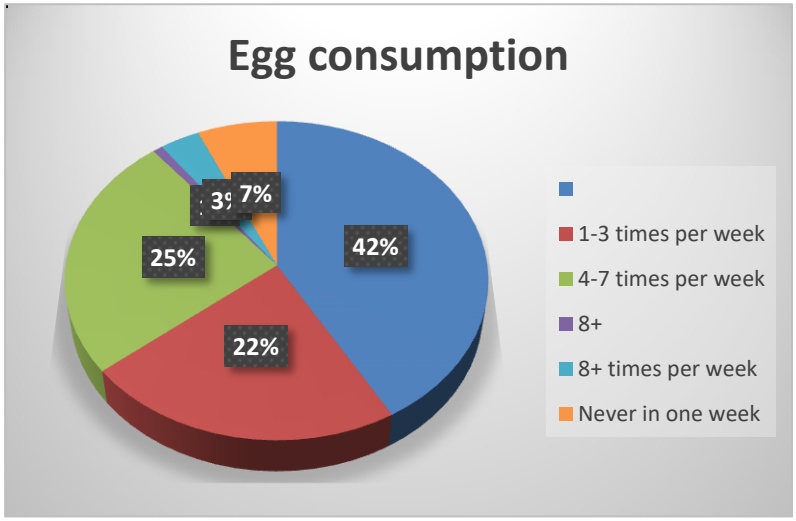

Figure 3: Egg Consumption

About 7% Study subjects never had egg consumption in a week.

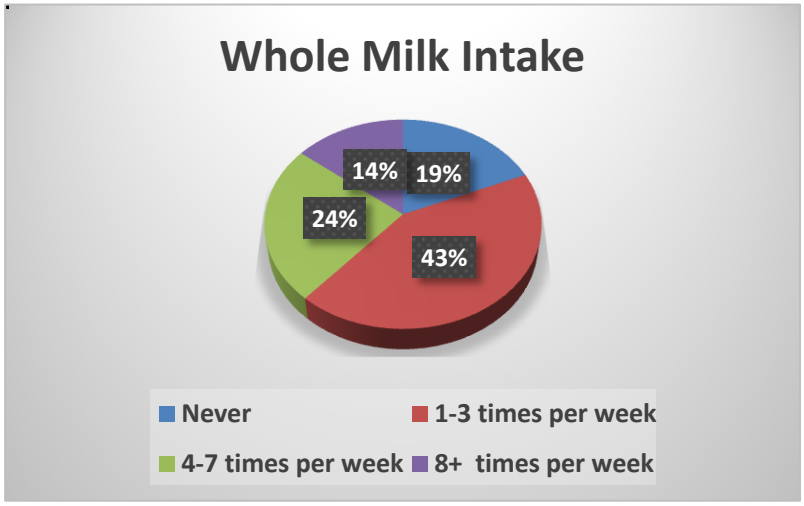

Figure 4: Whole milk intake

About 43% Study subjects had whole milk consumption in a week.

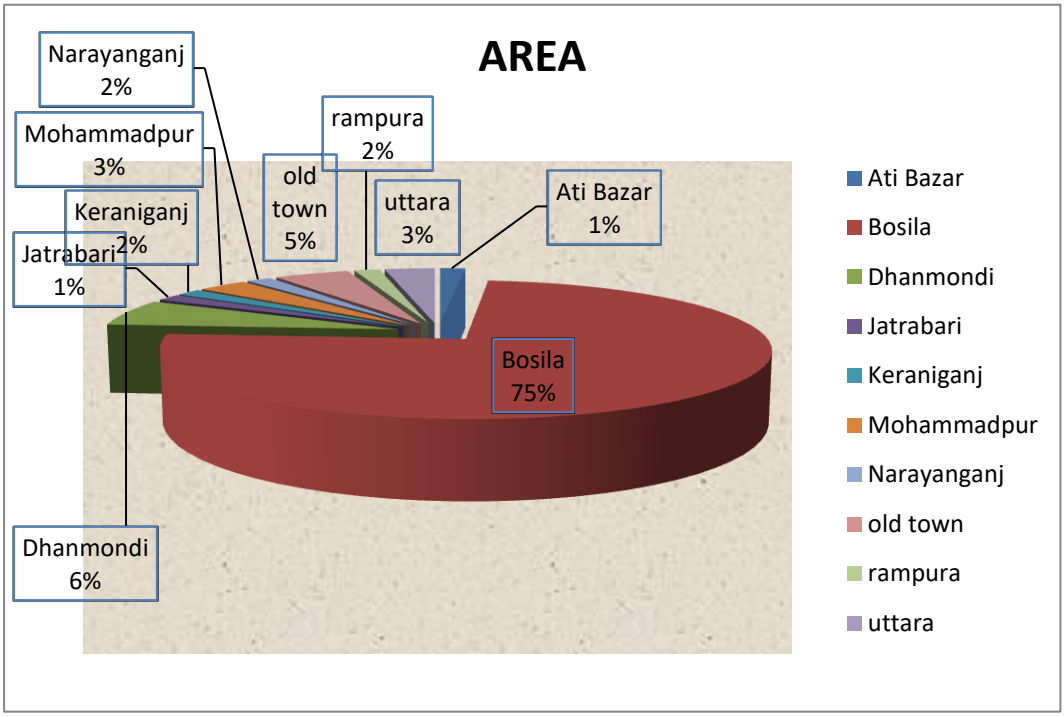

Figure 5: Living Area of the under 5 respondents

Figure 1 shows that highest number of respondents were from the area Bosila, as 75% of total. Dhanmondi area being the second highest, as 6% and followed by Mohammadpur and Uttara, as 3% both. Old Town respindents were at 5% and the respondents from other area were Narayanganj, Keraniganj, Rampura and Jatrabari being 2%, 2%, 1% and 1% respectively. This distribution highlighted the diverse living area of the respondents with a predominant presence of students and a varied representation across other areas of Dhaka City.

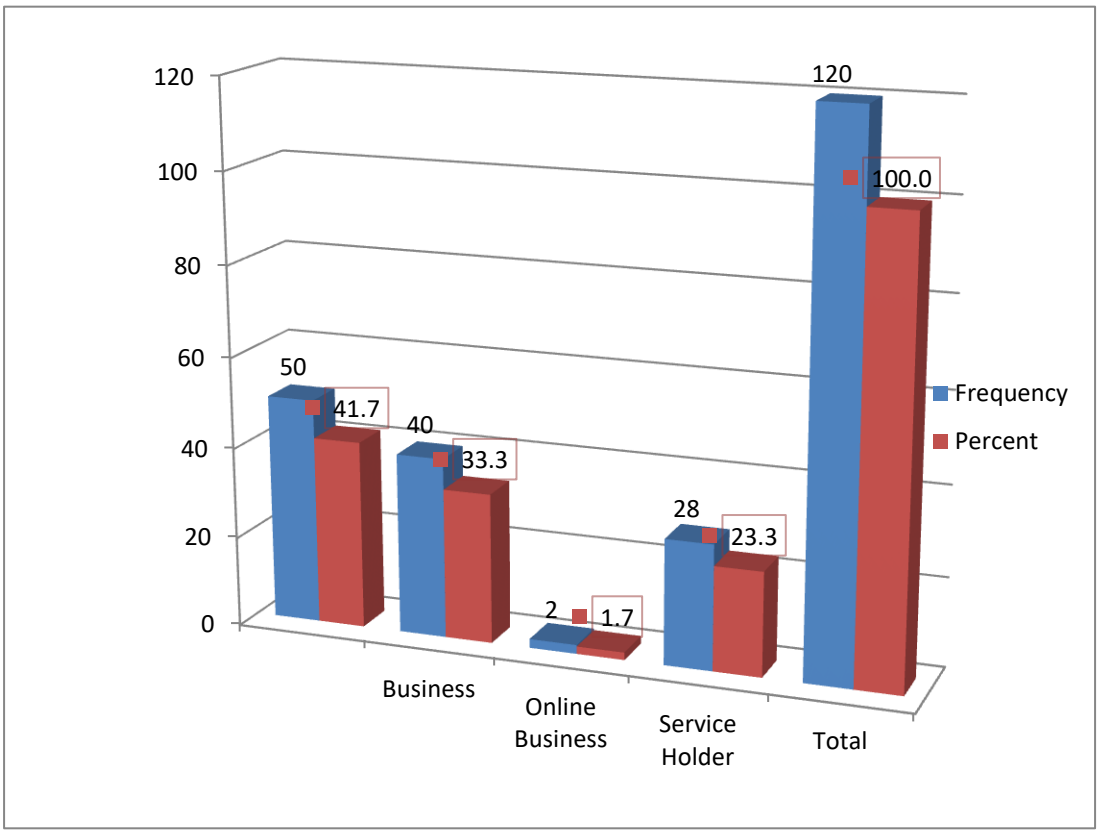

Figure 6: Respondents Father's Profession

Respondent's fathers professions in the study were distributed across various categories. A minimal percentage, 1.7% were occupied in online business, while 23.3% were employed in various service roles, with 33.3% were involved in various businesses. 41.7% were associated with various roles like doctors, accounts manager, freelancers. This distribution highlighted the diverse occupational backgrounds of the respondent's fathers, with a predominant presence of students and a varied representation across other professions.

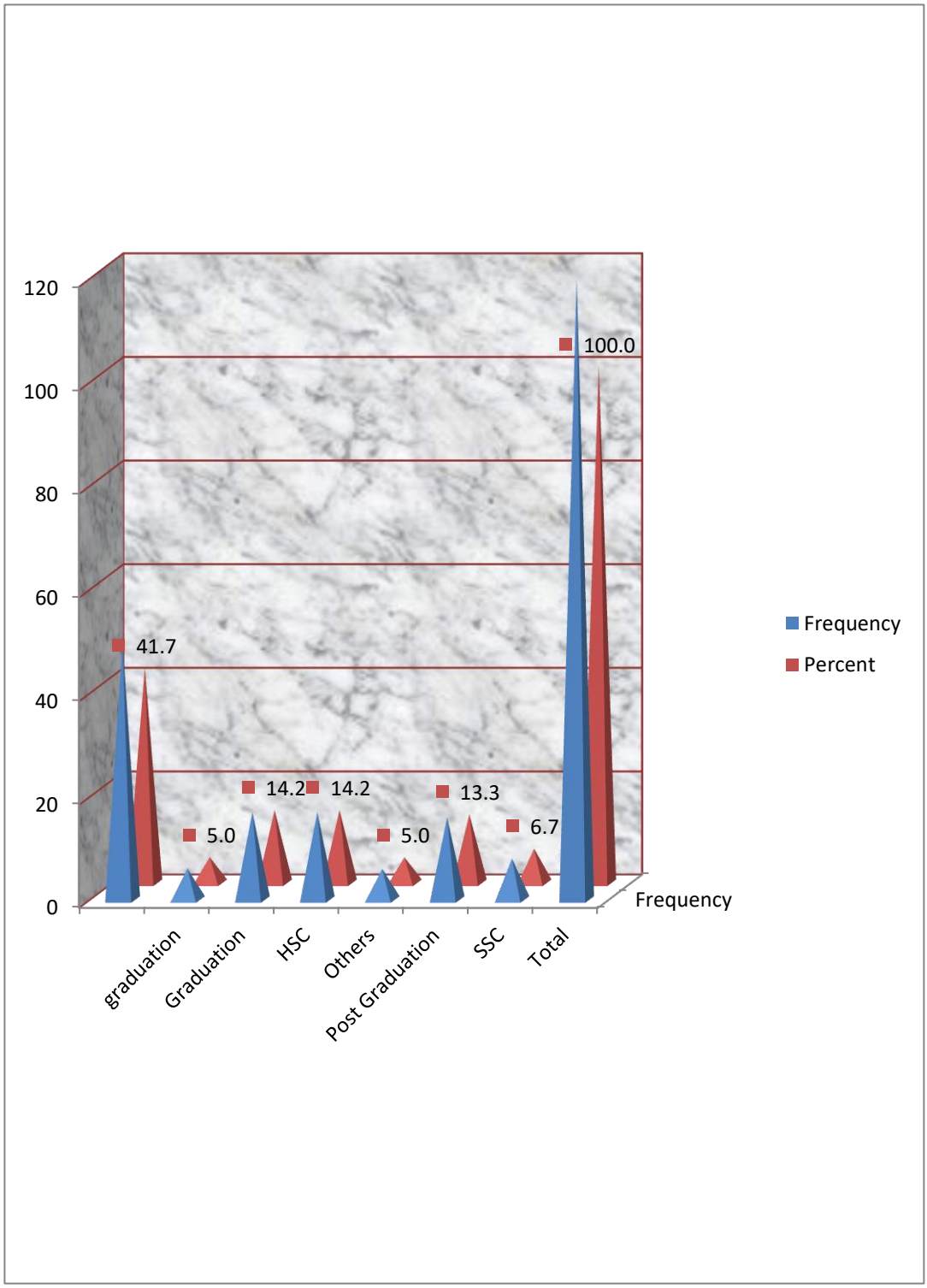

Figure 7: Frequency and Percentages Mother's Education

The participants' mothers education was equally important to know due to know the insights of a children's dietary habit, in the study were distributed across various categories. A minimal percentage, 6.7% had completed SSC (Secondary School Certificate), while 14.2% finished HSC (Higher Secondary Certificate). A significant portion, comprising 14.2% held a degree at the graduation level. Another proportion 13.3% had attained post-graduation qualifications. The remaining 5% fell into "others" category. This distribution indicated a diverse educational background among the participants, with a noteworthy percentage having completed post-graduate studies.

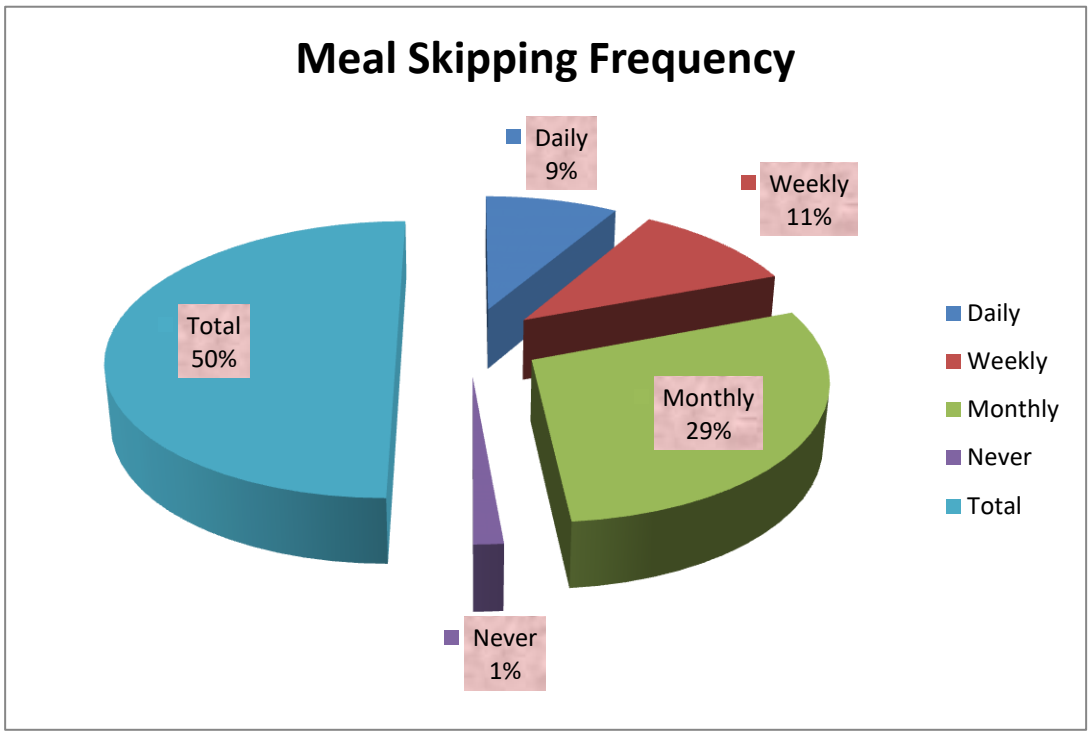

Figure 8 Frequency of Meal Skipping of the Respondants

There are several interesting trends in the data about respondents' tendency to skip meals. As kids, they tend to miss the breakfast most due to coming to school in the early morning. In particular, 9% of the individuals admitted to tending to miss at least one meal a day more significantly, breakfast. Moreover 11% tend to miss on a weekly basis skipping lunch of total 50%. On the other hand, a sizable majority which is 29% used to skip monthly. Among them only 1% never skipped meals. These results offer insightful information on the participants' common meal-skipping habbits.

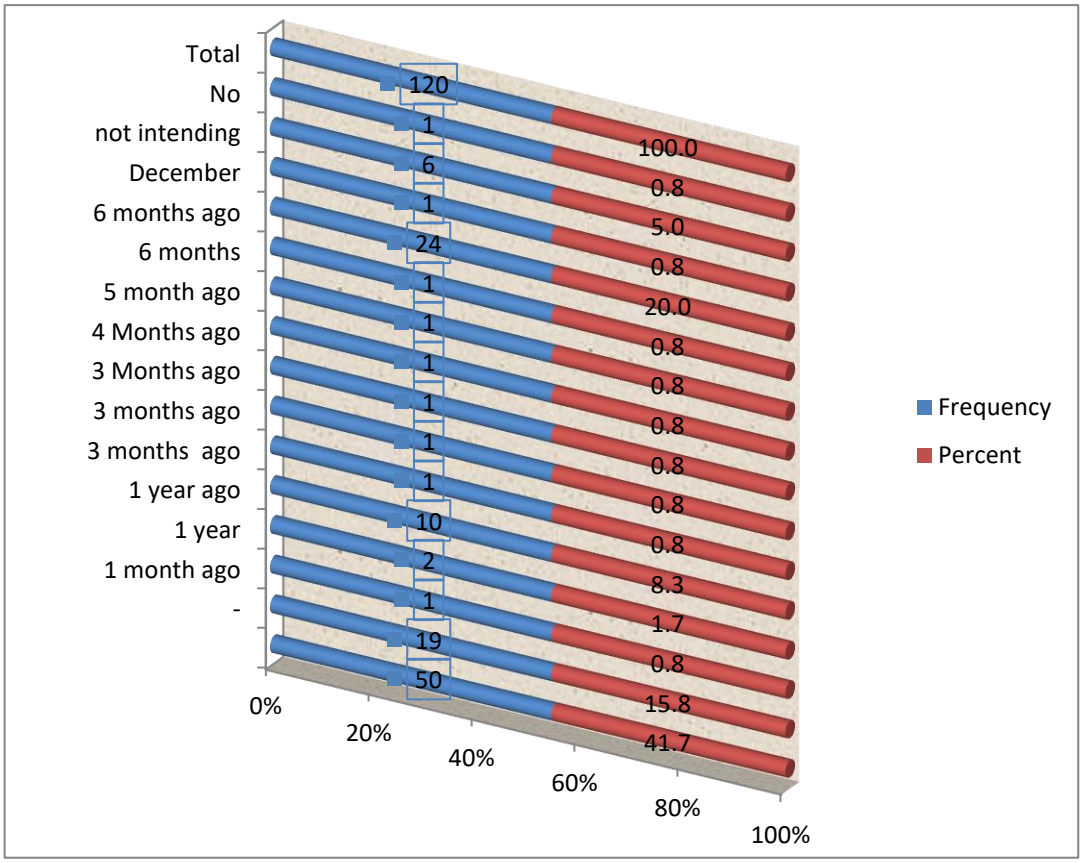

Figure 9: Frequency of Oral Mebandazol for Hookworms of the Respondents

The data on participants' inclination towards Oral Mebandazol for Hookworms is very rare. In particular, 41.7% took the oral vaccines 1 month prior the data collection. Most of the respondents took the oral vaccine before 6 months, as 20% where as it followed by 2 months prior, 3 months prior, 4 months prior and 5 months prior made up to 0.8%, 0.8%. 0.8%, and 5% consecutively. These result dictates the taboo and insights about the oral vaccines information.

DISCUSSION

The presented results showed that a comprehensive analysis of various factors concerning health, dietary patterns, vaccination status, and their correlations with stunting and wasting among the studied under 5 children. The findings reveal significant correlations between stunting and specific factors, notably demonstrating a strong negative correlation with age and a positive correlation with meal skipping. The inverse correlation between stunting and vaccination status also draws attention, indicating a potential link suggesting lower prevalence among vaccinated individuals. However, correlations with other factors like height, weight, BMI, and gender appear weaker and lack statistical significance, implying a more complex relationship or insufficient sample strength to establish significant associations. Conversely, the analysis concerning wasting reveals inconclusive or weak correlations across most factors, suggesting limited direct relationships between wasting and variables such as age, height, weight, and gender. The moderate correlation with meal skipping and the non-significant inverse correlation with vaccination status raise interesting considerations but require further investigation for substantiation. These outcomes imply that while stunting appears to have more discernible associations with certain factors, wasting demonstrates less direct relationships or possibly other underlying determinants not captured in this study. This suggests the need for additional research to comprehend the nuanced interplay of these factors on stunting and wasting within this demographic, emphasizing the importance of considering broader environmental, socioeconomic, and health-related variables to gain a comprehensive understanding.

CONCLUSION

Nearly 10 percent stunting have found in this study.

Stunting are related with skipping meal, age, mother education and mother occupation.

Wasting correlated with number of siblings, father's occupations, and hook worm infection.

The results of the study showed that every food intervention that was examined in this investigation has the ability to improve a child's linear growth. All feeding modifications did not, however, have the same impact on infants' and children's linear development. Consideration of nutrition quality, nutrient type, study location, local food availability, and food sources that should be taken into account for future food intervention programs are challenges associated with successful food intervention. When it comes to linear growth, animal protein has a greater influence than plant-based protein. However, additional data is required in order to improve linear growth circumstances for future practices and policies by the government, non-governmental organizations, researchers, and nutrition-based businesses. This data is based on the variety of high-calorie, locally available meals with particular nutrient contents.

The extent of underweight, wasting, and stunting was considered a minor public health concern in this study. There was a statistical correlation between stunting in school-age children and not drinking milk or milk products and not washing your hands with soap. Children who had not had milk and those who had fallen ill within the previous two weeks had higher rates of wasting. The degree of underweight in school-age children was significantly correlated with the father's educational attainment, the children's breakfast eating habits, the amount of milk they consumed, and the occurrence of illness within the previous two weeks. Based on the study's findings, we advise implementing interventions to raise living standards, promote good hygiene, increase consumption of milk and milk products, and encourage dietary diversification in order to enhance school-age children's nutritional status.

RECOMMENDATIONS

Increasing the scope of successful nutrition interventions: Multiple interventions must be carried out at large scale by NGOs and the public sector, as a single intervention would only have a marginal impact. Recently, a list of evidence-based treatments that need to be used in high-burden nations was released (34). As part of the life-cycle approach, interventions aimed at addressing the direct and immediate causes of undernutrition should focus not only on the "window of opportunity," or the first 1,000 days (the time between conception and up to two years of age), but also on the adolescent period that comes before. For noticeable results, undernutrition-related treatments should be expanded to include at least 70% of the population. The top initiatives in Bangladesh that should be expanded are as follows:

In the time of pregnancy and lactation

Women receiving iron-folic acid tablets as a supplement to help fight anemia during pregnancy and nursing during the second half of pregnancy, effective counseling on optimal infant-feeding habits and increased rest and food intake should be provided. Frequent use of salt that has been iodized.

Mothers who give birth within six weeks of receiving a 200,000 unit dose of vitamin A supplements.

Nutrition in 0–5 months

Early infancy EBF encouragement through customized counseling and troubleshooting-looking for solutions to the problems encountered during nursing, raising awareness of the value of breastfeeding through a variety of means, including media coverage, classroom talks for teenage girls, prenatal counseling, feeding assistance, and troubleshooting in the early hours and days following delivery.

Nutrition in 6-23 months

Encouragement of continuing breastfeeding, counseling women on the use of energy-dense, locally produced foods like as grains, veggies and pulses and, if available, animal protein (fish,

eggs, or meat) for supplemental feeding. Vitamin A supplements every six months Zinc therapy and ORT for diarrheal tract infections, hand washing and other hygiene measures Powdered several micronutrients for food fortification at home deworming in accordance with WHO guidelines.

Therapeutic meals that are ready to use and cooked with items found locally are used to treat SAM both in the community and in the facility.

Nutrition for Pre-school kids

Energy

Preschoolers require between 1,400 and 1,500 calories a day, depending on their age, development rate, and degree of activity.

Complete Protein

Protein should make up between 10 and 30 percent of a preschooler's caloric intake. Fish, poultry, beans, nuts, and lean meats are a few healthy protein sources.

Carbohydrate

Children older than one should aim to ingest 130 grams of total carbs daily. Carbohydrate-rich foods include fruits, vegetables, and whole grains. But not every carbohydrate is made equally. For instance, added sugars are categorized as carbohydrates even if they may have negative health implications. Therefore, for children older than two, it is advised to restrict ingestion to no more than 10% of total calories per day.

Fiber

The dietary guidelines suggest preschoolers have 19–25 g of fiber daily because it helps maintain regular bowel motions and a healthy digestive system. Whole grains, fruits, and vegetables are a few healthy sources of fiber.

Fats

It is advised to limit total fat intake in toddlers 2 to 3 years old to between 30 and 35% of calories, and in children over 4 years old to between 25 and 35% of calories, even if there is no set amount for fat consumption [8]. Saturated fat should also account for 10% of total calories, according to the Dietary Guidelines for Americans.

Nuts, seeds, avocados, fatty salmon, and olive oil are a few foods that are excellent providers of healthful fats.

Minerals and vitamins

A range of vitamins and minerals are necessary for preschoolers.

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