MALNUTRITIONAL STATUS OF 6-59 MONTHS OLD CHILDREN OF RURAL FAMILIES IN SELECTED AREAS OF DINAJPUR DISTRICT

A THESIS

BY

MONIKA KHATUN SHARNA
Registration No. 1605573
Session: 2016-2017
Thesis Semester: July-December, 2017

MASTER OF SCIENCE (M.S.)
IN
FOOD SCIENCE AND NUTRITION

DEPARTMENT OF FOOD SCIENCE AND NUTRITION
HAJEE MOHAMMAD DANESH SCIENCE AND TECHNOLOGY UNIVERSITY, DINAJPUR

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Submitted to the Department of Food Science and Nutrition
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DEPARTMENT OF FOOD SCIENCE AND NUTRITION
HAJEE MOHAMMAD DANESH SCIENCE AND TECHNOLOGY UNIVERSITY, DINAJPUR

JUNE, 2018

DEDICATED
TO MY
BELOVED PARENTS

ACKNOWLEDGEMENTS

All the praises must go to my almighty Allah who has provided me the courage and ability to undertake this herculean task. At the time of starting this task, I didn't know whether I could complete it or not, but I believed, "Fortune favors the brave". So, I was determined to try my level best to make it successful and I am most grateful to almighty Allah, that I have completed the work successfully.

I am expressing my earnest gratitude to my respected supervisor Dr. Anwara Akter Khatun, Chairman, Department of Food Science And Nutrition, Hajee Mohammad Danesh Science and Technology University, Dinajpur for her immense support and extensive co-operation.

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Lastly, my special thanks are extended to my mother and younger brothers, well-wishers for their considerate, amiable behavior, encouragement and inspiring discussions which have helped me to complete my thesis work. Finally, my sincere apology goes to the readers for conceptual and printing mistake, if there is any.

The Author

ABSTRACT

The objective of the study was to asses nutritional status of children aged 6-59 months from the rural families in selected areas of Dinajpur district. Anthropometric, sociodemographic, and food related data were collected. A interviewer administered questionnaire was used to collect data. The prevalence of malnutrition was assessed using three indicators, such as stunting, underweight, and wasting following the WHO guidelines and cut-off points. A total of 165 children (6-59 months) and their household of three Upazila (Kaharole, Dinajpur Sadar and Birganj) in Dinajpur district were included in this study. The prevalence rate of stunting, underweight and wasting of 6-59 months old children in Dinajpur were 38.8%, 41.3%, 12.1% respectively. The mean height of male and female children were 82.99 cm and 84.15 cm. The mean weight of male and female children were 10.97 kg and 10.78 kg. Female children were more susceptible to malnutrition than male children. The major factors associated with stunting and wasting children were religion, monthly income of family, parent education, criteria of child daily activity and the consumption of egg, cow milk, citrus fruits, leafy vegetables, other vegetables, rice, pulses.

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ACRONYMS

%	: Percent
BBS	: Bangladesh Bureau of Statistics
BDHS	: Bangladesh Demographic and Health Survey
BMI	: Body Mass Index
CIAF	: Composite Index of Anthropometric Failure
cm	: Centimeter
et al	: And others
FAO	: Food and Agricultural Organization
GNI	: Gross National Income
HAZ	: Height for age Z scores
IDD	: Iodine Deficiency Disorder
Kg	: Kilogram
LMICs	: Low and Middle Income Countries
LPG	: Liquid Petroleum Gas
MAM	: Moderate Acute Malnutrition
MILE	: Maximum Likelihood Estimation
NCHS	: National Center for Health Statistics
NGO	: Non-Government Organization
NIPORT	: National Institute of Population Research and Training
OR	: Odd Ratio
RC	: Reference Category
SAM	: Severe Acute Malnutrition
SD	: Standard Deviation
SPSS	: Statistical Package for Social Science
Tk	: Taka
UNICEF	: United Nations Child Emergency Fund
WAZ	: Weight for Age Z scores
WHO	: World Health Organization
WHZ	: Weight for Height Z scores

CHAPTER I

INTRODUCTION

CHAPTER I

INTRODUCTION

1.1 Background of the study

Bangladesh is a densely populated country having a small area of 1,47,570 square kilometer. According to Bangladesh Bureau of Statistics (BBS), the population of the country is about 158 million, with a population density of 1,070 persons per square kilometer in 2014. Almost 1 in 4 Bangladeshis (24.3 percent of the population) live in poverty, and 12.9 percent of the population live in extreme poverty. Bangladesh's poverty rate fell from 82% in 1972, to 18.5% in 2010, to 12.9% in 2016(World Bank 2017). The gross national income (GNI) per capita in Bangladesh has increased to US$1,314 in FY 2014-2015 (BBS, 2015). The population in Bangladesh is predominantly rural, with almost 80 percent of the population living in rural areas and depend on agriculture. The birth rate was declining from 192 births per 1,000 women in the 2004 to 143 births per 1,000 women in the 2014 according to BDHS. Although Neonatal mortality, infant mortality, under 5 mortality has been decreased from 1989 to 2014(BDHS 2014), but stunting, wasting and underweight percentage of child are still very high than globally. 41% of children under 5 years of age are stunted, 16% are wasted, and 36% are underweight (BDHS 2014). So children under age of 5 years are at a risk by malnutrition, especially those under the age of 2 years are more susceptible to under nutrition.

Malnutrition is a condition which occurs when there is a deficiency of certain vital nutrients in a person's diet. The deficiency fails to meet the demands of the body leading to effects on the growth, physical health, mood, behaviour and other functions of the body. Malnutrition has both short term and long term consequences. Malnutrition commonly affects children and the elderly. The term malnutrition covers 2 broad groups of conditions. One is 'under nutrition'—which includes stunting (low height for age), wasting (low weight for height), underweight (low weight for age) and micronutrient deficiencies or insufficiencies (a lack of important vitamins and minerals) such as vitamin A deficiency, anaemia and iron deficiency, iodine deficiency disorder (IDD) etc. The other is overweight, obesity and diet-related non-communicable diseases (such as heart disease, stroke, diabetes and cancer).Children under 5 are also affected by macro and micro nutrient deficiencies. There are various factors that influence malnutrition

among children such as socio-demographic, environmental, reproductive, institutional, cultural, political and regional factors (UNICEF-WHO, 2012).

Malnutrition among children also depend on poor nutrition, inadequate food intake, inadequate breastfeed of child, safe water. First two years of life is a crucial time for health and cognitive development of a child (Jerin, 2013). Growth of children greatly depend on food. Due to lack of food results under nutrition which can slow the growth of child. Poor nutrition can also lead to reduced immunity, increased susceptibility to disease, impaired physical and mental development, and reduced productivity which is irreversible. Good nutrition – an adequate, well balanced diet combined with regular physical activity – is a cornerstone of good health. Healthy children are better in education, stronger, more productive and more able to create opportunities to break the cycle of both poverty and hunger in a sustainable way (WHO, 2008).

Malnutrition is alarming for developing countries including Bangladesh. It is due to improper knowledge about nutrition of food, ignorance, improper diet, illiteracy, lower family income, poverty, mother occupation , father occupation ,densely populated area, sanitation, unhygienic environment etc are significant with nutritional status of children. Unhygienic environment, lack of sanitation lead to illness fever, diarrhea which can results malnutrition. Low birth weight, height and weight of mother, do unable to breast feed also manipulate malnutrition. Food insecurity, particularly due to insufficient food access caused by high levels of poverty, as well as food price volatility, natural disasters, and limited land for cultivation (Bosak *et al.*, 2018).

Malnutrition worldwide

In 2014, an estimated 41 million children under the age of 5 years worldwide are overweight or obese, while some 159 million are stunted and 50 million are wasted (WHO, 8 JULY 2016). Between 1990 and 2014, stunting prevalence declined from 39.6per cent (255 million) to 23.8 per cent (159 million). Overweight prevalence has increased slightly between 1990 and 2014, from 4.8 per cent (31 million) to 6.1 per cent (41 million). Approximately 1 out of every 13 children in the world was wasted in 2014.The global wasting rate was 7.5 percent in 2014. Besides, 50 million children under five were wasted, of which 16 million were severely wasted (WHO, UNICEF and World Bank, 2015).

22.9 per cent or 154.8 million children under 5 were affected by stunting in 2016 which is lower than 2014 globally. In 2016, wasting continued to threaten the lives of an estimated 7.7 per cent or nearly 52 million children under 5 globally which is higher than 2014. 6.0 per cent or 40.6 million children under age 5 around the world were overweight in 2016 (WHO, UNICEF and World Bank, 2017).

Globally, an estimated 101 million children under-five years of age, or 16%, were underweight (i.e., weight-for-age below –2SD) in 2011 — a 36% decrease from an estimated 159 million in 1990 (WHO, UNICEF and World Bank, 2012).

Malnutrition in developing countries:

Almost all forms of malnutrition largely occurs in Asia and Africa. More than 90% of the world's stunted children live in Africa and Asia. More than half of all stunted children under 5 lived in Asia(56%) and more than one third lived in Africa(38%).It indicates that stunting percentage is declined slowly in Asia but has increased in Africa. . More than two thirds of all wasted children (69%) under 5 lived in Asia and more than one quarter (27%) lived in Africa, which indicates that wasting status of children has increased in Asia. 35.9 million children under 5 in Asia are wasted, of which 12.6 million are severely wasted. In Africa, 14.0 million children under 5 are wasted, of which 4.1 million are severely wasted. Africa is the only region where number of stunted children has risen (WHO, UNICEF, World Bank group 2017).

Global Nutrition Report 2015 estimated that 36% children of Bangladesh, 45% children of Pakistan, 41% children of Nepal, 15% children of Srilanka, 39% children of India, 34% children of Bhutan, 24% children of South Africa, 9% children of China, 7% children of Brazil are stunted. This report indicates that the stunting percentage of children under 5 of India, Pakistan, Nepal, Bhutan, Bangladesh are higher than globally, but in China, Brazil are lower than globally and in Sri Lanka the percentage of stunting children are equal to global.

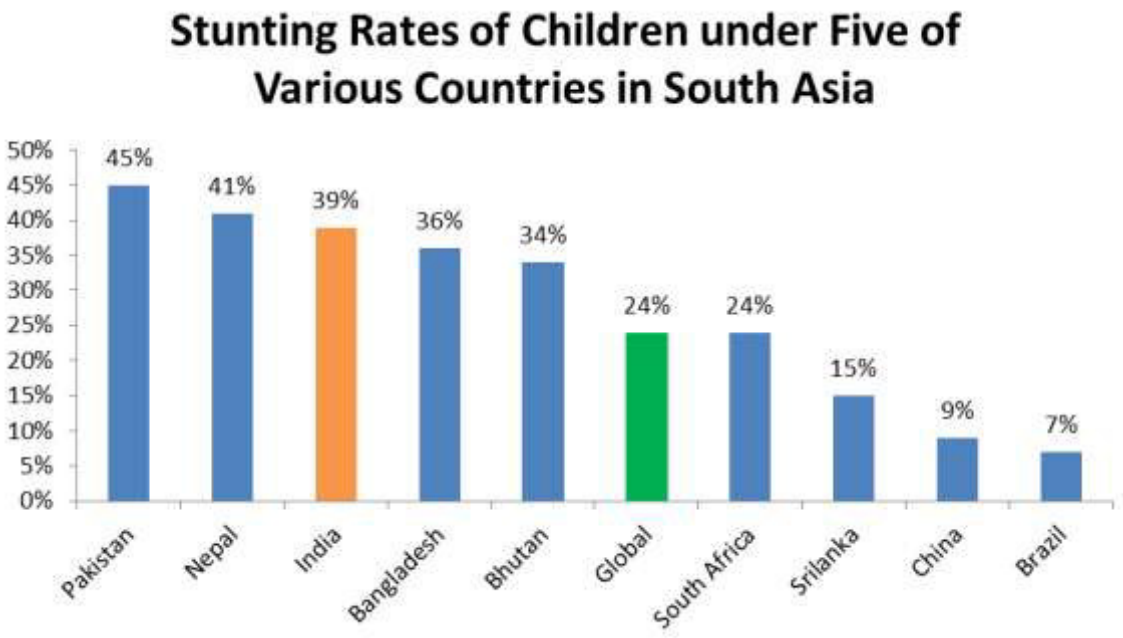

Figure 1.1: Stunting Rates of Children under Five of Various Countries in South Asia

Source: Global Nutrition Report 2015

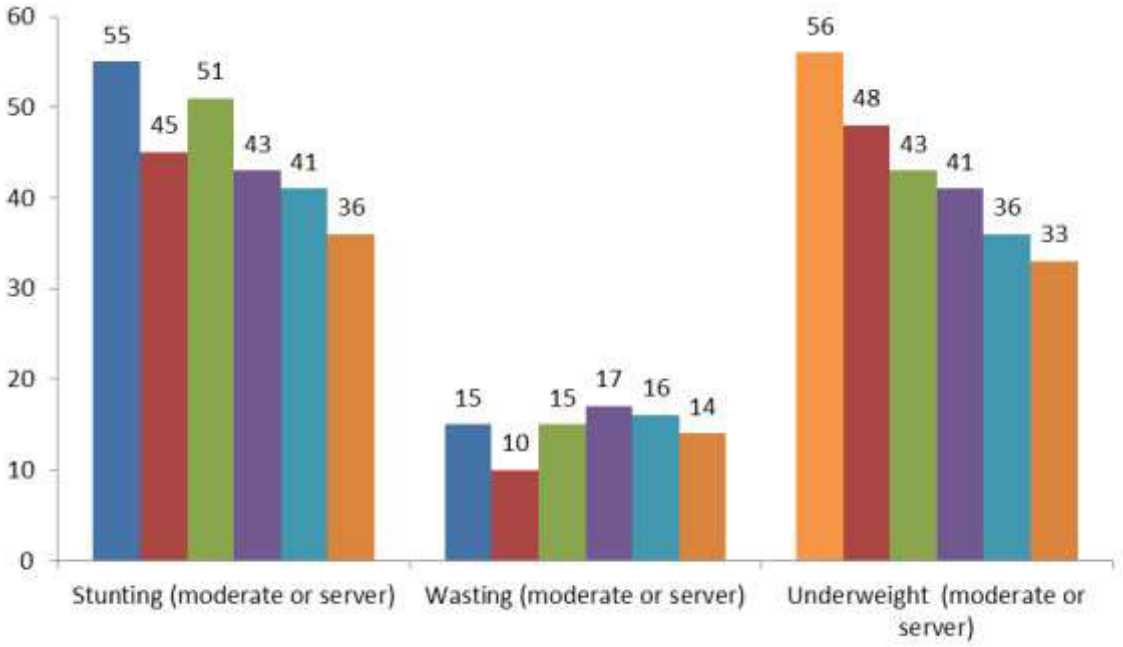

Figure 1.2: Trends in nutritional status of children under 5 years of age in Bangladesh, 1997–2014.

Source: NIPORT (2015)

According to this graph, stuntimg rate was declind from 55% in 1997 to 36% in 2004, wasting rate was declined from 18% to 10% in 2000 and again increased in 2007 and then again decreased slightly in 2014, underweight rate was declined from 56% in 1997 to 33% in 2014 in Bangladesh.

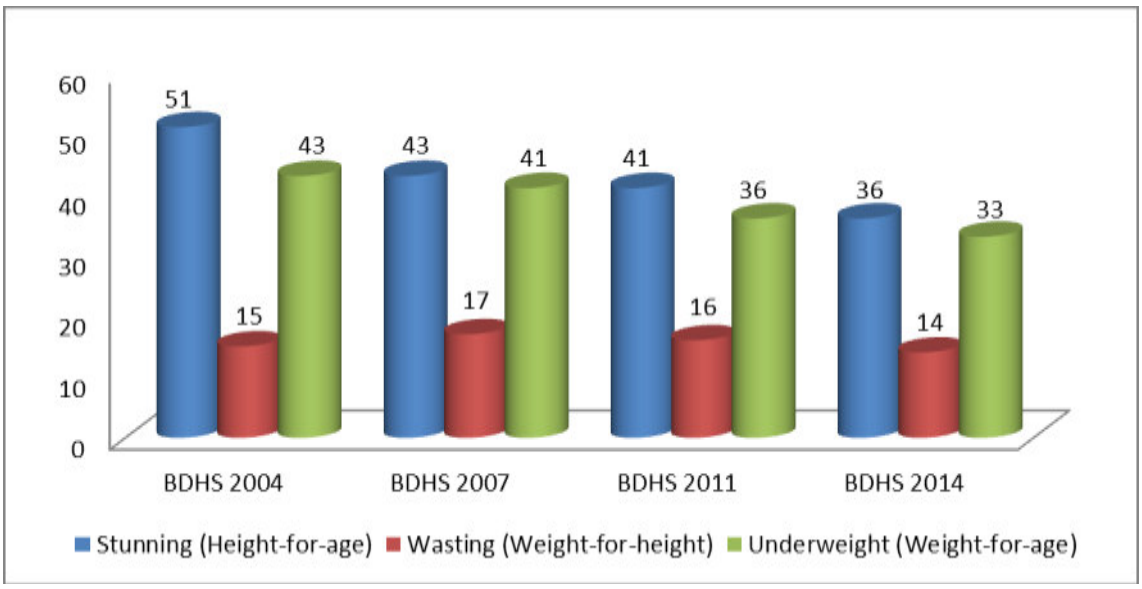

Figure 1.3: Trends in nutritional status of child under age 5 in Bangladesh, 2004-2014.

[Data Source: BDHS 2004, 2007, 2011 and 2014]

According to this graph stunting rate was decreased from 2004 in 51% to 2014 in 36%, wasting rate was decreased from 15% in 2004 to 14% in 2014 and underweight status was decreased from 43% in 2004 to 33% in 2014 in Bangladesh.

It is necessary to increase the sincerity to find out the determinants of under nutrition and take efficient action to eliminate it in Low and Middle Income Countries (LMICs) like Bangladesh. Although various NGO and government are working for malnutrition, lack of coordination to act on nutrition between and among government ministries, donors, different levels of government, and implementing bodies, such as nongovernmental organizations, at the local level (Bangladesh Nutrition Profile 2014) make difficult to eradicate malnutrition. The aim of this study was to explore stunted, wasted and underweight status of children (6-59 months old) at study area in Dinajpur district, Bangladesh.

1.2 Significance of the study:

- This study will help to know the prevalence of nutrition and health status of children of the rural the populations.
- This study will also help local authorities, policy makers to take policy implications regarding rural children health improvement.

1.3 Objectives of the study

1.3.1 General Objective

The overall goal was to describe the nutritional status of under five children according to socio-demographic, economic status and food consumption pattern of children of selected rural families of Dinajpur district.

1.3.2 Specific Objectives

1) To investigate the socio-economic and demographic characteristics of the selected household families.

2) To find out the stunting, underweight and wasting status of children (6-59 months old) by anthropometric measurements.

3) To find out the relationship between nutritional status with socio-demographic and food consumption frequencies.

4) To identify the important socio-economic and food consumption factors which are responsible for variations of child nutritional status.

CHAPTER II

REVIEW OF LITERATURE

CHAPTER II

LITERATURE REVIEW

The present and past status of malnutrition of child under 5 years of age and related literature is presented in this chapter. This chapter is divided into two sections: (1) Socio-economic and health status of children of selected rural families of Bangladesh and other countries; (2) Food consumption and child nutritional status of selected rural families of Bangladesh and other countries.

2.1 Socio-economic and health status of children of selected rural families of Bangladesh and other countries

Jerin (2013) conducted a study among children under 2 years of age in middle of the garments industry area of Bangladesh: insights from nationally representative data which revealed that the prevalence of stunting, underweight and wasting was 34.5%, 27.9% and 15.4% respectively. The multivariate results showed that children with low BMI mothers had 1.4 (95% CI [1.15-1.73], p=0.001) and 1.4 (95% CI [1.11-1.81], p=0.004) times more likely to be underweight and wasted than children with normal BMI mothers. They have also reported that minimum dietary diversity, minimum meal frequency, minimum acceptable diet, prelacteal feeding, fever, diarrhea, ARI, household food security, mother's antenatal care, region, age of the child, access to media, father's education, mother's education and wealth quintile were also important determinants associated with child's under nutrition.

Alom *et al.* (2009) conducted a nutritional study that on differential impact of some demographic, socioeconomic, environmental and health related factors on nutritional status among under five children (n=1547) in Bangladesh whose fathers' occupation was agriculture. The study used Bangladesh Demographic and Health Survey 2007 data. The analyses revealed that 19.6 percent of the children were severely stunted, 29.4 percent were moderately stunted and 51 percent were not stunted. This study also found that 3.5 percent of the children were severely wasted, 16.5 percent were moderately wasted and 80 percent were not wasted. Furthermore, the analyses revealed that 14.5 percent of the children were severely underweight, 32.5 percent were moderately underweight and 53 percent children were not underweight. The main contributing factors for under five malnutrition were found to be child's age, birth order, mother's education, father's

education, family wealth index, sanitation facility, place of delivery, place of residence and division. Community level variations were found significant for wasting only in the analyses.

Monoarul *et al.* (2014) conducted a survey of nutritional Status of Preschool Children (374 chakma children) of Ethnic Community at Sadar Upazilla of Rangamati in Bangladesh which investigated that moderate to severe underweight, stunted and wasted were 23.8%, 25.6% and 14.7% study subjects while rest of the children were healthy. The prevalence of mild malnutrition was more among girls than boys but opposite scenario in case of moderate and severe malnutrition except severe wasting. Children from housewife mother, no formal education and from lower middle income families suffered more from various grades of malnutrition. Significant association was seen between mother's occupation and child nutritional status. Child nutritional status was significantly associated with education of mother. Significant association was also found in relation of monthly family income and all form of child nutritional status.

Das (2015) conducted a study on Bangladesh Demographic and Health Surveys (BDHS) which showed that infant, child and under-five mortality in Bangladesh have declined steadily at least over the past years. However, differentials in trends and patterns of childhood mortality and even child nutritional status by the demographic determinants have not been explained elaborately. According to the 1993-1994 and the 2014 surveys found infant mortality two times, child mortality six times and under-five mortality rates three times declined in 2014 than those were in 1993-94. On the contrary, stunning, wasting and underweight are also declined in 2014 comparatively than the last two decades but it is noted that wasting situation is not gradually declined.

Alom (2010) studied a nutritional status that investigated differential impact of some demographic, socioeconomic, environmental and health related factors on nutritional status among under five children in Bangladesh. The study used Bangladesh Demographic and Health Survey 2007 data .The analyses revealed that 16 percent of the children were severely stunted, 25 percent were moderately stunted and 59 percent were not stunted or normal. This study also found that 3 percent of the children were severely wasted, 14 percent were moderately wasted and 83 percent were not wasted or normal. Furthermore, the analyses revealed that 11 percent of the children were severely under weight, 28 percent were moderately under weigh and 61 percent children were not under

weigh or normal. The main contributing factors for under five malnutrition were found to be child's age, birth order, mother's education, father's education, family wealth index and division. Significant community level variations were found in the analyses.

Habaasa (2014) conducted a study in Nakaseke and Nakasongola districts of Uganda to understand the determinants in these districts about malnutrition among under-five children. It was found out that Children aged 39-59 months were less likely to be underweight than those aged less than twelve months. Findings also revealed that stunting was more prevalent among children of peasant farmers than the pastoralists. There was however no significant relationship between child wasting and selected child characteristics. In conclusion, it is worthy to note that the study is essential in pointing out the particular age-groups among under five children as well as the occupations that contribute to malnutrition in the districts of Nakaseke and Nakasongola. Based on the findings, the study recommends exclusive breast feeding and proper complementary feeding especially among those aged less than three years. Special arrangement could also be put in place to have children of mothers engaged in cultivation brought regularly for breastfeeding.

Kellerhals (2017) conducted a study for understanding severe acute malnutrition in children globally. Severe acute malnutrition (SAM) affects 13 million children under the age of 5 worldwide, and contributes to 1-2 million preventable deaths each year. Malnutrition is a significant factor in approximately one third of the nearly 8 million deaths in children who are under 5 years of age worldwide (1). There have been many revolutions in treatment of SAM over time; however, the exact etiology of this preventable condition is not well understood. This review serves to identify the most common risk factors for the development of SAM in children and to identify the most effective treatment for the disease. There are many factors that contribute to developing and surviving SAM as a child, and this systematic review serves to highlight the most common variables that lead to this cause of mortality. The literature review demonstrates that the most common risk factor for the development of SAM is low maternal literacy.

Roy *et al.* (2015) surveyed to find out the contributing factors of malnutrition among under-five children in coastal region (Borguna) of Bangladesh. 175 children (6-59 months) and their household in Barguna district was considered for study subjects. Only 5.7% children were introduced with colostrum and 25.71% followed exclusive breast feeding. The rate of literacy was found to be higher in father (85.1%) as compared to mother (39.4%). 68.6% children are suffering from underweight whereas the percentage of wasting and stunting children were found to 40.6% and 60% respectively. Breastfeeding practice and monthly family income were significantly associated with wasting, stunting and underweight. Children who were not exclusively breast fed had higher rate of moderate wasting (59.5%), stunting (70.5%) and underweight (74.6%). Children with illiterate father were found to have more odd value of having wasting, stunting and underweight compared to literate father. Furthermore, early age (6-24 month) of children are more susceptible for malnutrition as compared to the age (25-59 months) of children.

Ahmed (2016) surveyed the nutritional Status of under Five Children among Manipuri Population of three villages of Kamalganj (Mangalpur, Madabpur and Tilakpur) under Moulovibazar district in Bangladesh during the period October 2010 to December 2014 using a semi-structured questionnaire. All the children of under five were taken as sample population total 357. Among study children 56.9% were of Bishnupriya, 26.9% were Meitei and 16.2% were of Meiteipangan sub-group of Manipuri population. Mean age was 22±12.6 months and 61.6% were male and 38.4% were female. Majority (88.2%) of the mothers was housewives and most of them are educated. Among the children 93% were completely immunized as per EPI schedule, 48.8% were exclusively breast feed and 67.3% started complementary feeding on time. Amongst study children, 19.3% were underweight, 27.5% were stunted and 8.96% were wasted. By specific blood nutrient parameters, 63.7% were found anaemic (Hb level below 15ng/ml). 39.8% had serum ferritin level below 15ng/ml. The association between hemoglobin and serum ferritin was found statistically significant. Amongst study children, 29.92% had protein of below standard (6.2 gm/dl), 17.6% had serum albumin level below 3.5 gm/dl, 52.3% had serum iron level below 50 µg/dl, 11.3% had serum Vitamin D level below 20 ng/ml and 26.79% had serum zinc level below 700 µg/l. Protein, albumin and ferritin level were found having significant association with wasting.

Kumari (2016) conducted a survey that identified that the determinants of undernutrition in Bihar State are multifactorial. These are a poor health status of the children, a poor nutritional status of mothers, inadequate ANC visits, improper child feeding practices, food insecurity at household level, poor health services and poor hygiene and sanitation and flaws in the existing nutritional programme.

Khan and Raza (2014) conducted a survey of nutritional Status of Children in Bangladesh: Measuring Composite Index of Anthropometric Failure (CIAF) and its Determinants. It is estimated that malnutrition in rural children is much higher than in urban children. The results have shown that probability of CIAF is negatively associated with birth-interval of child (in urban areas only), mother's education, wealth index of the household, mother's BMI and number of children (5-15 years) in the household (in urban areas only). However, birth-order of the child (in urban areas only), child's age (in rural areas only), breastfeeding, incidence of diarrhea and household size (in urban areas only) positively affect the probability of malnutrition in children. For the policy formulation mother's education, duration of breastfeeding and nutritional status (BMI) of the mother is recommended to eliminate malnutrition. The rural areas need special focus in the policy making.

Bosak *et al*. (2018) surveyed food Security level and Hunger Status of a NGO Supported Farmers' Families in Dinajpur, Bangladesh. It was also undertaken to identify the association between hunger status with selected socio-demographic and economic factors of the farmers' families. Socio-demographic, economic, food security level and hunger status related data were collected from the 165 estimated sampled families with simple random sampling method by using structured questionnaire. Analyses determined that only 21.2% households were food secured, while 78.8% households were insecure. Among the insecure families about 19.4% households were insecure in food without hunger, 20.6% households were food insecure with moderate hunger and 38.8% families were insecure in food with severe hunger. Overall 59.4% farmers' families were hunger and rest of them was not hunger (40.6%). But food insecurity level as well as hunger families were more prevalent among the families of landless farmers compared to marginal and small groups. Only 3.6% families give rich foods to the female child. Binary logistic regression analysis found that total land of the family, total family members and monthly family income were the significant contributing factors for determining hunger and not-hunger families.

Majumder *et al*. (2011) surveyed status of children among the Santal children aged 6-59 months old and household level food security status of families from the selected rural Santal households in Dinajpur. The number of the sample households was 104. They found that the prevalence of stunting, underweight, and wasting of 6-59 months old Santal children in Dinajpur were 54%, 33%, and 16%, respectively. The female children are relatively possessing better health status as compared to male children. About 14% HHs are food secured and about 86% are food insecure in any form. The prevalence of hunger families are 52%, amongst 17% are severely and 35% are moderately hunger. The factor showing significant role of hunger families are age of HH head, occupation of housewife, earning family members, monthly family income and interestingly child breastfeeding status.

Islam *et al*. (2015) studied Chronic stunting among under-5 children in Bangladesh. The data clearly suggest a strong relationship between selected socio-economic variables and stunting among children under the age of five. In rural areas, stunting prevalence rate was found to be more than six times higher than in urban areas. Income inequality was also a significant predictor of stunting. Children from the lowest wealth quintile are twice as likely to be stunted as children from the highest wealth quintile (54% of children under five in the lowest quintile compared to 27% of their counterparts in the highest wealth quintile). Similarly, the level of mother's education is strongly related to stunting: the higher the level of mothers' education, the lower the prevalence rate of stunting among children under five. Since wealth or income is a strong predictor of place of residence (urban/rural) as well as mothers' level of education.

Hoque *et al*. (2016) conducted a survey on nutritional Status among under-5 Children of a selected slum in Dhaka city. Results indicated that mean age of the study population was 32.95 months. Male was 52% and female was 48%. Regarding Anthropometric assessment according to weight for height Z-score, 39% were wasted moderately and 13% were severely wasted and height for age Z-score, showed 47% of children were stunted moderately and 14% children were severely stunted. According to weight for age Zscore, 46% of children were moderately underweight and 16% children were severely underweight. According to MUAC classification 43% of children were in border line and 16% were malnutrition.

Mustafa *et al.* (2017) surveyed of nutritional Status of Children of Under-5, attending a District Hospital–A Secondary Level Care Hospital at Gazipur District Hospital. In total 820 sample were studied, who were taken randomly on working days. Study indicated that according to Gomes classification 34% were suffering from mild (1st degree) 16% moderate (2nd degree) and 2% severe (3rd degree) malnutrition. As per Welcome classification under weight, marasmus, marasmasic kwashiorkor and kwashiorkor were 19%, 3%, 0.5% and 0.5% respectively. Stunted 19% and wasted 12 % were evident as per Water low classification. Based on mid arm circumstances (Wolanski standard) 37% were malnourished and 17% were severely malnourished. 82% of children having Hb level < 11 mg/dl were malnourished and 18% have Hb level >11 mg/dl, the finding is statistically significant.

Shamme *et al.* (2017) conducted a survey on nutritional Status And Factors Affecting Malnutrition Among Under 5 Year Old Children Attending In Paediatric Outpatient Department In A Tertiary Hospital, Sylhet. A total of 100 children were selected purposively. Among the study children 55% were male and 45 % were female. The study found that 66% of the children were completely immunized, 33% were partially immunized and 01% was not immunized. Results also showed that 38% of the children were history of low birth weight. According to MUAC assessment 45% of the children were normal, 49% had mild to moderate wasting) and 6% had found severe wasting. According to weight for height (WHZ) almost same results found 44% were normal, followed by 30% mild wasting, 20% moderate wasting and 6% severe wasting. In terms of height for age (HAZ) 29% were normal, followed by 10% mild stunted, 40% moderate stunted and 21% were severe stunted. According to weight for age(WAZ) 42% were found normal, followed by 8% mild under weight, 38% moderate under weight and 12% severe under weight. There was significance association found between sex of the children and nutritional status (HAZ). There was also significant association found between sex of the children and wasting . Among the mothers of the children 53% was found normal, 28% was under weight (BMI <18.5), 17% pre-obese (BMI, 25-29.99) and 2% was obese (BMI >=30). The significant association ($p<.05$) found between nutritional status (HAZ) of the children and age of the mothers. The significant association also found between nutritional status (HAZ) of the children and monthly family income, exclusive breast feeding to child, history of low birth weight of the child. There was significant association found between sex of the children and wasting. More

than one third (38%) of the studied children were low birth weight, 50% wasted, 61% stunted and 50% under weight.

Islam (2014) studied destitute children and initiatives for their welfare in Bangladesh. A large number of children are destitute in Bangladesh. They suffers severely from malnutrition, under weight and drink unsafe water. They are never enrolled in school. About 0.68 million children lives in the street in Bangladesh and they involved in child labour such as domestic works, agriculture, vehicle helper, garments workers, shoe polisher, construction helper, carpenters, hawkers etc. So there are responsibilities for the concern authorities of Bangladesh to rescue these destitute children from their miseries and also to ensure their rights.

Rahman *et al.* (2016) studied association of Low-Birth Weight with Malnutrition in Children under Five Years in Bangladesh. The prevalence of malnutrition was markedly higher in children with LBW than those with normal birth-weights (stunting: 51% vs 39%; wasting: 25% vs 14% and underweight: 52% vs 33%). While controlling for the known risk factors, children with LBW had significantly increased risk of becoming malnourished compared to their counterpart with RR 1.23 (95% CI:1.16–1.30), 1.71 (95% CI:1.53–1.92) and 1.47 (95% CI: 1.38–1.56) for stunting, wasting and underweight, respectively.

Rahman *et al.* (2017) conducted a survey on Contributing Factors to Under-Five Child Malnutrition in Rural Bangladesh. It is found that family income, maintain proper diet during pregnancy period, proper diet maintain for children have negative significant effect on child malnutrition. The magnitude of the child's malnutrition still is of great concern in Bangladesh. Since, poverty, imbalanced diet during pregnancy period and imbalanced diet for under 5 children influences to malnutrition are significantly associated with high prevalence of malnutrition, so government and people should reduce these factor to reduce malnutrition in rural area of Bangladesh.

Mohsena *et al.* (2015) conducted a survey on Regional variation in maternal and childhood under nutrition in Bangladesh. Maternal BMI and prevalence of underweight, stunting and wasting in children aged under 5 years were found to vary significantly according to administrative division. Of the six divisions, Sylhet was found to have highest prevalence of undernourished mothers and children. The trends from 1996 to 2007 also established Sylhet as the poorest-performing region overall.

Talukder (2017) studied factors associated with malnutrition among under-five Children and found father's and mother's education, wealth index, mother's body mass index (BMI), and antenatal care service during pregnancy were found highly significant ($p < 0.01$) factors for child malnutrition. Among the divisions, only Dhaka had more control on child malnutrition, compared to the Sylhet division. Birth interval of children was also reported as a significant factor at a 5% level of significance. Finally, the results of this paper strongly highlighted the necessity of increasing parent's education level, improving the mother's nutritional status, and increasing facilities providing antenatal care service in order to achieve better nutrition status among under-five children in Bangladesh.

Talukder (2013) conducted a survey on Regional Differences of Child Under-Nutrition in Bangladesh. Results showed that Across the divisions, a variation of under-nutrition is observed among the children. The prevalence of under-nutrition is statistically significant in poor households. Economics status, mothers' education, children's age, number of family members and duration of breastfeeding are important determinants of under-nutrition across divisions. Child under-nutrition in Bangladesh is still a concern for the household with poor economic status. The article calls for improvement of the economic status of the households across divisions keeping in view the nature of inequality in childhood under nutrition in the country and its differential characteristics across the divisions.

Chhetri (2005) conducted a survey on factors associated with Malnutrition among Children in Rural Terai of Eastern Nepal. Results showed that 53.3 percent of the children were underweight; about 30% had wasting about 36.6% had stunting. There was no significant difference in the prevalence among male and female children. Malnutrition was more among the older age groups, significant relation with maternal education,

mother's age at marriage, socioeconomic status, paternal education, feeding practices and the presence of toilet facility.

Hasan (2017) surveyed on prevalence and risk factors associated with under-5 mortality: A multi-country comparative study in South Asia. Results indicated that overall prevalence of under-5 mortality in South Asian countries according to pooled data was 10%. Country-specific results showed that Nepal having the highest prevalence (11.1%) of under-5 mortality followed by India (10.3%) and Pakistan (10.2%) in South Asia. In a multivariable model in pooled data, older age of the women (HR 0.70, 95% CI 0.68-0.72), being employed (HR 1.09, 95% CI 1.07-1.12), having husband with higher education (HR 0.74, 95% CI 0.70-0.78) and having higher education (HR 0.36, 95% 0.32-0.40) were significantly associated with under-5 mortality. Among other maternal and child factors, being female child (HR 0.95, 95% CI 0.93-0.97), wanted no children (HR 0.92, 95% CI 0.87-0.97), no contraceptive use (HR 0.95, 95% CI 1.30-1.37), currently pregnant (HR 1.17, 95% CI 1.17-1.23), no smoking (HR 0.85, 95% CI 0.83-0.87), male sex of children was associated with under-5 mortality. Most of the studied risk factors were common across the countries, but some difference in the factors associated with under-5 were country specific.

Masibo (2013) accompanied Trends and Determinants of Malnutrition among Children Age 0-59 Months in Kenya (KDHS 1993, 1998, 2003, and 2008-09). He showed that he levels of stunting and underweight declined significantly ($P<0.05$) over the study period, by 4.6 percentage points. Nonetheless, stunting remains of high public health significance in Kenya, while underweight is of medium public health significance, as per the World Health Organization (WHO) classification (WHO 1995). Household wealth index, maternal education, maternal Body Mass Index (BMI), and size of the child at birth were significant determinants of child under nutrition.

Debnath *et al.* (2017) accompanied a survey on malnutrition and morbidity profile of under Five in a rural area of Bangladesh. They found that about one-third (33.5%) of the children were stunted in Height for Age Z score. While 23.3% were moderately wasted and 6.5% were severely wasted in Weight for Height Z score. Severely underweight was 8.6%, 20.6% were moderately underweight and 70.8% of the children's weight was within the normal limit for their age. In MUAC measurement, about one-fourth (21.8%) were moderate acute malnutrition (MAM) and 1.1% were severe acute malnutrition

(SAM). Most prevalent disease (45.0%) was the diarrhoeal disease with respiratory tract infection was 32.0% and pneumonia was 18.0%.

Raza (2014) conducted nutritional Status of Children in Bangladesh: Measuring Composite Index of Anthropometric Failure (CIAF) and its Determinants. It is estimated that malnutrition in rural children is much higher than in urban children. The results have shown that probability of CIAF is negatively associated with birth-interval of child (in urban areas only), mother's education, wealth index of the household, mother's BMI and number of children (5-15 years) in the household (in urban areas only). However, birth-order of the child (in urban areas only), child's age (in rural areas only), breastfeeding, incidence of diarrhea and household size (in urban areas only) positively affect the probability of malnutrition in children. For the policy formulation mother's education, duration of breastfeeding and nutritional status (BMI) of the mother is recommended to eliminate malnutrition. The rural areas need special focus in the policy making.

2.2 Food consumption and child nutritional status of selected rural families of Bangladesh and other countries

Kuntal (2009) surveyed household food security is associated with growth of infants and young children in rural Bangladesh. They followed 1343 children from birth to 24 months of age who were born in the Maternal and Infant Nutrition Intervention in Matlab (MINIMat) study in rural Bangladesh. Household food security was associated ($P < 0.05$) with greater subsequent weight and length gain in this cohort. Attained weight, length and anthropometric indices from birth to 24 months were higher among those who were in food-secure households. Proportions of underweight and stunting were significantly lower in food-secure households.

Nath (2015) studied Food Security of Bangladesh. It has analysed the status of food availability, access to food, food utilization and food stability with emphasis on balanced nutrition and food safety to address the problems of nutritional food security in Bangladesh. Emphasis has been given on production, international trade, food stocks, price stability, safety nets and public food distribution system to address food availability. Special emphasis has been given on strengthening ability to afford food and intake of food of balanced nutrition. We have tried to highlight pattern of food intake, with eye to both quantity and quality and balanced nutrition for healthy life. Attempt has been made to verify the food adequacy and dietary diversity as compared to the

requirements for health. Food security situation under two umbrellas: macronutrients and micronutrients. Special care has been given to micronutrient deficiency among the people of Bangladesh. Food and nutrition security has been analysed by socio economic strata of the population. There has been effort to identify areas of food deficiency for proactive interventions. Attempt has been made to work out strategic options for food security in the interface of production, consumption requirements and global trade situation. The paper has analysed the alternatives of Self sufficiency and Self reliance strategies for formulating appropriate food security policy options in the long run for Bangladesh. Consideration has been given to highlight uncertainty of international trade, country's land scarcity, need for increase of production of nutritious food (like pulses, fish, dairy products and livestock), climate change and environmental hazards in the country and uncertainty in employment of the able bodied vast masses of people. Focus has been given on redefining food security in terms of stable and adequate supply of balanced nutritious food for all. Stress has been on nutrition education among the general public especially among women.

Adhiguru and Ramasamy (2003) surveyed on agricultural-based Interventions for Sustainable Nutritional Security. The study has indicated that, among the food groups, the deficit (shortage of RDA in %) is more pronounced in the case of fruits and green leafy vegetables for both males and females, and was least in pulses and cereals. Among the these production systems, the extent of deficit was comparatively lower in the vegetable production system. Gender wise, the adult females have higher deficit than adult males. The maternal beliefs about some food items being bad to children, have adversely affected the nutrients intake. There was also significant deficiency in respect of consumption of fruits, milk, fats and oils in children of all age groups, particularly, in the food-grain based and cash-crop based production systems. The deficit in the consumption of vitamin A, iron and vitamin C has been found to be significantly low in the vegetable system as compared to in food and cash crop-based production systems for both men and women. The influence of production systems on nutrient intake among children has revealed in the same pattern as that of adults.

Borgen (2010) surveyed on child under nutrition in the Far-West Terai of Nepal. Results found that in total 35 %, 35% and 16% of the children below five years were stunted, underweight and wasted, respectively. Of the children below 6 months, 77% were exclusively breastfed and the majority was breastfed for up to two years. The dietary

diversity and meal frequency was inadequate. Only 8% of the children aged 6-11 months received food from at least 4 groups and 60% of the children aged 9-23 months were given at least 3 meals a day. Thirty eight percent had been sick, and fever (77%), cough (31%) and diarrhoea (11%) were the most prevalent diseases. The nutritional care during the illness was poor, 88% were fed less and 76% were given less liquid. One third of the households were using coping mechanisms which might indicate that they were food insecure. Multivariate regression analysis showed that households headed by the mother, households where the mother worked more than 8 hours a day and household belonging to a low caste and households with crop farming as the main source of income, had higher levels of stunting than other households, These variables explained 24 % of the variation in stunting.

Yusuf *et al.* (2005) presented the dietary energy supply and nutrition status of South Asian countries drawing data from various sources, mainly FAQ Food Balance Sheets.. Result showed that within the region, Bangladesh, the second poorest country after Nepal, has always the lowest per capita calorie supply, with highest dietary energy supply from cereals (DES Car %, an indicator of poverty). To the tune of 80%, followed by Nepal, 72%. Among the countries Maldives has the highest per capita Gross National Income (GNI) (US$2680), the highest per capita calorie supply (2600 Kcal) and the lowest DES Cer (38 %). Maldives and Pakistan are the highest animal products consuming countries, but most pf it also rich in fruits and vegetables (7.3% of total calories), compared to only 2.6% in Pakistan and, <2% IN Bangladesh. The data present poor diversion in the diets of Bangladesh, Nepal and Pakistan. The diets of other countries, particularly Maldives, are relatively more diversified. Prevalence of under nutrition in total population is the highest in Bangladesh (30%) and lowest in Maldives (10%). Bangladesh, India, Nepal and Pakistan experience high under-5 stunting and underweight rates in the range of 43% to 51% and 47% to 48% respectively. National income largely, but not wholly, determines food consumption and nutritional status of a country

CHAPTER III

MATERIALS AND METHODS

CHAPTER III

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3.1 Study design

Community based cross sectional study.

3.2 Location of the study

The study was conducted at different locations in Dinajpur district of Bangladesh. The study area mainly covered with Dinajpur sadar, Kaharole and Birganj upazila of Dinajpur district.

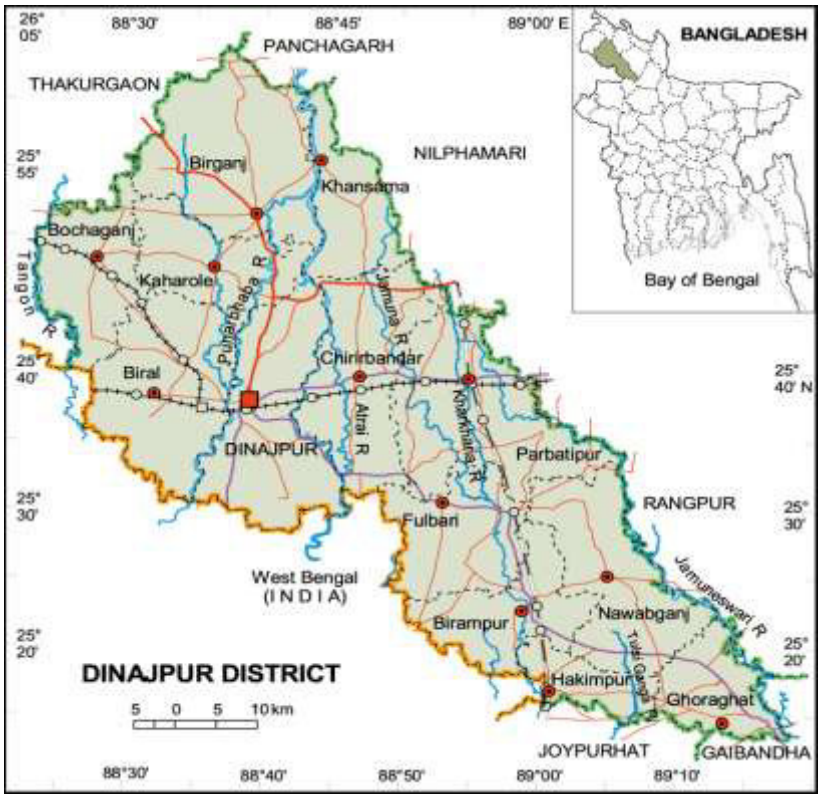

Figure 3.1: Map of survey areas

3.3 Sampling design and sample size

The sample size was determined by using the formula:

$$n = \frac{z^2 pq}{d^2}$$

Where,

n = required sample size

z = 90% of confidence limits (1.645)

P=0.36 (The prevalence rate of stunting status of under five children in Bangladesh (BDHS, 2014).

d = Precision or error allowed in the study = 6.5% = 0.065

$$n= \frac{Z^2 \times p\,(1-p)}{m^2} = \frac{(1.645)^2 \times 0.36 \times 0.64}{(0.065)^2} = 147$$

To find the adjusted sample size, allowing non response rate of 20%, the adjusted sample size will be 147+20%=176.

But in this study the children of under five families were found for data collection as sample 165.

3.4 Data collection instruments

A pre-coded and pre-tested questionnaire was administrated to the respondents by asking questions. Both qualitative and quantitative data were collected by interviewing. The questionnaire was designed to collect a bulk of socio-economic, demographic characteristics, health, intake of food related questions

Figure 3.2: Anthropometric data collection of under 5 children

3.5 Variables used for this study

Dependent and independent variable were selected first, before performing any statistical analysis.

Independent variables:

1. Age of children
2. Gender of children
3. Child breast feeding status
4. Educational level of mother
5. Educational level of father
6. Religion of family
7. Father occupation
8. Mother occupation
9. Monthly income of family
10. Total number of children in the family
11. Number of children under 5 years of age

Dependent Variables:

1. Height-for-age Z-scores
2. Weight-for-age Z-scores
3. Weight-for-height Z-scores

3.6 Assessment of nutritional status

There are several way to asses nutritional status of children**.**

1) Stunting
2) Wasting
3) Underweight

1) Stunting: Stunting referred to low height-for-age. A child who is stunted or chronically malnourished often appears to be normally proportioned but is actually shorter than normal for his/her age. Due to poor diets or recurrent infections Children who suffer from growth retardation tend to be at greater risk for illness and death. The effects of stunting are largely irreversible and generally occurs before age two. Stunting deferred motor development, impaired cognitive function and poor school performance (NILS).

2) Wasting: Wasting, or low weight for height, is a sturdy predictor of mortality among children under five. Wasting indicates current or acute malnutrition resulting from failure to gain weight or actual weight loss (Cogill, 2003). It is the result of insufficient food intake or a high incidence of infectious diseases, especially diarrhoea. It impairs the execution of the immune system and can lead to enlarged harshness and duration of and vulnerability to infectious diseases and an increased risk for death (WHO, 2010).

3) Underweight: Underweight means below a weight considered normal or desirable. A person may be underweight due to metabolism, drug use, lack of food (frequently due to poverty), eating disorder, or illness (both physical and mentaI), genetics.

3.7 Anthropometric measurement:

To measure the physical growth of child accurate measurement of height and weight is essential. Collected data are plotted on graph and then compared with international standards for monitoring the growth. Anthropometric measures are as follows:

Height

Height is important growth factor to asses nutritional status and malnutrition of child. The height of an individual is influenced both by genetic and environmental factors Malnutrition retarded the child growth contributing short stature compared to standard height that can monitor by measuring the height of child, for infants and children under 2 years of age, recumbent length should be measured with infantometer for accurate measure. For older children, heights are measured by stadiometer with movable head piece. The head piece is leveled with skull vault and height is recorded to the nearest 0.5 cm. The measurement should be done carefully. (Nutrition Science, B. Srilaksmi 335 page).

Weight

Another important factor is weight to asses malnutrition of child. Body weight is the most widely used method and simple method. Rapid loss of body weight should be considered as an indicator of potential malnutrition in children (Srilakshmi, 2016). A suspended scale a weighing sling may be used for weighing infants and children less than two years of age. They should be weighed naked or with the minimum clothing. After slipping the subject into the sling, the weight is recorded as soon as the indicator on the scale has stabilized (Jelliffe, 1996; Cameron, 1986). Sometimes the mother and subject can be weighed together and then mother alone, using a beam balance. The subject's weight can then be calculated by subtraction. For older children, use a regularly calibrated electronic or balanced-beam scale with light cloths, no shoes (Gibson, 2005).

Age:

Age is most important parameter to asses nutritional status. Depending on age anthropometric indices can be classified Height-for-age and Weight-for-age. Differents types of malnutrition are varied with different age.

Sex:

Malnutrition largely depends on sex because the body structure of boys and girls are different. During collection of data, It must be assured the sex male or female.

BMI:

Body Mass Index (BMI) is a measurement of a person's weight with respect to his or her height. (Mandal, 2017) The BMI is defined as the body mass divided by the square of height of the body, and is universally expressed in units of kg/m^2, resulting from mass in kilograms and height in metres. BMI is used categorize a person as underweight, normal weight, overweight, or obese based on that value. It has been shown that BMI correlates well with body fat (Norgan and Ferro-Luzzi, 1982).

3.8 Anthropometric indices

Anthropometric indices are an essential part of the interpretation of anthropometric measurements (WHO, 1986). Indices are formed from two or more raw anthropometric measurements. Various types of anthropometric indices are

Weight for age Z - scores (WAZ)

According to UNICEF**,** Moderate and severe - below minus two standard deviations from median weight for age of reference population; severe - below minus three standard deviations from median weight for age of reference population. W/A is commonly used for monitoring growth and to assess changes in the magnitude of malnutrition over time. Weight for age composite measure of height-for-age and weight-for-height, making interpretation difficult. Weight for age reflects body mass relative to age.

The reference standards (NCHS Cut-off point) of height and weight data are given below:

Severe (WAZ =< -3.00 SD)

Moderate (-2.99 =<WAZ =< -2.00)

Not underweighed (WAZ > -2.00 SD)

Weight-for-height Z – scores (WHZ):

According to WHO, is defined as a weight-for-age between -3 and -2 z-scores below the median of the WHO child growth standards. It can be due to a low weight-for-height (wasting) or a low height-for-age (stunting) or to a combination of both. Weight for height is a sensitive index of current nutritional status. The reference standards (NCHS Cut-off point) of height and weight data are given below:

Severe (WHZ =< -3.00 SD)

Moderate (-2.99 =<WHZ =< -2.00)

Not wasted (WHZ > -2.00 SD)

Height-for-age Z –scores (HAZ):

Children are defined as stunted if their height-for-age is more than two standard deviations below the WHO Child Growth Standards median (WHO, 2018). Low H/A relative to a child of the same sex and age in the reference population are referred to as “shortness”. It can not measure short term changes in malnutrition. Stunting is a slowing of skeletal growth and of stature, defined by Waterlow (1978) as “the end result of a reduced rate of linear growth”. It results from long time inadequate food intake and

increased morbidity and is generally found in developing countries where economic conditions are poor.

The reference standards (NCHS Cut-off point) of height and weight data are given below

Severe (HAZ =< -3.00 SD)

Moderate (-2.99 =<HAZ =< -2.00 SD)

Not stuned (HAZ> -2.00 SD)

Formula for calculating Z-scores:

$$\text{Weight for age z} = \frac{\text{Observed weight at age X} - \text{Standard weight at age X}}{\text{Standard deviation of weight at age X}}$$

$$\text{Height for age} = \frac{\text{Observed height at height X} - \text{Standard height at age X}}{\text{Standard deviation of height at age X}}$$

$$\text{Weight for height} = \frac{\text{Observed weight at height X- Standard height at height X}}{\text{Standard deviation of weight at height X}}$$

3.9 Software used and statistical analysis for the study:

For socio-economic, demographic, health and food preferences data analysis, general statistical software *SPSS 22.0* was used. For identifying risk factors associated with child health and nutrition *ANTHRO* software was used to calculate Z-scores. For chi-square test we used custom table. The overall software used for data entry, data analysis, graphical representation and writing report were SPSS 22.0, ANTHRO, MS WORD, MS-EXCEL etc.

3.9.1 Tabular and descriptive analysis

Tabular analysis:

1. For finding the frequency distribution of several variables simple table was formed
2. Demonstrating the relationship or association between two categorical variables bivariate tables was formed.

Descriptive statistics:

Some descriptive measures such as means, variances, proportions, standard error of mean were calculated.

Chi-square (X^2)-test was used:

To test the significance of the association between two categorical variables.

3.9.2 Logistic (binary) regression

Binary logistic regression estimates the probability that a characteristics is present (e.g. estimate probability of 'success") given the values of explanatory variables, in this case a single categorical variables; π =Pr (Y=1/X=x).

Single level binary logistic regression

Let Y be a dichotomous dependent variable, say nutritional status taking values 0 and 1 and suppose that Y=I if a child is malnourished and Y=0 otherwise. Also let X be an independent variable. Then the form of the logistic regression model is

$$P = p(Y = 1/X) = \frac{e^{\beta_0+\beta_1 X}}{1+e^{\beta_0+\beta_1 X}}$$

$$\text{and, } 1-P = p(Y = 0/X) = \frac{1}{1+e^{\beta_0+\beta_1 X}}$$

Then a transformation of *P* known as the logic transformation and is defined as

$$g(x) = \text{logit } P = \log\left[\frac{P}{1-P}\right] = \beta_0 + \beta_1 X$$

The importance of this transformation is that g(x) has many of the desirable properties of a linear regression model. The logic, g(x) is linear in its parameters, may be continuous, and may range from -∞ to + ∞ depending on the range of x. For more than one independent variable the model can be generalized as

$$g(x) = \text{logit}(P_{ij}) = \beta_{0j} + \sum_{l=1}^{K} \beta_l X_{ijl}$$

Model Fit

To determine the factors associated with the response variables (e.g. stunning, wasting and underweight) the cox's logistic regression model (single level) was fitted and the odds ratio of occurring an event was calculated for different independent variables using SPSS 22.0. All the independent variables found significant at the bi-variate analysis were considered but only the significant variables in regression analysis were retained in the final regression model. Possibility of multicolinearity and confounding was also explored.

CHAPTER IV

RESULTS AND DISCUSSIONS

CHAPTER IV

RESULTS AND DISCUSSION

This chapter contains the results obtained by using different statistical tools and their discussions. This chapter also showed the nutritional status of children according to socioeconomic and demographic characteristics and food intake pattern of children per week of selected rural families.

4.1 Socioeconomic, demographic characteristics and dietary intake of children under 5 of selected rural families

Table 4.1.1: Percentage distribution of socio-demographic, economic and household characteristics of selected rural families having children (aged 6-59 months old) in Dinajpur district, 2017-2018.

Variables	Categories	No	%
Age of children (months)	6-12	28	17.0
	13-24	36	21.8
	25 and above	101	61.2
Gender	Male	82	49.7
	Female	83	50.3
Religion	Muslim	137	83.0
	Hindu and others	28	17.0
Type of family	Nuclear	122	73.9
	Joint	43	26.1
Father occupation	Farmer	57	34.5
	Day labour	64	38.8
	Service holder and Other	44	26.7
Mother occupation	Housewife	134	81.2
	Day labour	17	10.3
	Service holder and Other	14	8.5
Monthly income of family (Tk)	=<10000	85	51.5
	>10000	80	48.5

Table 4.1.1: Percentage distribution of socio-demographic, economic and household characteristics of selected rural families having children (aged 6-59 months old) in Dinajpur district, 2017-2018.

Variables	Categories	No	%
Mother education	No formal education	38	23.0
	Primary	92	55.8
	Secondary and above	35	21.2
Father education	No formal education	52	31.5
	Primary	74	44.8
	Secondary and above	39	23.6
Total number of children of family	1	68	41.2
	2-3 and above	97	58.8
Number of children under 5 year	1	130	78.8
	2	35	21.2
Criteria of child's daily activity	Very active	153	92.7
	Active several hours	12	7.3

Table 4.1.1 shows that the distribution of socio-demographic, economic and household characteristics in categorical scale of the selected households that have under five children. The table showed that 17.0 % households had 6-12 months of child, 21.8% 13-24 months of child, 61.2% households had 25 and above months of child. For gender 49.7% households had male children and 50.3% households had female children. In case of religion 83% were Muslims and 17% were Hindu and others. In this study, regarding the type of family, 73.9% households had nuclear family and 26.1% family were joint. In educational level of mother, 23% mothers had no formal education, 55.8% were up to primary and 21.2% passed Secondary and above. For educational level of father, 31.5% fathers had no formal education, 55.8% fathers passed primary and 23.6% fathers passed Secondary and above. In case of mother occupation, 81.2% mothers were housewives, 10.3% mothers were involved in day labor, 10.3% were involved in Service holder and other. In father occupation, 34.5% fathers were farmer, 38.8% were day labor, 8.5% involved in Service holder and other. Results clearly indicated that 51.5% households had monthly income less than or equal 10 thousands, 48.5% households had monthly income above 10 thousands. The number of children were 1 of 65% households and 58.8% households were 2-3 above number of children. This study also indicated that 92.7% children were very active and 7.3% children were active several hours.

Table 4.1.2: Percentage distribution of food intake frequencies of children per week of selected rural families having children (aged 6-59 months old) in Dinajpur district, 2017-2018.

Variables	Categories	No	%
Current breastfeeding of child	Yes	95	57.6
	No	70	42.4
Meat consumption	Sometimes/never	102	61.8
	2-4 times/week	56	33.9
	5-7 times/week	7	4.2
Fish consumption	Sometimes/never	49	29.7
	2-4 times/week	78	47.3
	5-7 times/week	38	23.0
Egg consumption	Sometimes/never	59	35.8
	2-4 times/week	54	32.7
	5-7 times/week	52	31.5
Cow milk consumption	Sometimes/never	116	70.3
	2-4 times/week	11	6.7
	5-7 times/week	38	23.0
Citrus fruit consumption	Sometimes/never	79	47.9
	2-4 times/week	66	40.0
	5-7 times/week	20	12.1
Color fruit consumption	Sometimes/never	82	49.7
	2-4 times/week	56	33.9
	5-7 times/week	27	16.4
Leafy vegetables consumption	Sometimes/never	37	22.4
	2-4 times/week	93	56.4
	5-7 times/week	35	21.2
Color vegetables consumption	Sometimes/never	58	35.2
	2-4 times/week	70	42.4
	5-7 times/week	37	22.4
Other vegetables consumption	Sometimes/never	24	14.5
	2-4 times/week	112	67.9
	5-7 times/week	29	17.6
Rice, bread consumption	Yes	156	94.5
	No	9	5.5
Pulse consumption	Sometimes/never	78	47.3
	2-4 times/week	56	33.9
	5-7 times/week	31	18.8
Cake, biscuits consumption	Sometimes/never	39	23.6
	2-4 times/week	78	47.3
	5-7 times/week	48	29.1

Table 4.1.2 determined the distribution of food intake frequencies of children (6-59 months) in a week of selected households in categorical scale. This table indicated that 57.6% children were breastfeed and 42.4% children were not breastfeed. 61.8% children consumed meat sometimes or never, 33.9% consumed meat 2-4 days, 4.2% consumed 5-7 times per week. In case of fish, 29.7% consumed sometimes or never, 47.3% consumed 2-4 times per week, 23% were consumed 5-7 times per week. 35.8% children sometimes or never, 32.7% children 2-4 times per week, 31.5% children 5-7 times per week consumed egg. Cow milk consumed 2-4 times per week by 6.7 % children, 5-7 times per week by 23% children and 70.3% children consumed sometimes or never. In case of citrus fruits, 47.9% children sometimes or never, 40% children 2-4 times per week, 12.1% children 5-7 times per week were consumed . 49.7% children sometimes or never, 33.9% children 2-4 times per week, 16.4% children 5-7 times per week consumed color fruits. Results implied that 56.4% children 2-4 times per week, 21.2% children 5-7 times per week and 22.4% children sometimes or never consumed leafy vegetables .Besides, color vegetables were consumed by 35.2% children sometimes or never, 2-4 times per week by 56.4% children, 5-7 times per week by 21.2% children.14.5% children sometimes or never, 67.9% children 2-4 times per week, 17.6% children 5-7 times per week consumed other vegetables. Most of the children like 95.5% were consumed rice bread and 5.5% children were not consumed. In case of pulses, 47.3% children sometimes or never, 33.9% children 2-4 times per week, 18.8% children 5-7 times per week consumed pulses. 23.1% children sometimes or never 47.3% children 2-4 times per week, 29.1% children 5-7 times per week consumed cake, biscuits etc.

4.2 Nutritional status of children under –five of selected rural families and identification of causal factors

Table 4.2.1 showed that the average height of boy and girl were 82.99 cm and 84.16 cm. The average weight of boy and girl were 10.97 kg and 10.78 kg weight was significant. It indicated the average height of female children were higher than male children. But the average weight of male and female children was almost the same. The average weight for age for boy and girl were -1.53 SD and -1.66 SD. It showed that the value were greater than -2 SD which indicated normal underweight. The average height for age for boy and girl was -1.64 SD and -1.71 SD which were greater than -2 SD and also showed normal stunting status. The average weight for height of boy and girl was height -.67 SD and -.75 SD that were also greater than – 2 SD which showed normal wasting. Results of

average z-scores also indicated that the prevalence of stunting, wasting and underweight children for female was higher than male children.

Table 4.2.1: Mean and Standard deviation of anthropometric indicators of 6-59 months old children of selected rural families by gender, 2017-18.

	gender	N	Mean ± SD	P value (t-test)
Height(cm)	Boy	82	82.99 ± 13.25	0.114
	Girl	83	84.16 ± 11.74	
Weight(kg)	Boy	82	10.97 ± 3.10	0.006
	Girl	83	10.78 ± 2.41	
Weight for age	Boy	82	-1.53 ± 1.10	0.646
	Girl	83	-1.67 ± 1.12	
Height for age	Boy	82	-1.65 ± 1.29	0.470
	Girl	83	-1.72 ± 1.45	
Weight for height	Boy	82	-0.6723 ± 1.20	0.921
	Girl	83	-0.7504 ± 1.19	

Table 4.2.2: Mean and Standard error of mean of anthropometric indicators according to age category of 6-59 months old children of selected rural families by gender, 2017-18.

	Age in months					
	6-12		13-24		25 and above	
	Gender		Gender		Gender	
	Boy	Girl	Boy	Girl	Boy	Girl
	Mean±SE	Mean±SE	Mean±SE	Mean±SE	Mean±SE	Mean±SE
Height(cm)	67.25±1.13	63.71±1.02	76.87±1.55	74.19±1.12	92.17±1.31	90.56±1.08
Weight(kg)	7.47±0.30	7.81±0.42	9.52±0.51	8.78±0.26	13.04±0.31	11.93±0.27
Weight for age	-1.25±0.29	-0.39±0.52	-1.89±0.36	-1.71±0.23	-1.55±0.12	-1.82±0.14
Height for age	-1.35±0.29	-2.04±0.63	-1.93±0.35	-1.98±0.37	-1.69±0.19	-1.58±0.18
Weight for height	-0.51±0.37	1.68±0.39	-.83±0.41	-0.68±0.18	-0.69±0.11	-1.09±0.13

Table 4.2.2 demonstrated the mean and standard error of mean of the anthropometric indices according to age category of selected surveyed children of 6-59 months old. For children aged 6-12 months old, the mean of height of boy and girl were 67.25 cm and 63.71 cm. For children aged 13-24 months old, the mean of height of boy and girl were 76.87 cm and 74.19 cm. For children aged 25 and above months old, the mean of height of boy and girl were 92.17 cm and 90.56 cm. It clearly indicated that for each group of age the average height of male is higher than female. The average weight of male and female children were 7.47 kg and 7.81 kg for aged 6-12 months old, 9.52 kg and 8.78 for aged 13-24 months old, 13.04 kg and 11.93 kg for aged 25 and above months old children. Results indicated that weight of boy and girl was almost same at the age of 6-12 months old, but weight of male was higher than female for remaining two group. The mean z-scores value of weight for age for boy (-1.25 SD) and girl (-.39 SD) for aged 6-12 months old, boy (-1.89 SD) and girl (-1.71 SD) for 13-24 months old, boy (-1.55 SD) and girl (-1.82 SD) which were greater than -2SD that indicates normal underweight of children for each group. The mean z-scores value of height for age for boy (-1.35 SD) and girl (-2.04 SD) for aged 6-12 months old, boy (-1.93 SD) and girl (-1.98 SD) for 13-24 months old, boy (-1.69 SD) and girl (-1.58 SD) which were greater than -2SD that indicates normal underweight of children for each group. At age 6-12 months female were moderately stunted where male were normal. Remaining two group of age were normal. The mean z-scores value of weight for height for boy (-.51 SD) and girl (1.68 SD) for aged 6-12 months old, boy (-.83 SD) and girl (-.68 SD) for 13-24 months old, boy (-.69 SD) and girl (-1.09 SD) which were greater than -2SD that indicates normal wasting status of children for each group.

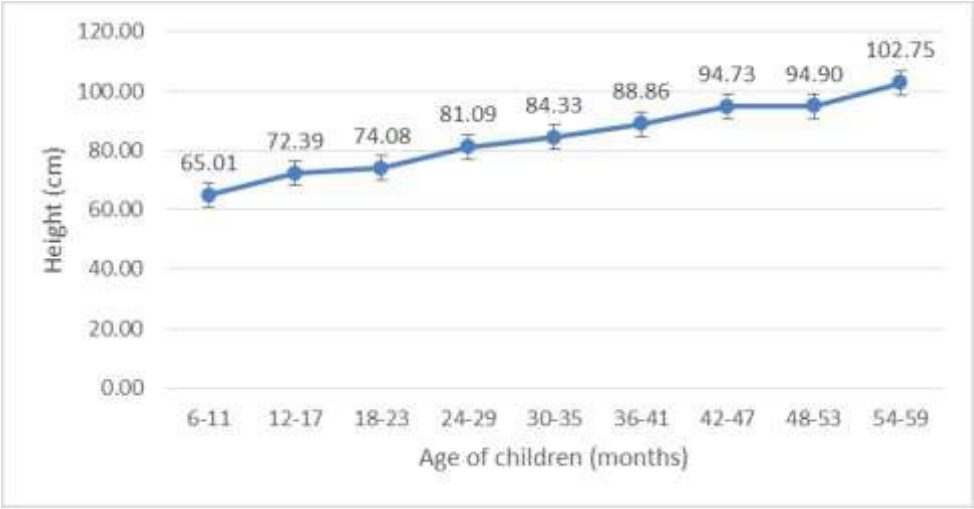

Figure 4.2.1: Trend of height (cm) of children aged 6-59 months old of rural families according to different age groups in selected areas of Dinajpur district, 2017-18

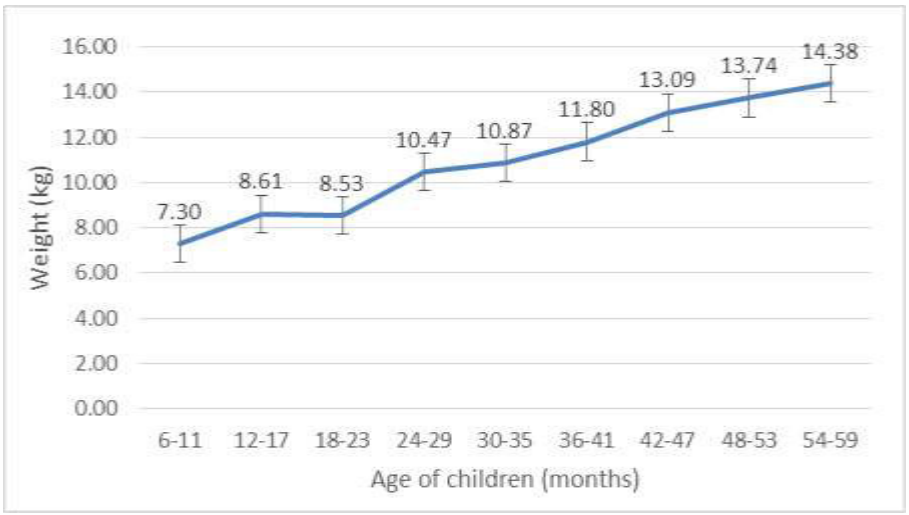

Figure 4.2.2: Trend of weight (kg) of children aged 6-59 months old of rural families according to different age groups in selected areas of Dinajpur district, 2017-18.

Figure 4.2.1 and 4.2.2 indicated the trend of percentage of height and weight of children aged 6-59 months of Rural families in selected areas of Dinajpur. It showed that as age increases the height (cm) and weight (Kg) of the children also increases parallely.

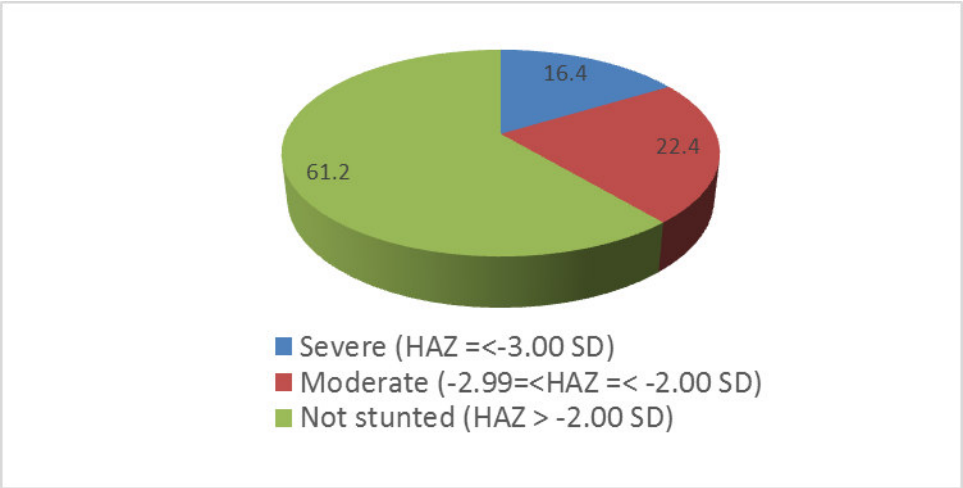

Figure 4.2.3: Stunting status of 6-59 months old children of rural families in selected areas of Dinajpur district, 2017-18.

Figure 4.2.3 showed stunting status (Height-for-age) of 6-59 months old children of selected rural families. Among the children, 61.2% were not stunted, 22.4% were moderately stunted and 16.4% were severely stunted.

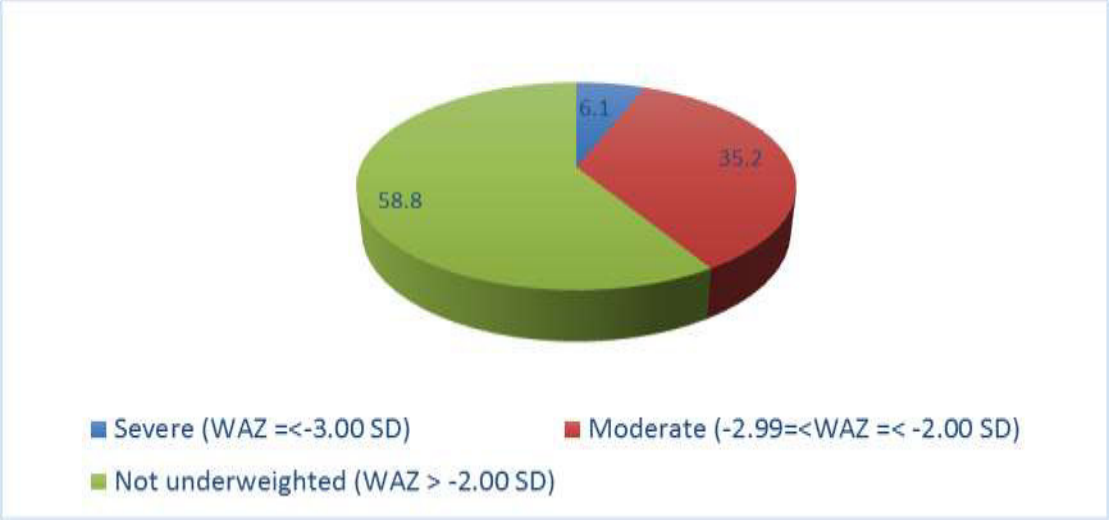

Figure 4.2.4: Underweight status of 6-59 months old children of rural families in selected areas of Dinajpur district, 2017-18.

Figure 4.2.4 demonstrated underweight status (low weight-for-age) of 6-59 months old children of selected rural families. It clearly showed that 58.8% were not underweighed, 35.2% were moderately underweight and 6.1% were severely underweight.

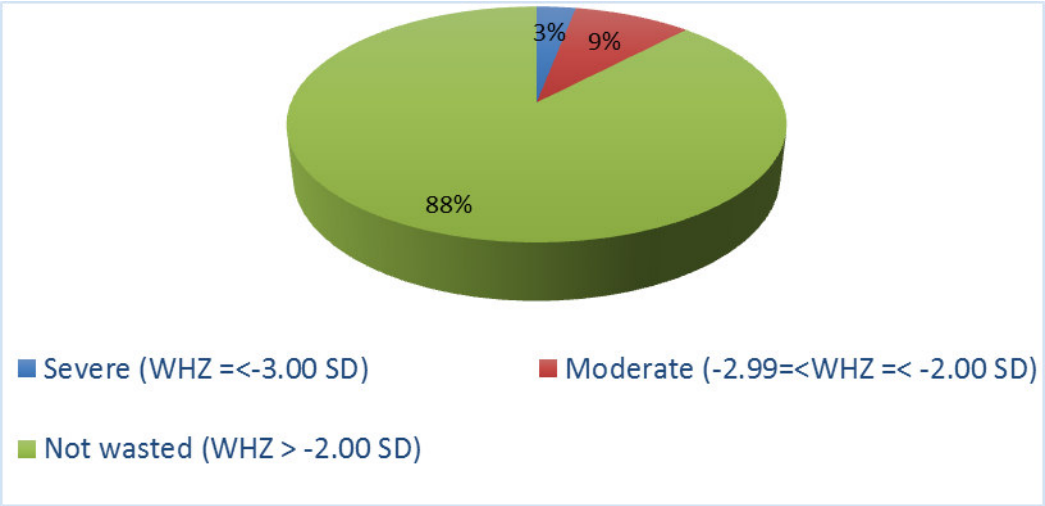

Figure 4.2.5: Wasting status (low weight-for-height) of 6-59 months old children of rural families in selected areas of Dinajpur district, 2017-18.

Figure 4.2.5 presented wasting status of 6-59 months old children of selected rural families. It clearly showed that, 87.9% children were not wasted. 9.1% were moderately wasted, and 3% were severely wasted.

Table 4.2.3: Stunting status of children according to socio-demographic, economic and household characteristics of selected rural families having children (aged 6-59 months old) in Dinajpur district, 2017-2018.

Variables	Categories	stunting status				P-value
		not stunting		stunting		
		No	%	No	%	
age of children in months	6-12	17	16.8	11	17.2	0.268
	13-24	18	17.8	18	28.1	
	25 and above	66	65.3	35	54.7	
Gender	Male	51	50.5	31	48.4	0.797
	Female	50	49.5	33	51.6	
Religion	Muslim	79	78.2	58	90.6	0.039
	Hindu and others	22	21.8	6	9.4	
Type of family	Nuclear	79	78.2	43	67.2	0.116
	Joint	22	21.8	21	32.8	
Father occupation	Farmer	35	34.7	22	34.4	0.904
	Day labour	38	37.6	26	40.6	
	Service holder and other	28	27.7	16	25.0	
Mother occupation	Housewife	81	80.2	53	82.8	0.916
	Day labour	11	10.9	6	9.4	
	Service holder and other	9	8.9	5	7.8	
Monthly income of family (Tk)	=<10000	58	57.4	27	42.2	0.056
	>10000	43	42.6	37	57.8	
Mother education	No formal education	29	28.7	9	14.1	0.022
	Primary	48	47.5	44	68.8	
	Secondary and above	24	23.8	11	17.2	
Father education	No formal education	32	31.7	20	31.2	0.043
	Primary	39	38.6	35	54.7	
	Secondary and above	30	29.7	9	14.1	

Table 4.2.3: Stunting status of children according to socio-demographic, economic and household characteristics of selected rural families having children (aged 6-59 months old) in Dinajpur district, 2017-2018.

Variables	Categories	stunting status				P-value
		not stunting		stunting		
		No	%	No	%	
Total number of children of family	1	41	40.6	27	42.2	0.839
	2-3 and above	60	59.4	37	57.8	
Number of children under 5 year	1	81	80.2	49	76.6	0.578
	2	20	19.8	15	23.4	
Criteria of child's daily activity	Very active	92	91.1	61	95.3	0.309
	Active several hours	9	8.9	3	4.7	

Note: Level of significance*p<0.05, **P<0.01, **P<0.10, NS = Not Significant

Table 4.2.3 clearly showed the association with stunting status of children according to socio –demographic, economic and household characteristics of selected families. Results revealed that religion, monthly income of family mother education, father education had significant association with stunting status of children.

Table 4.2.4: Underweighting status of children according to socio-demographic, economic and household characteristics of selected rural families having children (aged 6-59 months old) in Dinajpur district, 2017-2018.

Variables	Categories	underweighting status				P-value
		not underweighed		underweighed		
		No	%	No	%	
Age of children in months	6-12	20	20.6	8	11.8	0.223
	13-24	18	18.6	18	26.5	
	25 and above	59	60.8	42	61.8	
Gender	Male	53	54.6	29	42.6	0.129
	Female	44	45.4	39	57.4	
Religion	Muslim	76	78.4	61	89.7	0.056
	Hindu and others	21	21.6	7	10.3	
Type of family	Nuclear	71	73.2	51	75.0	0.795
	Joint	26	26.8	17	25.0	
Father occupation	Farmer	34	35.1	23	33.8	0.410
	Day labour	34	35.1	30	44.1	
	Service holder and other	29	29.9	15	22.1	
Mother occupation	Housewife	76	78.4	58	85.3	0.294
	Day labour	13	13.4	4	5.9	
	Service holder and other	8	8.2	6	8.8	
Monthly income of family (TK)	=<10000	52	53.6	33	48.5	0.521
	>10000	45	46.4	35	51.5	
Mother education	No formal education	21	21.6	17	25.0	0.625
	Primary	53	54.6	39	57.4	
	Secondary and above	23	23.7	12	17.6	
Father education	No formal education	33	34.0	19	27.9	0.358
	Primary	39	40.2	35	51.5	
	Secondary and above	25	25.8	14	20.6	

Table 4.2.4: Underweighting status of children according to socio-demographic, economic and household characteristics of selected rural families having children (aged 6-59 months old) in Dinajpur district, 2017-2018.

Variables	Categories	underweighting status				P-value
		not underweighed		underweighed		
		No	%	No	%	
Total number of children of family	1	39	40.2	29	42.6	0.754
	2-3 and above	58	59.8	39	57.4	
Number of children under 5 year	1	75	77.3	55	80.9	0.582
	2	22	22.7	13	19.1	
Criteria of child's daily activity	Very active	91	93.8	62	91.2	0.521
	Active several hours	6	6.2	6	8.8	

Note: Level of significance*p<0.05, **P<0.01, **P<0.10, NS = Not Significant

Table 4.2.5: Wasting status of children according to socio-demographic, economic and household characteristics of selected rural families having children (aged 6-59 months old) in Dinajpur district, 2017-2018.

Variables	Categories	wasting status				P-value
		not wasting		wasting		
		No	%	No	%	
Age of children in months	6-12	23	15.9	5	25.0	0.594
	13-24	32	22.1	4	20.0	
	25 and above	90	62.1	11	55.0	
Gender	Male	73	50.3	9	45.0	0.654
	Female	72	49.7	11	55.0	
Religion	Muslim	120	82.8	17	85.0	0.802
	Hindu and others	25	17.2	3	15.0	
Type of family	Nuclear	108	74.5	14	70.0	0.669
	Joint	37	25.5	6	30.0	
Father occupation	Farmer	50	34.5	7	35.0	0.983
	Day labour	56	38.6	8	40.0	
	Service holder and other	39	26.9	5	25.0	
Mother occupation	Housewife	119	82.1	15	75.0	0.720
	Day labour	14	9.7	3	15.0	
	Service holder and other	12	8.3	2	10.0	
Monthly income of family (Tk)	=<10000	74	51.0	11	55.0	0.739
	>10000	71	49.0	9	45.0	
Mother education	No formal education	33	22.8	5	25.0	0.769
	Primary	80	55.2	12	60.0	
	Secondary and above	32	22.1	3	15.0	

Table 4.2.5: Wasting status of children according to socio-demographic, economic and household characteristics of selected rural families having children (aged 6-59 months old) in Dinajpur district, 2017-2018.

Variables	Categories	wasting status				P-value
		not wasting		wasting		
		No	%	No	%	
Father education	No formal education	45	31.0	7	35.0	0.898
	Primary	65	44.8	9	45.0	0.714
	Secondary and above	35	24.1	4	20.0	
Total number of children of family	1	59	40.7	9	45.0	0.658
	2-3 and above	86	59.3	11	55.0	
Number of children under 5 year	1	115	79.3	15	75.0	
	2	30	20.7	5	25.0	
Criteria of child's daily activity	Very active	137	94.5	16	80.0	0.019
	Active several hours	8	5.5	4	20.0	

Note: Level of significance*p<0.05**P<0.01, **P<0.10, NS = Not Significant

Table 4.2.5 clearly showed the association with stunting status of children according to socio –demographic, economic and household characteristics of selected rural families. Results revealed that criteria of child's daily activity had significant association with stunting status of children.

Table 4.2.6: Stunting status of children according to food intake frequencies of children per week of selected rural families having children (aged 6-59 months old) in Dinajpur district, 2017-2018.

Variables	Categories	stunting status				P-value
		not stunting		stunting		
		No	%	No	%	
Do you breastfeed your child	Yes	54	53.5	41	64.1	0.180
	No	47	46.5	23	35.9	
Meat consumption	Sometimes/never	61	60.4	41	64.1	0.837
	2-4 times/week	36	35.6	20	31.2	
	5-7 times/week	4	4.0	3	4.7	
Fish consumption	Sometimes/never	33	32.7	16	25.0	0.376
	2-4 times/week	48	47.5	30	46.9	
	5-7 times/week	20	19.8	18	28.1	
Egg consumption	Sometimes/never	28	27.7	31	48.4	0.024
	2-4 times/week	38	37.6	16	25.0	
	5-7 times/week	35	34.7	17	26.6	
Cow milk consumption	Sometimes/never	65	64.4	51	79.7	0.044
	2-4 times/week	10	9.9	1	1.6	
	5-7 times/week	26	25.7	12	18.8	
Citrus fruit consumption	Sometimes/never	41	40.6	38	59.4	0.035
	2-4 times/week	44	43.6	22	34.4	
	5-7 times/week	16	15.8	4	6.2	
Color fruit consumption	Sometimes/never	49	48.5	33	51.6	0.563
	2-4 times/week	33	32.7	23	35.9	
	5-7 times/week	19	18.8	8	12.5	
Leafy vegetables consumption	Sometimes/never	22	21.8	15	23.4	0.941
	2-4 times/week	58	57.4	35	54.7	
	5-7 times/week	21	20.8	14	21.9	

Table 4.2.6: Stunting status of children according to food intake frequencies of children per week of selected rural families having children (aged 6-59 months old) in Dinajpur district, 2017-2018.

Variables	Categories	stunting status				P-value
		not stunting		stunting		
		No	%	No	%	
Color vegetables consumption	Sometimes/never	38	37.6	20	31.2	0.460
	2-4 times/week	39	38.6	31	48.4	
	5-7 times/week	24	23.8	13	20.3	
Other vegetables consumption	Sometimes/never	17	16.8	7	10.9	0.441
	2-4 times/week	65	64.4	47	73.4	
	5-7 times/week	19	18.8	10	15.6	
Rice, bread consumption	Yes	97	93.1	62	96.9	0.294
	No	7	6.9	2	3.1	
Pulse consumption	Sometimes/never	49	48.5	29	45.3	0.896
	2-4 times/week	34	33.7	22	34.4	
	5-7 times/week	18	17.8	13	20.3	
Cake, biscuits consumption	Sometimes/never	26	25.7	13	20.3	0.717
	2-4 times/ week	46	45.5	32	50	
	5-7 times/week	29	28.7	19	29.7	

Note: Level of significance*p<0.05, **P<0.01, **P<0.10, NS = Not Significant

Table 4.2.6 clearly revealed the association with stunting status of children according to food intake frequencies of children per week of selected rural families. Results indicated that consumption of egg, cow milk, citrus fruit per week had significant association with stunting status of children.

Table 4.2.7: Underweight status of children according to food intake of children per week of selected rural families having children (aged 6-59 months old) in Dinajpur district, 2017-2018.

Variables	Categories	underweighting status				P-value
		not underweighed		underweighed		
		No	%	No	%	
Do you breastfeed your child	Yes	57	58.8	38	55.9	0.712
	No	40	41.2	30	44.1	
Meat consumption	Sometimes/never	64	66.0	38	55.9	0.168
	2-4 times/week	31	32.0	25	36.8	
	5-7 times/week	2	2.1	5	7.4	
Fish consumption	Sometimes/never	29	29.9	20	29.4	0.956
	2-4 times/week	45	46.4	33	48.5	
	5-7 times/week	23	23.7	15	22.1	
Egg consumption	Sometimes/never	33	34.0	26	38.2	0.736
	2-4 times/week	34	35.1	20	29.4	
	5-7 times/week	30	30.9	22	32.4	
Cow milk consumption	Sometimes/never	69	71.1	47	69.1	0.850
	2-4 times/week	7	7.2	4	5.9	
	5-7 times/week	21	21.6	17	25.0	
Citrus fruit consumption	Sometimes/never	46	47.4	33	48.5	0.988
	2-4 times/week	39	40.2	27	39.7	
	5-7 times/week	12	12.4	8	11.8	
Color fruit consumption	Sometimes/never	48	49.5	34	50.0	0.997
	2-4 times/week	33	34.0	23	33.8	
	5-7 times/week	16	16.5	11	16.2	

Table 4.2.7: Underweight status of children according to food intake of children per week of selected rural families having children (aged 6-59 months old) in Dinajpur district, 2017-2018.

Variables	Categories	underweighting status				P-value
		not underweighed		underweighed		
		No	%	No	%	
Leafy vegetables consumption	Sometimes/never	24	24.7	13	19.1	0.637
	2-4 times/week	52	53.6	41	60.3	
	5-7 times/week	21	21.6	14	20.6	
Color vegetables consumption	Sometimes/never	34	35.1	24	35.3	0.948
	2-4 times/week	42	43.3	28	41.2	
	5-7 times/week	21	21.6	16	23.5	
Other vegetables consumption	Sometimes/never	14	14.4	10	14.7	0.924
	2-4 times/week	65	67.0	47	69.1	
	5-7 times/week	18	18.6	11	16.2	
Rice, bread consumption	Yes	90	92.8	66	97.1	0.234
	No	7	7.2	2	2.9	
Pulse consumption	Sometimes/never	46	47.4	32	47.1	0.613
	2-4 times/week	35	36.1	21	30.9	
	5-7 times/week	16	16.5	15	22.1	
Cake, biscuits consumption	Sometimes/never	26	26.8	13	19.1	0.284
	2-4 times/week	41	42.3	37	54.4	
	5-7 times/week	30	30.9	18	26.5	

Note: Level of significance *p<0.05, **P<0.01, **P<0.10, NS = Not Significant

Table 4.2.8: Wasting status of children according to food intake of children per week of selected rural families having children (aged 6-59 months old) in Dinajpur district, 2017-2018.

Variables	Categories	wasting status				P-value
		not wasting		wasting		
		No	%	No	%	
Do you breastfeed your child	Yes	84	57.9	11	55.0	0.804
	No	61	42.1	9	45.0	
Meat consumption	Sometimes/never	91	62.8	11	55.0	0.376
	2-4 times/week	49	33.8	7	35.0	
	5-7 times/week	5	3.4	2	10.0	
Fish consumption	Sometimes/never	42	29.0	7	35.0	0.847
	2-4 times/week	69	47.6	9	45.0	
	5-7 times/week	34	23.4	4	20.0	
Egg consumption	Sometimes/never	54	37.2	5	25.0	0.406
	2-4 times/week	45	31.0	9	45.0	
	5-7 times/week	46	31.7	6	30.0	
Cowmilk consumption	Sometimes/never	103	71.0	13	65.0	0.297
	2-4 times/week	8	5.5	3	15.0	
	5-7 times/week	34	23.4	4	20.0	
Citrus fruit consumption	Sometimes/never	69	47.6	10	50.0	0.948
	2-4 times/week	58	40.0	8	40.0	
	5-7 times/week	18	12.4	2	10.0	
Color fruit consumption	Sometimes/never	70	48.3	12	60.0	0.318
	2-4 times/week	49	33.8	7	35.0	
	5-7 times/week	26	17.9	1	5.0	
Leafy vegetables consumption	Sometimes/never	32	22.1	5	25.0	0.043
	2-4 times/week	78	53.8	15	75.0	
	5-7 times/week	35	24.1	0	.0	
Color vegetables consumption	Sometimes/never	48	33.1	10	50.0	0.220
	2-4 times/week	62	42.8	8	40.0	
	5-7 times/week	35	24.1	2	10.0	
Other vegetables consumption	Sometimes/never	19	13.1	5	25.0	0.053
	2-4 times/week	97	66.9	15	75.0	
	5-7 times/week	29	20.0	0	.0	

Table 4.2.8: Wasting status of children according to food intake of children per week of selected rural families having children (aged 6-59 months old) in Dinajpur district, 2017-2018.

Variables	Categories	wasting status				P-value
		not wasting		wasting		
		No	%	No	%	
Rice, bread consumption	Yes	139	95.9	17	85	0.045
	No	6	4.1	3	15	
Pulse consumption	Sometimes/never	66	45.5	12	60.0	0.046
	2-4 times/week	54	37.2	2	10.0	
	5-7 times/week	25	17.2	6	30.0	
Cake, buiscuits consumption	Sometimes/never	32	22.1	7	35.0	0.384
	2-4 times/week	69	47.6	9	45.0	
	5-7 times/week	44	30.3	4	20	

Note: Level of significance*p<0.05, **P<0.01, **P<0.10, NS = Not Significant

Table 4.2.8 showed the association with wasting status of children according to food intake frequencies of children per week of selected families. Results revealed that consumption of leafy vegetables, other vegetables, rice, bread, pulses per week had significant association with wasting status of children.

Binary logistic regression analysis was performed to identify the factors affecting stunting status of the rural children at study area in Dinajpur. For this analysis, we merged two categories of stunting i.e. severe and moderate as stunted (code1) and other category remained as not stunted (code 0). Various socio-demographic and economic variables such as gender, religion, type of family, father occupation, mother occupation, monthly income of family, mother education, father education, age of children was inserted in the binary logistic regression model as independent categories.

Table 4.2.9: Results of binary logistic regression analysis of significant studied variables for stunting of children aged 6-59 months old of selected rural families according to socio-demographic, economic and household characteristics in selected areas Dinajpur district, 2017-18.

Variables	Level	B	S.E	DF	P value	Odds ratio (OR)	95% C.I. for OR	
							Lower	Upper
Type of family	Nuclear	-.776	.401	1	.053	.460	.210	1.011
	Joint (RC)	-	-	-	-	1.00	-	-
Monthly income of family	=<10000	0.224	.180	1	.003	1.251	0.879	1.780
	>10000 (RC)	-	-	-	-	1.00	-	-
Father education	No formal education	1.739	.514	1	.001	5.691	2.080	15.572
	Primary	1.700	.573	1	.003	5.472	1.782	16.807
	Secondary and above (RC)	-	-	-	-	1.00	-	-

Note: RC-Reference category; Level of significance*p<0.05, **P<0.01

Table 4.2.9 showed the significant studied variables for stunting status of selected rural families children aged 6-59 months old at study area in Dinajpur district. The variables like type of family, monthly income of family and father education were statistically significant variables with stunting status of children. Result shows that children of nuclear families were .460 times higher risk of being stunting then joint families. It means the risk of stunting number decreases among children with the increase the family members. The families having monthly income <= 10,000 (Tk) had 1.250 times higher risk of being stunted than monthly income of family more than 10,000 (Tk). It implied risk of stunting status reduced among children with the increase of their monthly income. Children stunting status increased in 5.69 and 5.47 times for the No formal and Primary educated fathers respectively compared to the children of Secondary and above level educated fathers. It indicated that risk of stunted children reduced with the increase of their father's education.

Table 4.2.10: Results of binary logistic regression analysis of significant studied variables for stunting of children aged 6-59 months old of selected rural families according to food consumption frequencies of children in selected areas of Dinajpur district, 2017-18.

Variables	Level	B	S.E	DF	P value	Odd ratio (OR)	95% C.I. for OR	
							Lower	Upper
Fish consumption	Sometimes/ never	1.058	.536	1	.020	2.880	1.007	8.236
	2-4 times/week	.437	.375	1	.358	1.548	.742	2.228
	5-7times/week(RC)	-	-	-	-	1.00	-	-
Egg consumption	Sometimes/ never	1.019	.475	1	.032	2.772	1.092	7.036
	2-4 times/week	.062	.484	1	.497	1.064	.412	2.747
	5-7times/week(RC)					1.00		
Cow milk consumption	Sometimes/ never	.397		1	.247	1.487	.651	3.396
	2-4 times/week	.818	.615	1	.048	2.265	.678	2.023
	5-7times/week(RC)	-	-	-	-	1.00	-	-

Note: RC-Reference category; Level of significance*p<0.05, **P<0.01

In table 4.2.10 we used different food consumption habits such as meat, fish, egg, cow milk, citrus fruits, color fruits and other, leafy vegetables, color vegetables, other vegetables, rice, pulses consumption per week to find out the stunting status of children using binary logistic regression model. For this analysis, we merged two categories of stunting i.e. severe and moderate as stunted (code1) and other category remained as not stunted (code 0).

Table 4.2.10 showed the result of binary logistic regression analysis of significant studied variables for stunting of selected rural families children aged 6-59 months old at study area in Dinajpur district. The variables like fish consumption, egg consumption and cow milk consumption was found statistically significant with stunting status of children. Children who consumed fish sometimes/never were 2.280 times higher risk of being stunted than who consumed 5-7 times/week. It implied the risk of stunting reduced among children with the increase of fish consumption. Children who consumed egg sometimes/never per week were 2.722 times higher risk of being stunted than who consumed 5-7 times/week. It implied the risk of stunting reduced among children with the increase of egg consumption also. Children who consumed cow milk 2-4 times/week

were 2.265 times higher risk of being stunted than who consumed 5-7 times/week. That means the risk of stunting number reduced among children with the increase of cow milk consumption the child age under five.

Discussion

The percentage of male children (49.7%) was almost equal with female children (50.3%) for this study. The number of children aged 25 and above month old were higher (61.2%) than 13-24 months old (21.8%) and 6-12 months old (17%). Muslim households were higher (83%) than Hindu household families and others (17%). In this study, selected rural families composed of nuclear family (73.9%) and joint families (26.1%). In educational level of mother, 23% mothers had no formal education, 55.8% were up to primary and 21.2% passed Secondary and above. For educational level of father, 31.5% fathers were no formal education, 55.8% fathers passed primary and 23.6% fathers were passed Secondary and above. It clearly indicated that the percentage of no formal education of father was higher than mothers. Mother involvement in service were very low (10.3%) compared to mother who were housewife (81.2%). In father occupation, 34.5% fathers were farmer, 38.8% were day labor, 8.5% were involved in Service holder and other. It indicated that fathers involvement in service were very low. Results clearly indicated that monthly income less than or equal 10 thousands higher (51.5%) than households had monthly income above 10 thousands (48.5%). The number of under – five children were 1 in 65% households and in 58.8% households were between 2-3. This study also indicated that 92.7% children were very active and 7.3% children were active several hours.

The distribution of food intake frequencies of children (6-59 months) per week of selected households clearly indicated that percentage distribution of food consumption sometimes per never was higher than 5-7 times per week and 2-4 times per week. In case of most of foods such as meat, fish , egg, Cow milk, citrus fruits, color fruits, leafy vegetables, color vegetables, other vegetables, pulses, cake, buiscuits etc. Children who consumed egg, cow milk, citrus fruits sometimes per never per week , they suffered from stunting status much.

The average height and weight of male children under 5 years old were found 82.99 cm and 10.97 kg. The average height and weight of female children were found 84.15cm and 10.78 kg. It indicated the average height of female children were higher than male

children. But the average weight of male and female children was almost the same. Graphical representation showed that the height and weight increases as the age of the children was also increased.

Results also founds that the prevalence of stunting and wasting status reasonably lower than underweight status. In case of stunting status 61.2% were not stunted, 22.4% were moderately stunted and 16.4% were severely stunted. Regarding underweight of children 58.8% were not underweighed, 35.2% were moderately underweight and 6.1% were severely underweight. In case of wasting status of children, 87.9% children were not wasted, 9.1% were moderately wasted, and 3% were severely wasted.

Chi-square test showed that stunting status of children were significantly associated with religion, monthly income of family, mother education, father education. But wasting status of children was associated with criteria of child daily activity.

Stunting status of children was significantly associated with egg, cow milk, citrus fruits consumption. But leafy vegetables, other vegetables, rice bread, pulse consumption were significantly associated with wasting status of children.

The risk variables like type of family, monthly income of family and father education were statistically significant variables with stunting status of children. Result shows that children of nuclear families were .460 times lower risk of being stunting then joint families. It means the risk of stunting number decreases among children with the increase the family members. The families having monthly income <= 10,000 (Tk) had 1.250 times higher risk of being stunted than monthly income of family more than 10,000 (Tk). It implied risk of stunting status reduced among children with the increase of their monthly income. Children stunting status increased in 5.69 and 5.47 times for the No formal and Primary educated fathers respectively compared to the children of Secondary and above level educated fathers. It indicated that risk of stunted children reduced with the increase of their father's education.

The risk factors like consumption of fish, egg and cow milk per week were found statistically significant with stunting status of children. Children who consumed fish sometimes/never were 2.280 times higher risk of being stunted than who consumed 5-7 times/week. It implied the risk of stunting reduced among children with the increase of fish consumption. Children who consumed egg sometimes/never per week were 2.722

times higher risk of being stunted than who consumed 5-7 times/week. It implied the risk of stunting reduced among children with the increase of egg consumption also. Children who consumed cow milk 2-4 times/week were 2.265 times higher risk of being stunted than who consumed 5-7 times/week. That means the risk of stunting number reduced among children with the increase of cow milk consumption the child age under five.

In this study it was found that, the prevalence rate of stunting, underweight and wasting of 6-59 months old children in Dinajpur were 38.8%, 41.3%, 12.1% respectively. Majumder *et al*. (2011) found that the prevalence of stunting, underweight, and wasting of 6-59 months old Santal children in Dinajpur were 54%, 33%, and 16%, respectively.

CHAPTER V

SUMMARY AND CONCLUSION

CHAPTER V

SUMMARY AND CONCLUSION

In this study, most of the families were nuclear family and most of the households were muslim family than hindu and others. Most of the father were involved in farmer and day labour and most of the mother were housewife. Very few father and mother were involved in service holder and other occupation. Monthly income of family whose less than or equal 10,000 was higher than greater than 10,000. In case of educational level the number of no formal education of fathers were higher than mothers. Mothers who passed primary theirs numbers were higher than fathers who were passed primary. In the family, the number of children having 1 was higher than children having 2. Most of the children were very active.

In case of most of foods such as meat, fish , egg, Cow milk, citrus fruits, color fruits, leafy vegetables, color vegetables, other vegetables, pulses, cake, biscuits consumption sometimes or never was higher than 5-7 times per week and 2-4 times per week.

The average height of female children was higher than male children. But the average weight of male and female children was almost the same. Height and weight were increased with the increased age of children with parallels.

Although stunting, underweight and wasting status of children had decreased from past few years, the percentage rate is still high in Bangladesh and serious problem for our country. In this study area, the prevalence of underweight children (41.3%) was comparatively higher than stunted children (38.8%) and wasted children (12.1%). Results showed that the prevalence of stunting and underweight status were high than national level of Bangladesh which is very concerning. The female children were more stunted, underweighed and wasted than male children.

Stunting status of children was considerably dependent with religion, monthly income of family, mother education, father education. But wasting status of children was associated with criteria of child daily activity. Stunting status of children was also dependent with egg, cow milk, citrus fruits consumption. But leafy vegetables, other vegetables, rice bread, pulse consumption were dependent with wasting status of children.

Type of family, Monthly income of family, father education were major determinants of stunting of children. Consumption of fish, cow milk, egg were also most important determinants of stunting of children.

Recommendations

It is necessary to increase awareness about child nutrition, quantity of food consumption and their effects on children, recommendations that go after from this study findings are:

- Increase awareness about malnutrition of child and their effect's on children.
- Education of father and mother should be improved.
- Giving training to parent's about the nutrition of child, nutrition of food and diet chart of children.
- Improve alertness about regular check up of health of children.
- For regular measurement of height and weight of children persuade father and mother.
- In relation to underweight and stunting Government's and NGO's should pay concentration to the nutrition status of rural children.

REFERENCES

REFERENCES

Adhiguru, P. and Ramasamy, C. (2010). Agricultural-based Interventions for Sustainable Nutritional Security. National Centre for Agricultural Economics and Policy Research, New Delhi, India.

Ahmed, S.S. (2016). Nutritional Status of under Five Children among Manipuri Population of Bangladesh. Dhaka University Institutional Repository. Institute oh Nutrition and Food Science, University of Dhaka.

Alom, J. (2010). Nutritional status of under five children in Bangladesh: a multi-level analysis. M.S Thesis.

Alom, J., Islam, M. A. and Quddus, M. A. (2009). Socioeconomic Factors Influencing Nutritional Status of Under-Five Children of Agrarian Families in Bangladesh: A Multilevel Analysis. *The Bangladesh Journal of Agricultural Economics, XXXII* (1 & 2): 63-74.

Asian Development Bank. (n.d.). *Poverty in Bangladesh*. Retrieved 21 November 2016 from https://www.adb.org/countries/bangladesh/poverty

Bangladesh Bureau of Statistics (BBS), (2015). *Report on Bangladesh Sample Vital Statistics 2014*. Dhaka, Bangladesh: Bureau of Statistics. Statistics and Informatics Division. Ministry of Planning.

Bangladesh Demographic and Health Survey (BDHS) (2011). National Institute of Population Research and Training Dhaka, Bangladesh. Nutrition of Children and Adults (165-166).

Bangladesh Demographic and Health Survey (BDHS) (2014). Bangladesh Demographic and Health Survey (2011). National Institute of Population Research and Training Dhaka, Bangladesh. Nutrition of Children and Adults (153-155).

Borgen, H. (2010). Child under nutrition in the Far-West Terai of Nepal. Master thesis

Bosak, L., Majumder, U.K. and Sarker, B.C. (2018). Food Security level and Hunger Status of a NGO Supported Farmers' Families in Dinajpur, Bangladesh. IOSR Journal of Humanities And Social Science (IOSR-JHSS) 23(2): 39-47.

Bruce Cogill (2003). Anthropometric Indicators Measurement Guide

Cameron, N. (1986). The methods of auxological anthropometry. In: Falkner F, Tanner JM (eds). Human Growth. A Comprehensive Treatise. Volume 3: Methodology. Ecological. Genetic. and Nutritional Effects on Growth. Plenum Press, New work, pp. 3-46.

Chhetri, P.S.G. (2005). Factors associated with Malnutrition among Children in Rural Terai of Eastern Nepal. M.S thesis

Das, A.C. (2015). Childhood mortality and Child nutritional status of Bangladesh: A review on Demographic and Health Survey. Journal of Current and Advance Medical Research. ISSN 2313-447X. Volume 2 | Number 2

Debnath, S.C., Baizid Khoorshid Riaj, Md.Ziaul Islam and sharraf Samin (2017). Malnutrition and Morbidity Profile of Under Five Children: A Cross-Sectional Scenario in a Rural Area of Bangladesh. MOJ Public Health. 5(6): 1-5.

Gibson, R.S. (2005). *Principles of nutritional assessment*. Oxford university press, USA.

Habaasa, G. (2014). Determinants of malnutrition among under-five children in Nakaseke And Nakasongola Districts, Uganda (Doctoral dissertation, Makerere University).

Haque, M. M., Khatun, T., Sarker, M. R. and Hoque, M. A. (2014). Nutritional Status of Preschool Children of Ethnic Community in Bangladesh. European Academic Research, ISSN 2286-4822 Vol. II

Hasan, S. (2017). Prevalance and risk factors associated with under-5 mortality: A multi-country comparative study in South Asia. Master's Thesis. Faculty of Social Sciences, Health Sciences .University of Tampere.

Hoque, M.A., Sayeed, M.A., Ahsan, M.R., Mamun, M.A.A., Salim, F. (2016). Nutritional Status among under-5 Children of a selectedslum in Dhaka city. Northern International Medical College Journal, 7(02): 143-145.

Islam, A. and Biswas, T. (2015) Chronic stunting among under-5 children in Bangladesh: A situation analysis. Advances in Pediatric Research.

Islam, M.S. (2014). Destitute children and initiatives for their welfare in Bangladesh. International Journal of Social Science : 3(4): 403-413.

Jelliffe, D.B. (1966). The assessment of the Nutritional Status of the Community. WHO Monograph No. 53. World Health Organization, Geneva.

Jerin, I. (2013). Determinants of under nutrition among children under 2 years of age in Bangladesh: insights from nationally representative data.

Jesmin, A., Yamamoto, S.S., Malik, A.A. and Haque, M.A. (2011). Prevalence and Determinants of Chronic Malnutrition among Preschool Children: a Cross-Sectional Study in Dhaka City, Bangladesh. *J Health Popul Nutr.* 29: 494-99.

Kellerhals, S. (2017). Understanding severe acute malnutrition in children globally. Doctor of Medicine, University of Arizona College of Medicine- Phoenix.

Khan, R.E.A. and Raza, M.A. (2014). Nutritional Status of Children in Bangladesh: Measuring Composite Index of Anthropometric Failure (CIAF) and its Determinants . Pakistan Journal of Commerce and Social Sciences, 8(1): 11-23.

Kumari, S. (2016). Analysing the Determinants of Malnutrition Among Children Under Five Years of Age In Bihar State, India

Kuntal K.S. (2009). Household food security is associated with growth of infants and young children in rural Bangladesh. Public Health Nutrition: 12(9): 1556–1562

Majumder, U.K. Roy, L.N., Dey, R., Rahman, M.M. and Hassan, M.Z. (2011). Socioeconomic and Demographic Determinants: Malnutrition of 6-59 Months Old Rural Santal Children and Food Security Status of Their Families in Dinajpur. South Asian Journal of Population and Health, ISSN 1560-4373 Vol 4.

Mandal, D.A. (2017). Brachytherapy Side Effects, NEWS Medical Life Sciences http://www.news-medical.net/health/Brachytherapy-Side-Effects.aspx (access date 20.04.2017).

Masibo, P.K. (2013) Trends and Determinants of Malnutrition among Children Age 0-59 Months in Kenya (KDHS 1993, 1998, 2003, and 2008-09).

Mohsena, M. Goto, R., Nicholas, C.G. and Mascie-Taylor (2015). Regional variation in maternal and childhood under nutrition in Bangladesh: evidence from demographic and health surveys. WHO South-East Asia Journal of Public Health July–December 2015. 4(2).

Monoarul, H., Taslima, K., Manika R., and Sarker, A. (2014). Nutritional Status of Preschool Children of Ethnic Community in Bangladesh. European Academic Research, 2(5): 6450–6464.

Mustafa, M., Mustafa, M., Islam, T. and Khan, I.S. (2017). Nutritional Status of Children of Under-5, Attending a District Hospital – A Secondary Level Care Hospital. Dinajpur Med. Col. J. 10(1).

Nath, N.C. (2015). Food Security of Bangladesh-Status, Challenges and Strategic Policy Options.

National Institute of Population Research and Training (NIPORT), M.a.A., and ICF International (2015). Bangladesh Demographic and Health Survey 2014: Key Indicators. National Institute of Population Research and Training (NIPORT), Mitra and Associates, and ICF International, Dhaka, Bangladesh and Rockville, Maryland.

Norgan, N. G. and Ferro-Luzzi, A. (1982). Weight-height indices as estimators of fatness in men. Hum. Nut. Clin. Nutr. 36C:363-372.

Rahman, M.S., Ali, M. and Ahmed, N.A.M.F. (2017). Contributing Factors to Under-Five Child Malnutrition in Rural Bangladesh. Juniper Online Journal of Case Studies, 4(1): 555633.

Rahman, M.S., Howlader, T., Masud, M.S., Rahman, M.L. (2016) Association of Low-Birth Weight with Malnutrition in Children under Five Years in Bangladesh: Do Mother's Education, Socio-Economic Status, and Birth Interval Matter? PLOS ONE. DOI:10.1371/journal.pone.01578.

Raza, M.A. (2014). Nutritional Status of Children in Bangladesh: Measuring Composite Index of Anthropometric Failure (CIAF) and its Determinants. Pakistan Journal of Commerce and Social Sciences. 8(1): 11-23.

Roy, R. K., Matubbar, M. S., Kamruzzaman, M. and Ud-Daula, A. (2015). Determination of Nutritional Status of Under-Five Year Children Employing Multiple Interrelated Contributing Factors in Southern Part of Bangladesh. International Journal of Nutrition and Food Sciences, 2015; 4(3): 264-272.

Shamme, D.R., Shafique, K.M.A., Alam, P.D.M.M., Khan, D.M.S. (2017). Nutritional Status And Factors Affecting Malnutrition Among Under 5 Year Old Children Attending In Paediatric Outpatient Department In A Tertiary Hospital, Sylhet. Imperial Journal of Interdisciplinary Research (IJIR), ISSN: 2454-1362 Vol-3.

Srilakshmi, B. (2006). Nutrition Science. New Age International. 4th Ed. pp. 335.

Talukder, A. (2017). Factors Associated with Malnutrition among Under-Five Children: Illustration using Bangladesh Demographic and Health Survey, 2014 Data. Children 4: 88.

Talukder, B. (2013). Regional Differences of Child Under-Nutrition in Bangladesh. Finnish Yearbook of Population Research XLVIII 2013, pp. 189–201.

The Global Nutrition Report (2015). What we need to do to advance progress in addressing malnutrition in all its forms. *Public health nutrition*, *18*(17), 3067.

UNICEF / WHO / World Bank Group Joint Child Malnutrition Estimates (2017). Level and trends in child malnutrition.

UNICEF / WHO / World Bank Group Joint Child Malnutrition Estimates (2015). Level and trends in child malnutrition.

United Nations Children's Fund (2009). The state of the world's children 2009. Special edition: celebrating 20 years of the convention on the rights of the child, New York, pp. 92.

Waterlow, J.C. (1978). Observations on the assessment of protein-energy malnutrition with special reference to stunting. Extrait Courier 28: 455-460.

WHO (1986). Use and Interpretation of Anthropometric Indicators on Nutritional Status. Bulletin of the World Health Organization, 64(6): 929-941.

WHO, UNICEF and World Bank, (2012). Levels & Trends in Child Malnutrition Bangladesh Nutrition Profile 2014

World Bank (2017). Bangladesh Continues to Reduce Poverty But at Slower Pace". The World Bank. Retrieved 11 April 2018.

World Health Organization (WHO). (2010). Nutrition Landscape Information System (NLIS) country profile indicators: interpretation guide.

World Health Organization (WHO). (2010). Stunting in a nutshell.

Yusuf, H.K.M., Bhattacharjee, L. and Nandi, B. K. (2005). Trends and Patterns of Dietary Energy Supply and Nutrition Status in South Asian Countries, 1995-2005. South Asian Journal of Population and Health; Vol – 1, No – 1.

APPENDIX

Appendix: Questionnaire & schedule

"Study on Malnutrition Status of 6-59 Months Old Children of Rural Families in Selected Areas OF Dinajpur District"

A questionnaire on malnutrition of child (1 to 5 years of age)

1. Child's Name: _____

2. Date of Birth: _____ Age _____

3. Sex: Male ☐ Female ☐

4. Father's Name:_____ Mother's Name:_____

5. Location:

Village:_____
Post:_____

Thana:_____
District:_____

6. Religion: Muslim ☐ Hindu ☐ Christian ☐ Others ☐

7. Name of the head of the family:

8. Type of family: Nuclear ☐ Joint ☐ Others ☐

9. Father's occupation:…… Mother's occupation:……

10. Have any own land? Yes ☐ No ☐

11. Have any other property? Yes ☐ No ☐

12. Monthly income of family:

Less than 5000 ☐ 5000-10000 ☐ Above 1000 ☐

13. Educational level of mother

No formal education ☐
Primary level ☐
Secondary level and above ☐

Educational level of father

No formal education ☐
Primary level ☐
Secondary level and above ☐

Number of total children of family:_____

Number of children under five year:_____

Name of Guardian (absence of parent): _____

14. **Eating habit:**

15. **Does your child skip meals or have a limited amount of food at meals because there is not enough money to buy food?** Yes ☐ No ☐

16. Do you breastfeed your child? Yes ☐ No ☐

How many times during the day? _____times

Do you breasted at night? Yes ☐ No ☐

17. **Check all that your child drinks:**

Breast milk ☐ Cow milk ☐ Water ☐

Fruit juice ☐ Tea ☐

other_____

21. **What is your child's usual daily activity?**

Very active (plays actively 2 or more hours per day) ☐

Active some of the time (plays actively about 1 to 2 hours per day) ☐ not active ☐

22. **Check how often your child eats these foods:**

	How many days in a week	**None**
Meat, poultry		
Fish		
Egg		
Milk, yogurt, or cheese		
Citrus fruits		
Colored fruits and others		
Leafy vegetables		
Colored vegetables		
Vegetables		

Grains- cereal, bread, rice, pasta		
Pulses		
Cookies, cakes, Candy		
Fried foods, french fries, sausage, hot dogs,		

23. Health information:

1) Height (cm): _____

2) Weight (kg):_____

3) Head circumference (cm): _____

4) Mid-arm-circumference (cm):_____