UNIVERSITY FOR DEVELOPMENT STUDIES

SCHOOL OF PUBLIC HEALTH

DEPARTMENT OF GLOBAL AND INTERNATIONAL HEALTH

HOUSEHOLD FOOD INSECURITY AND SOCIODEMOGRAPHIC DETERMINANTS OF MALNUTRITION AMONG CHILDREN (6-59 MONTHS OLD) IN TAMALE SOUTH IN THE NORTHERN REGION OF GHANA.

BY

NTIM SARPONG NATHANIEL

2021

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BY

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A THESIS SUBMITTED TO DEPARTMENT OF GLOBAL AND INTERNATIONAL HEALTH, SCHOOL OF PUBLIC HEALTH, UNIVERSITY FOR DEVELOPMENT STUDIES IN PARTIAL FULFILMENT OF THE REQUIREMENTS FOR THE

AWARD OF MASTER OF PUBLIC HEALTH

OCTOBER, 2021

DECLARATION

Student

I Ntim Sarpong Nathaniel hereby declare that this thesis is the result of my own research work and that all the sources that I used have been duly acknowledged by way of references and that this work has not been submitted to any institution for the award of any degree.

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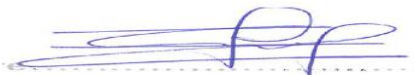
I hereby declare that the preparation and presentation of the thesis were supervised in accordance with the guidelines on supervision of thesis laid down by the University for Development Studies.



08/11/2021

DR SUFYAN BAKURI SUARA **DATE**

(SUPERVISOR)

DEDICATION

I dedicate this thesis to the Almighty God for granting me the knowledge and strength to complete this thesis. Also dedicate this thesis to my dad the late Mr Fred Ntim Kwabia, may his soul rest in perfect peace for his encouragement and support.

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My sincere gratitude goes to my academic supervisor, Dr. Bakuri Suara Sufyan of the School of Public Health for his guidance, contribution, and insightful inputs into the substance of this work. His patience, attention, encouragement, and assistance throughout this work are heart-warming. I say God richly bless him and replenish whatever he might have lost in hundreds of folds.

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Finally, I acknowledge the immense contribution of the authors whose work was used as a literature review to support my study

ABSTRACT

Food insecurity is a detrimental household shock that forces a subpar redistribution of household resources affecting the frequency of dietary intake, adequacy, and monotony of diet as well psychosocial apprehension of the situation. Children 6 – 59 months are among the worst affected in such situations given their non-resilience relative to other members of the household. The objective of the study was to assess the contributions of sociodemographic characteristics and the level of household food insecurity to nutritional status of children under 5 years in Tamale south. The study adopted an analytical cross-sectional design through which 240 mother-child pairs were assessed. These participants were selected through a 3-multi-stage approach. Data were collected using a structured questionnaire containing sections on demographic characteristics, Household Food Insecurity Access Scale (HFIAS), and child anthropometry. The results showed that caregivers were mostly mothers who were predominantly married and native Dagomba with little formal education and earn less than GHC200.00. The prevalence of moderate and severe wasting was 7.1% and 0.4%, respectively. Moderate and severe stunting was 27.5% and 1.7%, respectively, while 10.4% were moderately underweight and 0.4% were severely underweight. Household food insecurity (total HFIAS) was significantly associated with higher odds of acute malnutrition in both unadjusted [OR=1.29, 95% CI: 1.05-1.60, p= .018] and adjusted binary logistics regression results [OR=1.34, 95% CI: 1.07-1.68] but no significant influence on chronic malnutrition. Also, household size (increased) and age of the child (6 – 23 months vs 24-59 months) had higher odds of susceptibility for chronic malnutrition. In conclusion, food insecurity predicts acute child malnutrition and larger households predispose children to perpetual food shortages that spell long-term malnutrition that renders 6 – 23 months old children most vulnerable. Social protection and economic empowerment interventions should be integrated with health-based family planning promotion for holistic household improvement.

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LIST OF ACRONYMS

ACRONYM	FULL MEANING
UNICEF	United Nations Children' Fund
USAID	United States Agency for International Development
WFP	World Food Programme
HFIAS	Household Food Insecurity Access Scale
HCES	Household Consumption and Expenditure Surveys
HHHS	Household Hunger Scale
MUAC	Mid Upper Arm Circumference
UN	United Nations
FAO	Food and Agricultural Organization
WHO	World Health Organization
DDS	Dietary Diversity Score
SAM	Severe Acute Malnutrition
BMI	Body Mass Index

HAZ	Height per Age z-score
WAZ	Weight per Age z-score
NEPAD	new partnership for African's development
WASH	Water, Sanitation and Hygiene
ICDS	Integrated Child development Scheme
TaMA	Tamale Metropolitan Assembly
HFIES	Household Food Insecurity Experience Scale
SD	Standard Deviation
FIES	Food Insecurity Experience Scale
SPSS	Statistical Product and Services Solutions
FANTA	Food and Nutrition Technical Assistance
CI	Confidence Interval
OR	Odds Ratio
DHS	District Health Service
GSS	Ghana Statistical Service

EDHS	Ethiopian District Health Service
NGOS	Non-Governmental Organizations

CHAPTER ONE

INTRODUCTION

1.1 Background

Optimum nutrition is the most significant bio-marker of the efficacy of public health actions in the domains of health prevention, protection, and regulation. Especially, the nutritional status of children in a household indicates a host of factors: access to food, intra-household distribution of food, quality and quantity of food consumption as well as decision making on food expenditure. In a household, children are the most susceptible to the deleterious aftermath of shocks and upsets to the available resource pool. Health indicators of Early childhood are sensitive to drastic changes in food security conditions, environmental conditions, socio-economic conditions, and policies (Bhandari & Chhetri, 2013; Cunha et al., 2018; Singh et al., 2016). Children 0 – 59 months are the most vulnerable because their systems react swiftly to dietary changes and are more susceptible to being ill which consequently leads to undernutrition.

Malnutrition in children is vastly delineated to undernutrition in low- and middle-income countries. The proxy measures of malnutrition include levels of wasting, underweight and overweight. In the year 2019 alone, 47 million (6.9%) children under-five years were estimated to be wasted, 38 million (5.6%) were overweight, 144 million (21.3%) were stunted and at least 340 million had micronutrient deficiency diseases (UNICEF / WHO / World Bank Group, 2020). Current global estimates point out that, 162 million children under-five (5) years are stunted; a chronic manifestation of malnutrition resulting from persistent malnutrition. In Sub-Saharan Africa, an estimated 40% of children aged five (5) and below are estimated to be

stunted (de Groot et al., 2017). Despite Asia constituting over half of all stunted children globally, Africa is the only region where the number of children who suffer from stunting has increased from 49.7 million to 57.5 million in the timeframe 2000 to 2019, with Western and Eastern Africa being worse affected.

In Ghana, the prevalence of stunting is 19% and northern regional prevalence is 33%. The proportion of wasted children is also higher in the northern regions of Ghana, especially the Upper East Region where it is highest with a 9% prevalence (GSS; GHS; ICF International, 2015). The correlates of the high prevalence of stunting in the five Northern Regions of Ghana include inappropriate feeding practices (i.e. starch reliant diets and poor intake of fruits and vegetables as well as proteins), immense poverty, poor access to healthcare services together with compromised water access, sanitation and hygiene (WASH) practices (Cooke, 2015). According to sources, up to 70% of child stunting occurs prior to a child's second (2^{nd}) birthday; a period noted for grave levels of susceptibility to infections, malnutrition, and other risks commonly referred to as the first 1,000 days (Leroy et al., 2014). A case in point is, in the Northern Region of Ghana, 32.5% of children less than five years of age suffer from stunting, 12.9% suffer from wasting, and 21.8% are underweight (Saaka, 2014) as well as 40% of the children had stunting in the Tamale Metropolis (Wemakor & Iddrisu, 2018).

The effects of malnutrition have been reported in most studies. Some of these consequences include poor brain and social development, growth faltering, poor performance in school, high risk of disease and death as well as decreased productivity in the future (World Health Organization, 2019; Pelletier et al., 1995). Other consequences of malnutrition include high risks of childhood mortality and high risks of chronic disease in later adulthood (Black et al., 2008). According to Chandler et al, the impact of child undernutrition encompasses physical, cognitive, and psychosocial dimensions of development in children (Candler et al., 2017).

Some of the causes of undernutrition are diets of poor quality and have fewer calories and essential nutrients including consistent infections (GSS, 2016). The greatest threat to child nutritional status is the looming, resilient and vicious cycle of resource deprivation in developing countries resulting in the transient and perpetual prevalence of food insecurity households.

Child undernutrition and household malnutrition as a whole is largely determined by household food insecurity and hunger. Some studies previously conducted have shown positive correlations between household food insecurity situations and incidences of poor child nutritional status (Berra, 2020; Betebo et al., 2017; Bukania et al., 2014). The relatedness of food insecurity and household hunger to nutrition, health, and development is an issue of immense global concern and for that matter is enshrined under the Sustainable Development Goals (SDGs). The second of the SDGs is aimed at the ambitious goal of ensuring zero hunger in every country by 2030.

Additionally, a previous study showed that increased susceptibility to under-five child malnutrition is attributable to household food insecurity (Betebo et al., 2017). Food insecurity is a type of economic hardship, and the prevalence of food insecurity among households with children is influenced by the household structure and various demographic and disadvantaged socioeconomic factors (Daponte & Bade, 2006). Some studies have carried out an in-depth examination of the interplay of forces in the family environment including how the food security status of households can influence nutritional status of children under-five years (Mutisya et al., 2015; Saaka & Osman, 2013). Household food insecurity has a negative effect on food consumption, including nutrient intake, dietary quality, and subsequently, household members' nutritional status.

About three-quarters (75%) of food insecure persons worldwide live-in developing countries and depend primarily on agriculture for their livelihoods and overall well-being. Food insecurity is associated with agricultural production in some studies (Birhane et al., 2014; Gelli et al., 2017). Subsistence farming is the primary means of livelihood for about 2.1 billion people thriving on less than two dollars (< $2) per day (people living in moderate poverty) and 880 million living on less than one dollar (< $1) per day [people living in extreme poverty] (World Bank, 2008). A study by Madiba et al. purported those children who are food insecure are predisposed to poor nutritional status since they depend on inappropriate levels of food intake (Madiba et al., 2019). Moreover, the consumption of low quantity food and monotonous diets could put children at risk of malnutrition with micronutrient deficiencies (Ntila et al., 2017). Food insecurity influences dietary intake: The dietary intake of children is more critical and important during the first 2 years of life (Som et al., 2018) the first period of active growth spurt. Poor dietary intake may prevent the children from growing or developing properly and as well as enhance the risk of illnesses and diseases.

Social protection programs have rapidly moved up the policy agenda both nationally and internationally to curb child nutrition through livelihood empowerment geared at guaranteeing household food security (Renzaho et al., 2017). Ghana introduced several social policy interventions since the 2000s which are evaluated through intermittent Ghana Poverty Reduction Strategy Reports (GPRS). Examples include a national school feeding programme (2005) [GSFP], capitation grants to expand free primary education (2005), Livelihood Empowerment Against Poverty (LEAP) cash transfer programme (2008), and LEAP 1000. The reason for these programmes according to (Atsu et al., 2017) is as a result of the Nation's government's ability to increase household resilience and improve households' ability to obtain food as well as health care. However, targeting of beneficiaries in these programmes has not

been holistic but demand-driven affecting the quantum of vulnerable households that can be reached with social protection.

In recent times the assessment of an independent relationship between child nutritional status and household food insecurity is gaining prominence in public health. Therefore, this study purposed to assess the nexuses between household food security levels and how that impacts on child nutritional status with hindsight on the potential sociodemographic confounders.

1.2 Problem statement and Justification

There is paucity of data on household food security situation in the Tamale South as well as how it impacts on child nutritional status. Child malnutrition is a significant issue of public health concern. It accounts for over one-third of child mortalities worldwide although it is often an indirect cause (Bain et al., 2013). Malnutrition is attributable to 45% of under-five child mortalities occurring predominantly in low and middle income nations. If nutrient requirements of children are not met in the early years of their lives, it poses the risk of lifelong consequences. In Ghana, the prevalence of under-five chronic malnutrition remains resiliently high. For instance, 32.5% of children under five years in the Northern Region of Ghana are stunted, 21.8% are underweight and 12.9% are wasted (Saaka, 2014). More proximately to this study's setting, 40% of under-five children had stunting in the Tamale Metropolis (Wemakor & Iddrisu, 2018).

Food insecurity can be classified as a type of economic shock, and the prevalence of food insecurity among households with children is influenced by the household structure and various demographic and disadvantaged socioeconomic factors (Daponte & Bade, 2006). Few studies have taken an in-depth examination of the family environment by investigating how the food

security status of households can influence nutritional status of under-five children which is the focus of the present proposed study.

Additionally, several conflicting results have been reported regarding the relationship between child nutritional status and household food security. For instance, some studies previously conducted in other countries revealed a positive association between poor child nutritional status and household food insecurity (Berra, 2020; Betebo et al., 2017; Bukania et al., 2014), whereas, others have not (Kac et al., 2012; McDonald et al., 2015; Osei et al., 2010). Moreover, in the Tamale Metropolis, a previous study did not find an association between indicators of child nutritional status and household food insecurity as was measured by the HFIAS (Saaka & Osman, 2013). In contrast, a study conducted in Laos found a high prevalence of FIES scores and malnutrition indicators within the same households (Boulom et al., 2020). Therefore, this proposed Thesis may be a useful addition that may help clarify the association between child nutritional status and household food insecurity.

Tamale South Sub-Metro is a microcosm of the third biggest Metropolitan area in Ghana i.e. the Tamale Metropolis. The incidence of child malnutrition and household poverty are concurrently highest in this region. According Wemakor and Iddrisu, the prevalence of chronic malnutrition is 40% of the children under five years in the Tamale Metropolis (Wemakor & Iddrisu, 2018) a figure higher than national estimates (Saaka, Larbi, Hoeschle-Zeledon, et al, 2015). Relative to the major part of the Metropolis, the Tamale South consist of chiefly peri-urban and rural communities placing her inhabitants at even greater risk of both household resource deprivation and child malnutrition. The works of (GSS, 2015) associated scarcity of household resources for food with predominantly, the Northern Region and rural settings in particular. Thus, it is imperative to learn the sociodemographic and food insecurity related susceptibility posed to children of households in the Tamale South.

1.3 Significance of the study

This study seeks to assess the extent of the link between household food insecurity and nutritional status. Findings from this study would be relevant to the government, non-governmental organizations, and other interested parties that are engaged in the areas of child nutrition and food security. The Ministry of Food and Agriculture (MoFA) and UN's Food and Agriculture Organization (FAO) could add the food security estimates made in this study as surveillance data for the tamale South. Findings on the association between the nutritional status of under-five children and the level of household food insecurity in Tamale south would guide Ghana health Service and MoFA to tailor nutrition education as well as livelihood empowerment activities. The data when generated may also be useful in the formulation of health and nutrition policies geared towards enhancing levels of household food security and subsequently, child nutrition.

1.4 Research Questions

1.4.1 Main question

What is the association between nutritional status of children under 5 years and the level of household food insecurity in Tamale south?

1.4.2 Specific Research Questions

1. What is the food security levels of households of selected participants in the Tamale South District?
2. What is the respective prevalence of underweight, wasting, and stunting among children 6 – 59 months in the Tamale South District?

3. What is the relationship between the socio-demographic characteristics of mother-child pairs and the nutritional status of children 6 – 59 months in the Tamale South District?
4. What is the association between nutritional status of children 6 – 59 months and household food insecurity status of mother-child pairs and in the Tamale South District?

1.5 Research Objectives

1.5.1 Principal Research Objective

This study sought to assess the association between the nutritional status of children 6 – 59 months and level of household food insecurity in the Tamale South District?

1.5.2 Specific Research Objectives

1.5.2.1 Descriptive objectives

- To assess prevalence of household food insecurity.
- To assess prevalence of child anthropometric indicators [stunting (Height-for-Age), wasting (Weight-for-Height), and underweight (Weight-for-Age)].

1.5.2.2 Analytic objectives

- To assess association between sociodemographic characteristics of mother-child pairs and child nutritional status (anthropometric indicators).
- To evaluate association between child nutritional status (anthropometric indicators) and household food security status.

1.6 Null Hypotheses

- There is no relationship between sociodemographic characteristics of mother-child pairs and child nutritional status (anthropometric indicators).
- There is no association between household food insecurity status and child nutritional status (anthropometric indicators).

1.7 Conceptual model

Conceptually, this study will examine factors that determine childhood malnutrition in Tamale-South. Socio demographic factors of mother/caregiver may influence childhood malnutrition as shown in figure1. These factors are likely to affect income level, knowledge on the importance of a healthy and adequate diet, her level of support and care can contribute to child malnutrition. A mother with good knowledge of nutrition may make the best choices when it comes to what food, what quantity and quality of diet is suitable for the child.

Also, children from a household of good socio-economic status may have access to a good, quality, and healthy diet compared to those from low socio-socioeconomic status. Moreover, mothers or caregivers who are married may receive support from husbands in terms of finance and provision of adequate food. Household food security is very crucial because it directly affects the individual's dietary intake. When there is food insecurity in the household, then this can consequently lead to poor dietary intake and ultimately lead to child malnutrition.

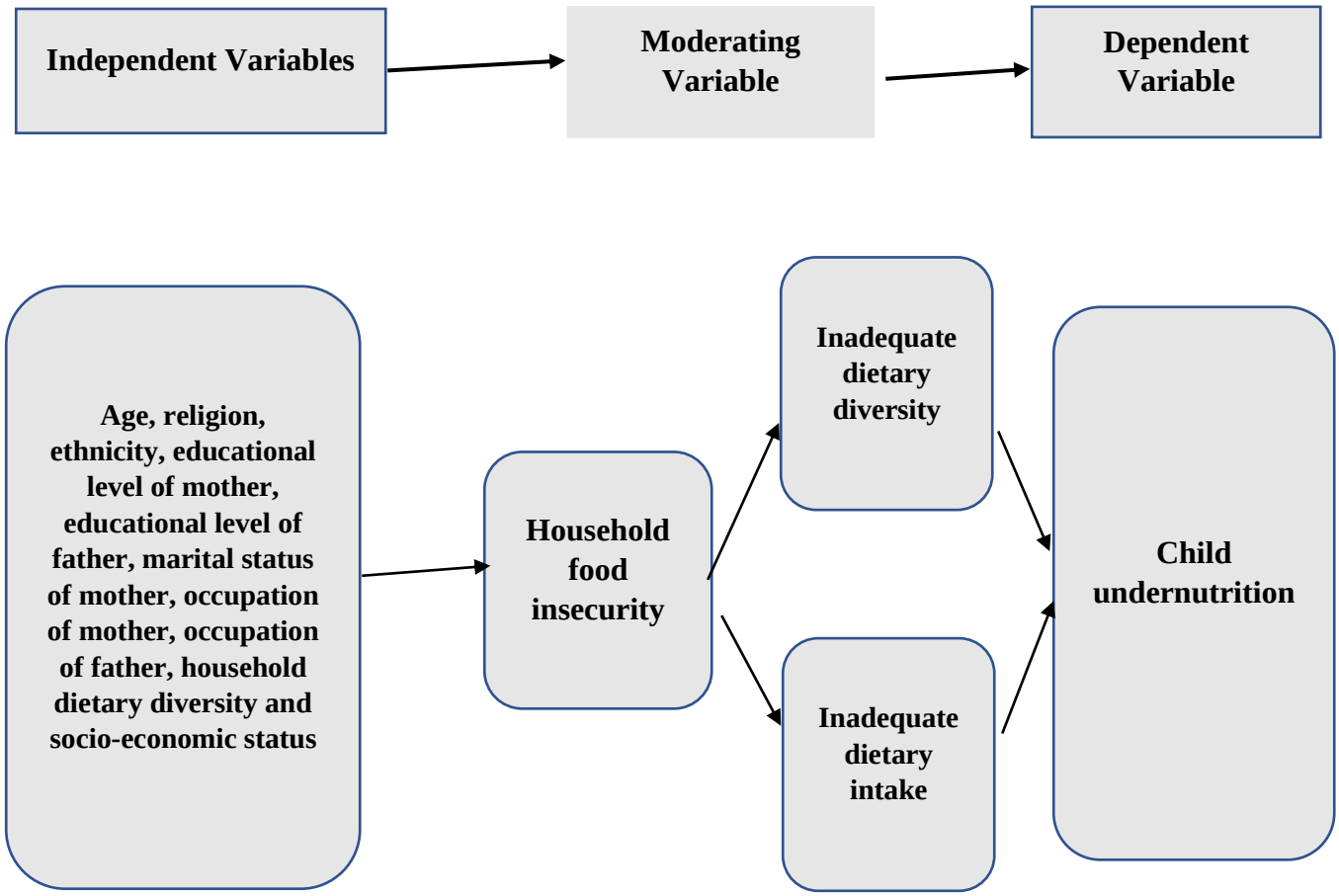

Figure 1: Conceptual Framework of The Relationship Between Child Nutritional Status, Dietary Intake/Diversity, Food Security and Background Characteristics

CHAPTER TWO

LITERATURE REVIEW

This chapter presents a review of relevant literature on food security, household food security, nutritional status of under-five children, and its association with household food security. The socio-demographic determinants of child malnutrition were also reviewed.

2.1 The Definition and Concept of food security

2.1.1 Food security

Food security has got several definitions as a result of its dynamic nature over time (Hoddinott, 1999). The concept of food security evolved in mid 1970 during the discussions of the food crisis globally (Maxwell & Wiebe, 1999). Previously, as stated by the UN in 1974, the focus of food security was on price stability and food supply of basic consumable food items. The United Nations, defined food security as the "availability of at all times of adequate food supplies of basic foodstuffs to sustain a steady expansion of food consumption and to offset fluctuations in production and prices" (UN, 1975). The UN definition only shows the availability of adequate food on a global scale; it does not necessarily imply that the food is accessible and available in sufficient quantities at the individual or household level, and it only proposes price stability as a means of ensuring entitlement to foodstuff.

As a result, the FAO took on the challenge of reshaping the conception of food security in 1983 to encompass securing food access to people in vulnerable groups to the available food supply. To put it another way, the definition attempted to retain the existing equilibrium between the supply and demand sides of the food security equation. The definition is quoted as "ensuring

that all people at all times have both physical and economic access to the basic food that they need" (FAO, 1983). In spite of these new inputs, the definition failed to elaborate sufficiency of the food. It does not explain whether the food is adequate or not and to what level the food consumed has nutritional value for active work. As a result, the World Bank introduced another concept of the definition of food security. The definition included the detailed sense of food security and outlines vividly the difference between transitory and chronic food insecurity which are a result of conflict, natural disasters, and crisis in the economy (Maxwell & Wiebe, 1999). According to Reutlinger (1986), food security is stated as "access of all people at all times to enough food for an active, healthy life."(Reutlinger, 1986). The definition takes food availability and accessibility as an integral essential element.

The definition of food security has now been agreed upon after several submissions from around the world since the World Food Conference in 1974 and is based on several decades of work. The World Food Summit (WFS) in the year 1996 defined food security as "when all people at all times, have physical and economic access to sufficient, safe and nutritious food to meet their dietary needs and food preferences for an active and healthy life" (Shaw, 2007). Food accessibility is defined as the capacity to acquire a suitable and nutritionally adequate diet, and it is particularly related to household resources. The physiological capability of the body to effectively convert food into energy is termed the biological utilization domain of food security, and it is related to individual food security.

Based on the definitions provided above, there are four concepts that are contained in the concept of securing access to sufficient food all year round. The first is adequate food access; which is defined as the individual's entitlement to purchase, produce, exchange, or receive food as a gift. The second is food sufficiency; which is defined as the quantum of calories and quality of foods in nutrients needed for a healthy and active life. The third is security; which refers to

maintaining a balance between risk, insurance, and vulnerability. Time is the fourth component and is defined as the condition under which food insecurity could be long-term (chronic), short-term (acute), cyclical or transitory. The definition provided by the FAO is consistent with the purpose of this study i.e. to assess food insecurity (access dimension) with HFIAS. Therefore, food security refers to "when all people, at all times, have physical, social and economic access to sufficient, safe and nutritious food which meets their dietary needs and food preferences for an active and healthy life."

2.1.2 Food Security Fundamentals

When members of a household have year-round access to the variety and quantity of safe foods they need for a healthy and active lifestyle, this is an index of food security at the household level. Household available foods should be shared while taking needs of individual household members into account; the food should be adequate in terms of variety, safety, and of good quality, and family members should be healthy and fit to be able to utilize the food he or she has consumed (Maxwell et al., 2013).

The broad concept of food security includes that it encompasses nature issues, food quality, and food security supply, and food accessibility. The WHO outlined three key elements which are essential in the definition of food security (WHO, 2018).

First and foremost, food access must be improved. In terms of food security, this is essentially the strategy that households use to obtain food. Food can be obtained by households and individuals through a variety of means, including production, purchase, gifs, and national safety net mechanisms. Access can also be defined as the capacity of individuals or whole households to purchase physically available food in the local market.

The second important factor is to increase food availability. Basically, availability is a term used to describe the quality and quantity of food available to people in terms of protein, energy, carbohydrates, and micronutrients on a long-term basis. Household availability is defined as the ability to obtain something, which is primarily satisfied through production. All activities of the household to improve food supply or food production in the agricultural sector may be included in a food availability strategy

Thirdly, make proper use of the available foods. Households that are food insecure tend to have a large size with high dependency ratio. Food should be used appropriately in the family to meet the food requirements of households (WHO, 2018).

2.1.3 The Significance of Measuring Household Food Insecurity

Food insecurity is not only a challenge in some parts of the world, but it is a major issue in all of them. Food insecurity is a challenge in every part of the world, according to studies aimed at developing useful and realistic measures of food insecurity (Jennifer Coates et al., 2006). The assessment of food insecurity necessitates measures that can elaborate food deprivation causes and systems, as well as the susceptibility to deprivation specific to the particular people and area. Measuring food security aids in the investigation of its processes, improves and promotes precision as well as clarity through standardization. Food insecurity's multifaceted nature necessitates that it be captured accurately to make sure that its constituents are not overlooked. On the other hand, malnutrition and hunger, are unmistakably the direct effects of food insecurity, and they have serious consequences for whole societies, households, and individuals. The Millennium Project Hunger Task Force purported that, productivity and labor losses due to hunger and malnutrition are in the range of 6% to 10% of GDP, and noteworthy declines in children's cognitive development are also intricately linked to malnutrition.

Furthermore, the report claimed that hungry or food-insured people are frequently subjected to political and social segregation. According to a previous study, the challenges of household food insecurity include physical impairment due to hunger and sickness, psychological stress, and socio-familial disruptions. (Hamelin et al., 2002).

Given that several regions around the globe face the challenges of food insecurity and its severe consequences, it is critical to investigate its relationship with children's nutritional status.

2.1.4 Measures of Household Food Security

Mostly the measurement of household food security is indirect; it's based on national income distribution, food balanced sheets, and consumer expenditure income. Associating hunger with an inadequate intake of food allows us to measure availability, consumption of staple foods or energy intake when it comes to food insecurity. This corresponds to previous definitions of chronic food insecurity. To measure this, the proportion of households in a community who do not take in adequate dietary calorie/energy is calculated. In order to measure that, one must determine whether a household gets adequate food within a given reference period to meet the dietary calorie (energy) requirement of all the members in the household. In case the approximate total energy (calorie) in the household's daily diet is less than the sum of nutrient requirements for the said household then that particular household maybe classified as food energy deficient (Kakwani & Son, 2016).

2.1.5 Tools for measuring Household Food Security

The Household Consumption and Expenditure Surveys (HCES), Household Hunger Scale (HHS), Food Insecurity Experience Scale (HFIES) and flagship Household Food Insecurity

Access Scale (**HFIAS**) being adopted for use in this study are just a few examples of validated household level food security assessment tools (Jones et al., 2013; Maxwell et al., 2013)**.**

Household Food Insecurity Access Scale [HFIAS (FANTA & FHI 360 v.III, Washington DC, US)] was developed to determine the food access dimensions of food insecurity in a household. The said tool was developed by a joint platform involving experts from FANTA and 'FHI 360'organizations (Coates et al, 2007). This food insecurity measurement tool was initially adapted from United States Food Security Survey Module (USFSSM); a tool used to assess food security but with more domains of food insecurity relative to HFIAS. The development of HFIAS was based on the premise that certain reactions, anxieties, perceptions, and behaviours become apparent among a cohort of people that have experienced food insecurity, and as such these areas were developed into a suitable scale.

HFIAS is unidimensional; it measures the food access domains of food security and as such when 'food Insecurity' is written with reference to HFIAS, 'access' is written in brackets after it. HFIAS can be used for geographical targeting of the food insecure and evaluation (both process and impact) of food and nutrition programmes. The tool can detect changes in food insecurity over long periods of time. However, HFIAS does not measure the food utilization and food production dimensions of food security. In addition, the measurement of diet quality is based on perceptions rather than actual counts of food intake. Thus, it is recommended that researchers should triangulate responses of HFIAS with anthropometric data that assess food utilization and food consumption tools (*like* 24HrR) that assess the quantum and diversity of food intake (FANTA, 2004). HFIAS contains nine (9) food insecurity (access) occurrence questions with each containing a sub-question that elicits frequency-of-occurrence (*how often does it happen? rarely, sometimes, and often*). The occurrence questions are divided into three main domains viz: anxiety about not being food secure, perceptions of food inadequacies (both

quality and quantity) as well as behavioural modifications in response to food insecurity situation (Coates et al, 2007; Coates et al, 2005).

The HFIAS module is administered based on a recall period of 1-month or four weeks. The originators of HFIAS also recommend that subsequent studies adopt the sampling strategies used for testing and verification of the tool.

Another renowned food security tool is Household Food Insecurity Experience Scale (HFIES) which assesses household experiences in obtaining food (Ballard et al., 2013). It was made up of eight questions that captured a variety of food insecurity indicators in descending order of severity. All the questions are dichotomous with yes/no responses. Based on the eight (8) questions regarding their access to adequate foods, the level of severity of food insecurity was categorized as mild (1-3 raw scores), moderate (4-6 raw scores), and severe (7 or 8 raw scores) (Boulom et al., 2020). A household with a score of zero (0) was considered food secure. The FIES module is administered based on a recall period of either 1-month or 12-months. The HFIES's main strength is that it generates population-level estimates of food insecurity that are comparable across countries, cultures, and subpopulations (Jones et al., 2013), and its validity had also been tested in Sub-Saharan Africa, including Ghana (Wambogo et al., 2018).

2.2 Nutritional Status of Children

Nutrition is an essential factor that affects peoples' health whether poor or rich. However, malnutrition makes people susceptible to morbidity and premature death (Pinstrup-Andersen, 2012). The meaning of malnutrition is "bad nutrition" and includes both undernutrition and overnutrition. The main source of concern in low-resource settings is undernutrition, despite the fact that there has been an alarming rate of overnutrition in recent years due to changes in eating habits and industrialization. Unless otherwise specified, malnutrition is classified as

nutrition by the World Food Program (WFP). When it comes to malnutrition, children are the most vulnerable because they are more susceptible to adverse environments. Also, they are vulnerable to malnutrition because they respond quickly to dietary changes and are more at risk of being ill which consequently leads to loss of weight.

2.2.1 Prevalence of Childhood Obesity and Overweight

Overweight and obesity in children is now a public health problem that affects both high and low resource settings (United Nations Children's Fund (UNICEF), W. H. O., 2016). Globally, the increasing rate of obesity in childhood remains a public health challenge. The estimated overweight or obesity prevalence for the Global burden of disease in low-middle income countries in the year 2013 were 22.6% and 23.8% of girls and boys respectively (Akowuah & Kobia-Acquah, 2020). Evidence from current studies indicates that the prevalence of obesity among school-aged children in Sub-Saharan countries is alarming. In Ghana, studies have shown that there is a significant rise in overweight and obesity among children over the past decades.

Obesity in the pediatric population has been found to be around 7% worldwide and 18.5 percent in the United States, respectively. Furthermore, from 1988 to 2008, the prevalence of childhood obesity increased from less than 1% to 5%. It is also noteworthy that previous research indicates an increasing prevalence of childhood obesity in the country. (Amidu et al., 2013). About 17.4% prevalence of obesity in children under five years was found in a previous study (Mogre et al., 2013).

Furthermore, so far there have been variations in terms of the prevalence values reported for both obesity and overweight in children. Concerning obesity, a range of 0.7% and 47.06% have been reported whereas 0.8% and 33.66% range has also been reported for overweight (Atsu et

al., 2017). The discrepancies in the prevalence reported about childhood obesity could be attributed to variations in dietary patterns and lifestyles across regions.

The wide range of consequences that being overweight or obese has on human health cannot be overstated. To ensure the success of public health interventions, overweight or obesity in the early stages of life should be avoided, and risk factors in the local context that can be modified should be identified. Obesity in children may be caused by a combination of risk factors at the individual, behavioural, and environmental levels. Obesity in children has been associated with an increased risk of cardiovascular disease (Gupta et al., 2012). Some research also suggests that childhood obesity or overweight may lead to adult obesity. Furthermore, obese children are more likely to develop conditions such as hypertension, type 2 diabetes, high cholesterol, and orthopaedic problems. According to studies, approximately 41 million people worldwide suffer from obesity and overweight, with Africa accounting for roughly a quarter of them (Akowuah & Kobia-Acquah, 2020).

2.2.3 Underweight, wasting and stunting in children

Malnutrition does not cease to be a major public health threat in developing countries. Fundamentally, having sufficient nutrition is vital for proper growth, development as well as survival (Latham, 1997). It has been estimated that 186 million and 55 million children who are under-five years are stunted and wasted respectively. In Ghana, the recent demographic and health survey shows that 18.8% are stunted, 11.0% are underweight and 4.7% are wasted (WHO, 2016). Undernutrition has got several consequences such as high risks of disease, poor cognitive development, poor performance in school, poor productivity, high risks of childhood mortality, and high risks of chronic disease in later adulthood (Black et al., 2008). Some of the

causes of undernutrition are diets of poor quality and have fewer calories and essential nutrients including consistent infections (GSS, 2016).

2.3 Association between Household food Security and Nutritional Status of Children

Prior research has discovered that household food insecurity has an adverse impact on food consumption, including nutrient intake, dietary diversity, and, most importantly, the nutritional status of household members. Nonetheless, research on these topics has yielded mixed results. While some researchers have found positive links between children's nutritional status and household food insecurity, others found the opposite. A study conducted in Southern Ethiopia found that food insecure households had the highest percentage of malnourished children. Another study in Nepal found that food insecure households had a higher prevalence of underweight and stunting (Pandey & Fusaro, 2020). Similar studies were conducted in other parts of the world and results of these studies revealed that household food security was not having significant associations with the nutritional status of children. Several studies report statically significant associations between the nutritional status of children and household food insecurity (Osei et al., 2010).

2.3.1 Relationship between sociodemographic, food security, and DDS

The key factors that influence the growth and development of a healthy child are good feeding practices and optimum nutrition (Michaelsen, 2000; Pomerleau & World Health Organization, 2001). The most critical period of a child's life to prevent micronutrient deficiencies and infection is from birth to 2 years. Thus, to meet the nutrient requirement of a child, adequate nutrient intake is basic(Dewey, 2003; World Health Organization, 2008). Studies have shown that how diversified a diet is would determine the adequacy and the quality of diet for children who are young (Dickson Abanimi Amugsi et al., 2015). A diverse diet has to do with the

consumption of the different food items which is likely to increase the adequacy of nutrients among children which more improves their brain and physical development (Hatløy et al., 1998; Torheim et al., 2004). The World Health Organisation (WHO), has acknowledged dietary diversity to be a reliable and simple proxy measure of a child's feeding practices for the adequacy of child intake of nutrients (World Health Organization, 2010).

Previous research indicates that inadequate dietary diversity is common among the population of low socioeconomic status as they often consume diets rich in starch with less animal products and few intakes of fruits and vegetables (Arimond M, 2004). Prior studies have found a significant association between dietary diversity with sociodemographic and socioeconomic characteristics (Arimond M, 2004). This is possible as people coming from high-income households are more likely to eat diversified foods compared to people from low-income households. This may be due to the fact that they are more exposed to resources and good environmental conditions (Leatherman, 1994).

Furthermore, there are different and complex cultural factors that are special to societies and can influence the feeding practices of children (Sika-Bright, 2010). For instance, in Pakistan infants are denied various kinds of nutritious food because of the misconception that they will lead to an infection (Memon et al., 2006) and the perception that the child does not have the capacity to breakdown food except breast milk (Arif et al., 2015). A litany of researches has assessed the link between DDS and socioeconomic characteristics at the household level (Sika-Bright, 2010).

In low middle-income countries, nutrient adequacy among children is a common indicator by using the dietary diversity score (DDS). Several approaches have been adopted to estimate the

DDS such as simple food count, weight-based food group count, and group food count (Dickson A Amugsi et al., 2016; Iqbal et al., 2017)

One of the strategies to ensure a child meets his/her optimal nutrient intake and to ensure dietary adequacy is dietary diversity. Several researches in both high- and low- and middle-income countries have established a link between the indicators of dietary diversity (DD) and improvement in terms of nutrient intake (Arimond M, 2004). It has been recognized in 11 demographic surveys that, dietary diversity is positively associated with sociodemographic factors when some factors such individual level factors, maternal, household, and the community (Kennedy et al., 2007).

Studies conducted previously show that lower dietary diversity is common among children coming from poor households. This is mostly because, their meals are based on starches with littles protein-rich foods (Moursi et al., 2008).

Studies have shown that during moon season children from households that are food secured have a high dietary diversity score compared to households that are food unsecured (Robinson et al., 2007; Sawadogo et al., 2010). Some of the explanations for the escalating household food insecurity in most low and middle-income countries include low levels of agricultural production, poverty, alarming food prices, and natural disasters (Xiao et al., 2011). Studies in Bangladesh confirm the alarming rate of food insecurity and poor growth among children. Households food security has also been shown to be associated with agricultural production in several studies (Birhane et al., 2014; Gelli et al., 2017). The availability and accessibility of foods can be improved when there is an improvement in the level of agricultural production.

A prior study in Napal revealed that unit increase in the food group which a household produces leads to an increase in the log odds of achieving the minimum dietary diversity by 0.25 at a p-

value of 0.01. When their diversification in terms of household food production, there is an improvement in household consumption of fruits and vegetables, poultry, and dairy intake (Mulmi et al., 2017).

2.3.2 Relationship between sociodemographic, food security and Weight for Height

Acute malnutrition (SAM) is composed of wasting and oedema. Basically, children are considered as wasted when their weight for length/height z score is lower than minus two standard deviations from the median of the reference population and the mid-upper arm circumference (MUAC) is lower than 12.5cm. SAM is a public health problem of international concern. Wasting is prevalent among children under-five years worldwide affecting 52 million children with about 17 million being severely wasted (UNICEF, 2019). Evidence has shown that about 4.3 million severely wasted children globally are residing in Africa (UNICEF, 2019). Moreover, undernutrition has been reported to affect about 3.1 million children leading to death. Studies have shown that, when there is no effective treatment, SAM can lead to 4.4% of all child mortality (Bhutta et al., 2013).

It is a global priority to reduce the prevalence of wasting and stunting in children under the age of five. According to WHO and UNICEF estimates, wasting affects 50 million children, with 16 million of them being severely wasted, and stunting affects 156 million children. Around 800,000 deaths are linked to wasting each year, with severe wasting accounting for about 60% of deaths and stunting accounting for over one million. Stunting/wasting has been linked to a loss of 64.6 and 54.9 disability adjusted life years, according to studies. Global reports show a significant amelioration of the prevalence of childhood stunting, but not in African countries. Countries ultimately to meet the goals of the world assembly of 40% childhood stunting decrease.

2.3.3 Relationship between sociodemographic, food security, and height for age

Low height for age happens when there is inadequate nutrition for a long time which can lead to chronic undernutrition. Children are described as stunted if their height for age z score is less than minus two standard deviations from the median of the reference population (Ethiopian Demographic and Health Survey, 2016). Recurrent and chronic infection can result in stunting which shows inadequate nutrition for a long period of time.

Malnutrition contributes to a significant part of public health challenges as well as economic problems. When there is an enhancement in nutrition, poverty will decline significantly and health, education, and employment goals will be archived (WHO, 2014). Studies have shown a high prevalence of undernutrition among children in low and middle countries which causes a significant rise in death and burden of disease (Black et al., 2008). About 25% of all children under five years are estimated to be stunted and one-third of all these children are living in Africa (World Hunger and Poverty Statistics, 2016). The areas with the highest prevalence of stunting are 36% in South Asia and 34% in Sub-Saharan Africa. According to the World Bank, the prevalence of stunting as of 2017 in Ghana was 17.5 among children under five years (World Bank, 2017).

Several reports have been reported on the prevalence of stunting in both high and low-middle-income countries. Some of these studies may include Nigeria (36.7%) (Akombi et al., 2017), Northwest Ethiopia (38.3%) (Motbainor et al., 2015), and Nepal (38%) (Dorsey et al., 2018), and Eastern Ethiopia (45.8%) (Yisak et al., 2015).

2.3.4 Relationship between sociodemographic, food security and weight for age

Malnutrition is among the leading causes of infant and under-five mortalities. Undernutrition has been linked to a high rate of death among children, according to studies. In 2016, it was estimated that 22.2 percent of children worldwide were stunted, with 7.5 percent having a higher risk of becoming stunted in the same year. Around 39 percent of all children under the age of five in low and middle-income countries are stunted, and 27% are at risk of dying. (World Health Organization, 2017).

Poor diet, infections, socioeconomic, and environmental factors are all possible causes of malnutrition. In addition, studies in low and middle-income countries have identified the following factors as determinants of child malnutrition: the child's age, sex, vaccination, birth weight, birth order, and birth spacing, the household wealth index, potable water, improved and enhanced hygiene and sanitation, and the size and structure of the family. (Alam et al., 2017; Chalashika et al., 2017; Habyarimana, 2016; Sulaiman et al., 2018; Talukder, 2017)

The effects of malnutrition have been reported in most studies. Some of these consequences may include poor brain and social development, growth faltering, poor performance in school, high risk of disease and death as well as decreased productivity in the future (World Health Organization, 2019; Pelletier et al., 1995).

Stunting is associated with bad environmental conditions and constant exposure to poor conditions that can lead to poor nutrition in pregnant women and childhood (Smith & Haddad, 2014). Wasting increases the risk of death and it’s the consequence of inadequate intake of food and infection (Fotso & Kuate-Defo, 2006). Nonetheless, children's nutritional status can be used as an indicator for determining the health of populations. This is because indicators for

early childhood are sensitive to food security conditions, changes in terms of the environment, economy, and policies (Bhandari & Chhetri, 2013; Cunha et al., 2018; Singh et al., 2016).

Reports from the 2014 Ghana Demographic and Health Survey (GSS; GHS; ICF International, 2015) reveal a decrease in mortality rates among infants, neonates, and young children. Likewise, the prevalence of malnutrition has reduced over that period yet, it is still alarming. Little progress is being made regarding being underweight whereas wasting and stunting are still having a negative influence on children under five years. Resultantly, small and large-studies have both examined the factors that affect children undernutrition (Darteh et al., 2017; Nikoi & Anthamatten, 2013; Tette et al., 2016).

2.3.5 Relationship between sociodemographic, food security and MUAC

Household food insecurity is basically when a household has insufficient or limited economic as well as physical access to secure adequate amounts of nutritious foods that are safe, healthy, and socially acceptable in order for household members to maintain a healthy and active life (Furness et al., 2004). Based on this definition, household food insecurity basically has two broad concepts; inadequate access to nutritious and safe food supply at the level of the household and insufficient utilization of this food by the members of the household (Jennifer Coates et al., 2006, 2007; Furness et al., 2004). Some of the variables that may have an impact. In terms of the access component, three domains are known: uncertainty about the household's food supply, insufficient food intake, and poor food quality by household members. Health care access, nutritional knowledge, beliefs, water, and sanitation are some of the factors that may influence the component that has to do with utilization (Jennifer Coates et al., 2007). Food insecurity in the household can have a negative impact on the consumption of food which includes; a decreased variety of diet, intake of nutrients, and nutritional status of members in

the household. Previous studies have found insignificant associations between food insecurity in the household and growth indicators of the child. Also, a negative association was found among children on weight and again height.

Studies have shown that food insecurity is still a problem and has been a public health concern in low and middle-income counties. Reports from the food and Agricultural Organization reveal that 12% of the world's population are not able to meet their energy requirements concerning their diet. Thus, one in eight people is more at risk of suffering from chronic food deficiency and lacking adequate food for a healthy and active life (Food and Agriculture Organization, 2013). Even though the rates of malnutrition seem to be decreasing worldwide, the observed discrepancy between 2010 and 2012 was 0.6% and 14.3% between 2011 and 2012 according to reports in low and middle-income countries (Food and Agriculture Organization, 2013; McGuire, 2013).

Prior researches have reported a high prevalence of food insecurity in several parts of the world. For example in Los Angeles, the level of food insecurity was 24.4 (Furness et al., 2004). A study in Canada revealed household food insecurity to be 33% (Veugelers et al., 2009). Studies have reported have shown high rates of disease burden and deaths among children suffering from malnutrition (UNICEF, 2013). Research evidence reveals that the major risk factor in children under five years is malnutrition (Aguayo et al., 2017; Ahmadi et al., 2018). Most often, malnutrition in the child is described with 4 indicators; low height for age, low weight for height, low weight for age, and BMI for age (Akinbami et al., 2017). The reflection of the cumulative consequence of diseases and poor nutrition prior to or from birth is low height for age (stunting). Wasting on the other hand is used to describe acute malnutrition and it is mostly as a result of inadequate food intake or onset of diseases. Low BMI for age and underweight is linked with mortality in children. Child stunting is regarded as the most prevalent form of

malnutrition since millions of children are suffering from its worldwide (De Onis & Branca, 2016). The effects of malnutrition on children maybe on their physical growth, brain development, social and psychological development (Candler et al., 2017).

The sex and age of the child are critical factors in determining stunting in children. Prior research on chronic malnutrition has revealed how nutritional status changes across a range of ages. Dietary diversity in children must be maintained in order to contribute directly to growth and brain development. The findings of the study revealed a significant relationship between child anthropometric status and maternal characteristics such as level of education, dietary diversity, breastfeeding, mid-upper-arm circumference, and complementary feeding adequacy.

2.4 Factors responsible for child malnutrition

2.4.1 Income and ethnicity and nutritional status

Household income plays a vital role in determining childhood health and nutrition, though there is a little uncertainty. To determine the impact that ethnicity and race have on nutritional status, a study was undertaken in the United States of America. Overweight was the criteria used in measuring malnutrition in this study. It was seen that the proportion of overweight in children from African backgrounds was higher than other children. Also, American-Mexican boys have a lesser chance of about 6%-7% of not being overweight than that of African girls (Freedman et al., 2006).

It was seen that children from wealthier families in less developed and developing countries were predisposed to being overweight relative to the poor families because of eating less nutritious but expensive fast foods. Likely wise in the developed countries, the rich people select healthy foods and the poor eat traditional and non-nutritious foods (Goisis, 2019).

A survey conducted in 12 countries shows that malnutrition reduces by an equal margin when there is an increment in the income level of the individual household or the nation as a whole (Haddad, 2003). In northwestern Tanzania, Alderman et al. estimated the predictors of a child's nutritional status using four-round panel data set (Alderman et al., 2005). The outcome shows that there is a positive relationship between good nutrition and higher income.

Studies reveal that, the unfair distribution of economic and social environmental plays a vital role in malnutrition (Lokshin et al., 2005). According to a study conducted by Hacket et al to assess the determinants of child anthropometrics among poor Colombian children living in small municipalities; the authors talked about the effect public infrastructure and household consumption have on childhood malnutrition (Hackett et al., 2009). Considering household consumption two instruments were used: household asset and municipality average wage.

In the selfsame study, it was discovered that, in assessing a child's nutritional status, household assets and municipality average wage plays a vital role. They also found that the availability of a pipe water network in the community positively affects the health of the child if the parents are educated.

2.4.2 Sex of the Child

The sex of the child is another factor within the household. Many studies revealed that due to societal differences and beliefs mothers prefer to give certain nutrients to their sons. However, Sen and Sengupta at Sankantiniketen in west Bengal carried out a study on the nutritional status of children aged under five years in two villages of Sahajapur and kuchli. The study revealed that the incidence of girls undernourished with severe and disastrous types was high whiles the reverse is true for boys (Sen and Sengupta, 1983). How surprising is it for such villages with good nutritional records to have such high sex discrimination against girls. Kuchli land has

seemed not to be beneficial to girls and rather boys. However, the nutritional statuses of girls in these two villages were approximately equal though kuchli nutritional status is better than sahajabur.

In Pakistan, malnutrition among girls is higher than in boys showing the level of sex discrimination against girls. The study shows that family income and feeding practices have a link with gender bias (Arif et al., 2012). Also, in a study to examine the spatial distribution of nutritional status of children less than 3 years by Bharati et al. using Indians national family health survey-2 data through Z-score of weight-for-age, HAZ and WAZ (Bharati et al., 2008): The regression results show that gender difference cannot be declared authoritatively and excluding age and socio-demographic variables make it nearly null.

2.4.3 Maternal Characteristics

Parents, especially mothers are generally concerned about giving better healthcare to their children to achieve better health status and their needs (Ettinger, 2004). Also, mothers are considered health care workers due to the premium they put on the child's health. Hence, the individual characteristics of women such as employment status, their education, and health care attitude have a bearing on child health.

2.4.4 Maternal education

A lot of researches have been carried out on the link between child nutritional status and mother's education and employment status. However, researchers have been categorized into groups on the influence maternal characteristics have on childhood malnutrition. Many studies have revealed positive linear relationship between a mother's education and the nutritional status of children. It has been accepted that mother education exposed her to knowledge and

awareness, good hygiene, and feeding practices (Webb, 2006). It has been revealed that educated mothers have their children nourished than illiterates. Studies conducted in Indonesia found that mothers' education is a great indicator of their child nutritional changes over time (Waters et al., 2004). Sahn and Stifle found that, in South Africa, the number of years the father spent in school greatly affect his son's nutritional level and that of the mother on her daughter's nutritional level (Sahn and Stifel, 2002). Research in Nigeria proposed that the presence of public health programs and women's educational programs policies in other decrease child malnutrition (Ajieroh, 2009). Lindelow shows that educational attainment of other households should be included and not only the individuals' education in Mozambique patronage of health services (Lindelow, 2008)

2.4.5 Maternal Employment Status

The influence of maternal employment on malnutrition in children is a matter of argument, for it is not always true that well-nourished children belong to employed mothers. However, the more women are engaging in the labour force they would automatically be empowered which would help them to think well on better child feeding and other practices. Women empowerment is hypothesized to influence the child's nourishment through access to and utilization of food and medical care. On the other hand, many studies have revealed that mothers may give less attention and care to their babies due to the high demand nature of their occupation, which can be a contributory factor to the malnourishment of the child.

Leon and younger in Ecuador found that the receipt of a transfer of payment by mother has no significant influence on the nutritional status of children (Leon and younger, 2007). A study conducted in the United States revealed that maternal employment makes insignificant

difference in the health of children (Black et al., 2013). However, any positive effect can be attributed to the availability of other resources, financial resources inclusive.

Researchers have concluded that increases in the level of maternal employment through urbanization and modernization have led to the improvement of child's health by reducing childcare costs. According to Berman et al. mothers from the poor household if employed would help to increase the household income, and hence her child's health would be improved (Berman et al., 1997). Maternal employment would help to add additional income to the household which can be used to buy clothing, medical care, and food which collectively help to improve a child's health.

Huston and Aronson relationship between maternal employment and the time mothers spent with their babies (Huston and Aronson, 2005). Employed mothers spent less time with their babies than unemployed mothers however, the quality of the less time they spent with the babies is greater than unemployed mothers. Employed mothers pay more attention and care to their babies within the little time they spent with them as compared to unemployed mothers. So, therefore, the negative effect of the time employed mothers spent on their babies becomes null by the quality of time they spent on their babies.

On the other hand, other schools of thought argued that the health of the child becomes worsen and increases their mortality rate if the mother is employed. However, other research cited above believes that this is due to shortage of time allocated for childcare and breastfeeding (Jatrana, 2003; Sivakami, 1997).

A case study in Dhaka revealed that mothers who are employed outside home have a strong relation with severe malnutrition in children (Islam, 1994). The study again revealed that full time maternal employment adversely reduces vitamin A levels in children less than six years.

2.4.6 Mothers' Health Awareness and Childhood Nutrition

Access to and utilization of optimum maternal health services is an important variable to pregnant mothers. Also, a study in morocco revealed that the health knowledge of mothers about pregnancy is a serious determinant of her child health seeking attitude (Joshua, 2012)

Seeking antenatal care is proven not to ensure only safe delivery but better growth rates among children (WHO, 2020). Good antenatal care has a good effect on child health and its utilization is determined by the mothers' educational attainments and access to new, among others. Hence the use of antenatal care is reliant on mothers' education attainments. Halim et al found that children would become healthy when mothers utilize proper antenatal care and maintain good health.

2.4.7 Other Maternal Characteristics

Tharakan et al. perform regression analysis on the data of Botsawana and revealed the role other vital factors contribute in malnutrition in children (Tharakan et al., 1999). They therefore grouped these factors into biological, morbidity, cultural, and economic factors. Data such as the educational level of the mother and father, age, birth weight, duration of breastfeeding, and sex of the child have been discussed. In other to develop an interventional approach to reducing malnutrition in children the above factors should be considered together with other additional factors such as consumption of staple foods, cereals, and grains, milk and dairy product, and incidence of diarrhoea and cough.

David et al. found that anthropometric development in children is mainly determined by household size, the age gap between older and younger siblings, and the income levels of the household (David et al., 2004). They found that maternal education was linked to nutritional

status of children in similar communities in western Honduras. A study in Nigeria on how to reduce malnutrition in children set a policy of engaging women in educational programs, sanitary environment, and clean drinking water in rural areas (Ajieroh, 2009)

A study on child stunting, wasting, and underweight in Bangladesh was related to maternal pregnancy intentions (Rahman, 2015). So, therefore, the prevention of unplanned pregnancy could help to curb the prevalence of malnutrition in children, if these relations turn to be casual. A study conducted in south India revealed that mental depression in mothers during pregnancy is an important contributor to malnutrition in children (Anoop et al., 2004)

Other factors such as domestic violence may have some psychological and physical health effects, however, there has been little proved concerning the association that exists between malnutrition and domestic violence. Ackerson et al. analyzed the data of self-reported victims of physical domestic violence using the 1998 to 1999 Indian national family health survey to find this relationship (Ackerson et al., 2008). Underweight and prevalence of anemia were the areas of nutritional status been analyzed. The classification of anemia and being underweight were measured using a blood test for hemoglobin and anthropometric measurement of the women's body mass index respectively. Also, the survey considered data on wasting and stunting of children. The results showed that anemia and being underweight were associated with domestic violence in the previous year and hence a suggested association in malnutrition in children. This finding shows that curbing domestic violence would have an instrumental health benefit and not only from moral perspective.

2.4.8 Government Initiatives

Almost all countries have a continuous problem with childhood malnutrition, hence interventional programs are being taken by governments to reduce this problem. Reddy et al. revealed that Ethiopia for a long period of time has been battling with childhood malnutrition so a goal was set to curb malnutrition by 2030 (Reddy et al., 2019). National policies such as the national nutrition strategy 2008 and national nutrition strategy 2005-2006 were implemented to lessen the prevalence of malnutrition with the set goal in mind. Semba mentioned that protein malnutrition is focused on United Nations programs (Semba, 2016). Though this intervention is not solving the problem of the pressing micronutrient deficiency. Goudet et al. in their systematic review show that the low and middle-income countries, micronutrient supplements on malnourished children do not give a strong positive impact (Goudet et al. 2019). In other to improve the nutritional development the African Union has set up the new partnership for African Development (NEPAD) whose objectives include reducing hunger and as well as improving nutritional development (Benson, 2008).

Bain et al. stated that food insecurity is an important contributor to childhood malnutrition (Bain et al., 2013). However, increasing genetically developed and modified food and improving socio-cultural conditions would help to resolve the problem of food insecurity. A study conducted by khan and Raja in Bangladesh revealed that children can be protected from malnutrition when there is improvement in water, sanitation, and hygiene (WASH) (khan and Raja, 2014). The Indonesian government has implemented certain developmental programs such as community capacity development, health insurance, and microcredit provision to help reduce malnutrition. Some programs developed in India in the quest to eliminate malnutrition include Integrated Child Development Scheme (ICDS) a nutrition program basically for children under five, pregnant and lactating mothers, and also the wheat base supplementary

nutrition program through the public distribution system (World Hunger and Poverty Statistics, 2020).

2.4.9.0 Factors affecting the Nutritional status of children

2.4.9.1 Food insecurity at the household level

Studies have shown food security to be one of the major contributors to child's malnutrition. Even though several strategies have been implemented in Africa to decline the rates of children's poor nutritional status, the situation is persisting. Some of these interventions include the provision of grants, food parcels, food integrated nutrition programmes among others. A study by Madiba et al. reported that children who are food insecure are predisposed to poor nutritional status since they depend on inappropriate food or less food (Madiba et al., 2019). Moreover, the consumption of low quantity food and monotonous diets could put children at risk of malnutrition (Ntila et al., 2017). A study in Tanzania proved that nutritional status of children is significantly influenced by seasonal food insecurity at the household level which consequently leads to a malnourished state. Likewise, a favorable relationship between child malnutrition and food insecurity at the household level was found by a previously conducted study (Agho et al., 2019). The researcher stated further that, the dietary intake of the people in the household is being influenced by food insecurity. Thus, it causes undernutrition. Many studies conducted worldwide have found similar findings and that the basic contributor of malnutrition in children is food insecurity at the household level. (Belayneh et al., 2019).

2.4.10 Income level of household

The household consumption pattern of food is being determined by their income level. For instance, a study by Shinsugi et al. found that low-income households are more likely to have a poor food consumption pattern which impacts negatively on the nutritional status of household members resulting in malnutrition in children (Shinsugi et al., 2017). A systematic review conducted previously found that low household income level has a negative effect on household nutritional status and also found a high rate of malnourished children (Mbalenhle and Melusi, 2020).

A similar finding was established in South Africa where about 2.5 million children aged below 5 years were observed to be from households that reside below the food poverty line (Illifa, 2020) When households have low-income level, they are compelled to buy foods of poor quality and nutritional value since they cannot afford to buy a healthier and nutritional diet. Consequently, children's nutritional status is being compromised as a result of that. In spite of the provision of grants to low-income households in most settings around low middle-come countries, a study conducted before found that children who took the social grant were stunted in comparison with children who did not take the social grant. Moreover, a study by Otterbach and Rogan found that social grant plays significant role in ensuring availability of food, low-income households continue to eat the food of low quality and nutritional value (Otterbach and Rogan, 2019). Thus, the intervention for social grants is not enough to address the problem of undernutrition in children. Previously, a systematic review was undertaken in low middle-income countries and asserted that the income level of household members is one of the factors which influences the nutritional status of children (Black, 2013). Another study which was conducted by Asim and Nawaz was consistent with the finding that the income level of

household members is positively associated with malnutrition in children (Asim and Nawaz, 2018).

2.4.11 Level of education of caregivers

There are several reported in the available literature which shows that the level of education of caregivers affects the nutritional status of children. A study by Nguyen et al elucidated that the level of education of caregivers affects the income level of household members thereby influencing nutritional status of children. The finding was also corroborated by a study conducted by Ji et al. who asserted that education level of caregivers negatively affects the income level of the household (Ji et al., 2017). Caregivers who have a low level of education are less likely to get jobs that are sufficiently paid. A prior study found that children who were stunted were with caregivers who had education up to primary level. The study again highlighted some of the reasons why this is so; those who are educated are better informed and well aware of health-related issues, practices of hygiene and income of the households (Phooko-Rabodiba, 2019) Thus, caregivers who are educated may not know health issues and issues related to sanitation and hygiene. This study elucidates that a caregiver's educational status is crucial in determining the nutritional status of children. Another study by Fonyuy and Jocelyne found that caregivers who lack knowledge on a balanced diet and the various nutrients which are necessary for the development of the body may contribute significantly to nutritional status of children (Fonyuy and Jocelyne, 2018).

The findings from the study above were also corroborated by Onyeneke et al. who indicated that the nutritional knowledge of caregivers is essential when it comes to the development and survival of children (Onyeneke et al., 2019). A different study conducted by Chege and Kuria found approved those caregivers who had no education may have fewer chances of having

proper nutritional knowledge which may impact negatively their children's health and nutritional status. A study by Sinha et al. elucidated those children who were living with caregivers of good nutritional knowledge were having good nutritional status compared to children who live with caregivers of poor nutritional knowledge (Sinha et al., 2017. Thus, improving caregivers' nutritional knowledge can serve as an effective factor to enhance the nutritional knowledge of children.

2.4.12 Unemployment at the household level

Several studies conducted previously showed that employment at the household level is essential in improving the children's nutritional status. Several reports of unemployment have been reported in the literature which could be as a result of a rural setting. For example, rural setting in South Africa is being considered as places with significant level of employment (Sinha et al., 2017) Studies have revealed that normally caregivers are not permitted to work to earn money and only men are allowed to work in some settings which may affect caregivers' ability to manage the foods available in the house in cases where the man fails to provide. When caregivers are employed, it affects the income level of the household and the ability of the household to buy nutritious and healthy foods which ultimately affects children's nutritional status (Monday, 2018).

By contrast, a study by Page et al asserted that the employment status of mothers does not have significant relations with children's nutritional status. This is because in cases where caregivers are not working, they get ample amount of time to take good care of the children by preparing healthy and nutritious meals for growth and development. A study by Rashad and Sharaf also supported that despite the influence of maternal employment on the income level of the household, there is still a positive relationship between child nutrition and maternal

employment (Rashad and Sharaf, 2019). Another study by Brauner-Otto et al. indicated that the work conditions of mothers play a major role in determining children's nutritional status (Brauner-Otto et al., 2019). Generally, in households where employment is high, then children's nutritional status is more likely to be compromised and are more likely to be susceptible to poor health conditions. In contrast, households with good employment status are more likely to have good nutritional status.

2.4.13 Dietary intake of the children

The diet taken in by children is a significant contributor and determinant of nutritional status of children as confirmed by previous studies. The dietary intake of children is more critical and important during the first 2 years of life (Som et al., 2018). According to some researchers, poor dietary intake may prevent the children from growing or developing properly and by putting them at high risk of illnesses and diseases that may consequently lead to bad nutritional status in children.

A study by Nasreddine found a significant relationship between inadequate dietary intake and eating foods that lack certain essential nutrients including calcium, Vitamin A, iron, folic acid, zinc among others (Nasreddine et al., 2018). When children are prone to the consumption of foods deficient in critical nutrients for growth and development develop the condition known as protein-energy malnutrition. Which is in reflection with marasmus and kwashiorkor. Low birth weight has been identified as a significant predictor of poor nutritional status by several researchers across the globe.

A study conducted by Meshram et al. opines that children with low birth weights are more likely to be stunted than children with birth weights greater than 2.5kg (Meshram et al., 2019). A study by Lestari also portrayed a significant association between stunting and low birth

weight among children who were below 5 years. In an attempt to compare the nutritional status of high-, low- and middle-income countries, one will realize that the nutritional status of those living in low- and middle-income countries are associated with several conditions such as high incidence of disease, low-income level, poor growth of the economy (Nasreddine et al., 2018). On the other hand, the nutritional status of those in high income countries is not associated with the growth of the economy or poverty but with eating disorders (Mustelin et al., 2017). The most prevalent eating disorders in this part of the world are bulimia nervosa, anorexia nervosa, and binge eating. The consequence of eating disorders is a loss in weight or obesity.

2.4.14 Child's illness and infection

Children who suffer from chronic diseases may encounter loss in appetite, absorption failure, metabolic diseases, and even changes in behaviour which may influence their nutritional status. On the contrary, children suffering from malnutrition may have problems which may increase their risk of chronic disease or adverse health conditions. Several studies and systematic reviews have identified child illness as a significant determinant of malnutrition in children. These studies are supported by other scientists who asserted that illnesses such as diarrhoea, malaria, vomiting, and fever have a negative impact on children's nutritional status. In the same way, malnutrition reduces the body's capacity to fight against infections by decreasing the function of the immune system.

2.4.15 Monotonous diet consumption

Studies have shown that consuming a monotonous diet is negatively correlated with the nutritional status of children below 5 years of age. Eating a monotonous diet involves the consumption of a diet that is not varied or diversified to contain other critical nutrients which can lead to malnutrition in children (Nyati et al., 2019). The finding of these studies is

consistent with the study by Blakstad et al. in Tanzania who found that children who were eating diet diverse in terms of nutrients were having a lower risk of malnutrition among children compared to children who were consuming monotonous diet (Blakstad et al., 2019). Research conducted by Shaakya indicated that people who consume a monotonous diet basically it's made up of carbohydrates and for that matter its nutritionally deprived (Shakya, 2017)

2.4.16 Poor Access to water and sanitation

Studies have shown that most people especially in Africa have poor access to improved sanitation and potable water. For instance, a previous study suggested that about 17.20% of households in the southern part of Africa lacks access to safe drinking water and sanitary facilities (Statistics, 2020). Poor access to improved sanitation and portable water has a negative effect on the health status of individuals, especially children. Studies conducted previously have found an association between poor water and sanitation with malnutrition among children aged 5 years and below (Otsuka, 2019). Scientific researchers worldwide have identified poor water and good sanitation to be major contributors to the poor nutritional status of children. Singh et al. in their study asserted that not having access to potable water may consequently result in poor nutritional status (Singh et al., 2019). This is because when children consume impure water, they are more vulnerable to infections and diarrhoea which may result in a compromised nutritional status. The finding of this study was supported by Ravindranath et al (Ravindranath et al., 2019).

2.4.17 Poor weaning practices

Weaning practices that are poor have been shown to be correlated with poor nutritional status. A prior study found that some weaning practices may deny the child from consuming critical and essential nutrients. Moreover, some scientists have also identified inappropriate weaning practices to be a major factor contributing to child malnutrition.

According to the WHO, children should be breastfed exclusively for six months and it should be followed by introducing nutritious foods as complementary feeding. Thus, good weaning practices are important in improving the nutritional status of children (Schoenbuchner et al., 2019). A previous study showed that children who did not undergo good weaning practices were found to be stunted and underweight (Seyda et al., 2020).

CHAPTER THREE

METHODOLOGY

3.1 Study area

Tamale is the regional capital of Ghana's Northern Region of which is divided into three subs that is tamale north, central, and south. It also serves as the capital of Tamale Metropolitan Assembly (TaMA), one of the Northern Region's 26 local government units. Moreover, Tamale was established as the capital of the British Northern Territories in the first decade of the twentieth century by the administration. The Tamale Metropolitan Area is located within longitudes 0°34′W and 0°57′W and latitudes 9°16′N and 9°34′N. The predominant tribe in the area is Dagomba with other tribes including Mamprusi, Mossi, Sissala, Fulani among others. Concerning the religious groups, Islam is the dominant faith, with some other religions like christianity and traditional religion.

3.2 Study design

The study adopted an analytical cross-sectional design in its methodological approach. In the design, a sample of individuals from the target population was enrolled and their exposures and nutritional outcomes were measured simultaneously. This reduces the need for a follow-up study and opportune the study of several research questions in one shot. Thus, the nutritional status of children 6 – 59 months was assessed together with the household food insecurity situation and the sociodemographic background of mother-child pairs. The analytical cross-sectional design affords the researcher the platform to conduct associative tests between two or more variables using binary and multivariate regression analysis. The research was

conducted in Tamale south in Northern Region, Ghana. Within each household, children aged 6 months to 59 months were selected at random.

3.3 Sample size determination

The principal objective of this research was to assess the relationship between nutritional status of children (6 to 59 months old) and the level of household food security in Tamale south in the Northern Region of Ghana by using a binary logistic regressions model. In the calculation of the required sample size, from literature, advice was provided premised on the number of independent variables [predictors (p)]. Thus, sample size, N > 50 + 8 * p (Green, 1991; Jenkins & Quintana-Ascencio, 2020). In this study, p = 21 because there are 21 independent variables as outlined in the questionnaires [*refer to* **Appendix 1**].

$$N > 50 + 8 \times 21$$

$$N > 218$$

Hence, by substituting p into the formula, it yielded 218 study subjects. And since N must be greater than 218, an addition of 10% of 218 was added to cater for potential non-response i.e.

$$\frac{10}{100} \times 218 = 21.8 \quad \gg \quad n = 218 + 21.8 \quad n = 239.8 \cong 240$$

This would finally yield a total sample size of 239.8 approximately, 240 which satisfies the equation (Green, 1991; Jenkins & Quintana-Ascencio, 2020).

3.4 Study Population and Sampling technique

Caregivers/mothers with their children within the age bracket 6 – 59 months old constituted the study population. Thus, 240 mother-child pairs from individual households were selected

to participate in the study adopting a three-stage sampling approach. Tamale South was considered the macrocosm with individual communities as the units. A list of the Tamale South communities was obtained from the Tamale Metropolitan Assembly and used as a sampling frame. From that list, four villages or communities were chosen at random using the lottery approach (*analogous to pick and act*). The four communities chosen were Tugu, Juni, Tugu Yapalsi, and Labariga: an even quota of 60 households (*ceteris paribus*) was allotted to each of the four communities for sampling. In every community, a list of households was obtained in liaison with population and housing census (PHC) provincial coordinators. Using a numbered list of households as a sampling frame, a systematic sampling technique was employed to select the households within the communities i.e. with the first household selected and used as a reference point, every third household encountered was selected. Finally, in every household, every caregiver/mother with a child 6 – 59 months was purposefully selected for the study. However, if the designated mother-child pair is not encountered in a household, then the next household is chosen.

In summary, a multi-stage (3-stage) sampling process was employed to choose participants: communities were selected through simple random sampling, households through systematic random sampling, and individual duos of participants through purposeful sampling.

3.5 Data Collection Methods and tools

3.5.1 Data collection Method

Four data collectors and a supervisor were trained and supervised in question interpretation in the dominant local dialect (Dagbani). The data for this research was gathered through face-to-face interviews using a semi-structured questionnaire data collection instrument. Face-to-face interviews offer the interviewer the chance to observe non-verbal cues for follow-up probing

or withholding questioning when sensitive issues are encountered. Also, the COVID-19 pandemic is still a dominant health risk with new lethal variants being reported. As a result, one-on-one data collection sessions seemed best with respect to participant protection against the fatal disease.

3.5.2 Data Collection Instruments

The data collection tool/instrument was a semi-structured questionnaire consisting of five sections (A – E). Section A consists of the socio-demographic characteristics of mother-child pairs such as marital status, maternal age, religion, ethnicity, occupation, and the educational level attained among others. Section B contained variables on young child feeding knowledge and practices including exclusive breastfeeding, early initiation of exclusive breastfeeding, frequency of breastfeeding, time of introduction of complementary foods, age-appropriate feeding frequency, and inclusion of snacks among others. Section C involved child anthropometry to elicit child weight per age, weight per height, and height per age measures. Section D was a 24-hour recall of all meals given to the child within the previous 24 hours to ascertain feeding patterns and habits. Section E was adapted from Household Food Insecurity Access Scale (HFIAS) notably used in food (in)security assessments. The component questions of this scale are approximately 18 (9 with sub-questions) as shown in **Appendix 1 (p.112).**

3.5.2.1 Sociodemographic Data

Child's date of birth, Gender of the children, household size, maternal educational level, maternal occupation, marital status, religion, ethnicity, sex of household head, household monthly income, and occupation of household head were all included in the demographic data. Parents or guardians were in most instances not able to give information about the child's age, which was supposed to be verified using child immunization cards. Thus, child age in months

was sourced from child immunization cards. Caretakers/guardians were asked to recall or use references calendar events if cards were not available. Furthermore, information on the household constitution was collected including sex of household heads, caregiver relationship to household heads, occupation of household heads, and household monthly earnings among others.

3.5.2.2 Nutritional Status

Children's height/length and weight were measured anthropometrically in all eligible respondents (children 6 – 59 months) in the selected households. The WHO classification of anthropometric measurement cut-offs was used to report standard nutritional status categories. (WHO, 2000, 2006). Table 3.1 as shown below displays the various cut-off points (World Health Organization, 2017). The UNICEF-designed wooden height and length boards were used to measure height and length to the nearest 0.1 cm. Recumbent length measurements were taken for children less than 24 months of age and heights were taken for children that were 24 months and above. In all height and length measurements, it was ensured that the head touches both the headpiece and the calibrated board; the shoulders, the buttocks, the calf, and the heels were also made to touch the calibrated board before the moveable foot-piece is closed in to take readings. The UNICEF Seca 762 classic mechanical medical weighing scale was used to assess the weight to the nearest 0.1 kg. For children who were too young or too violent for the enumerators, the weight of the mother was taken and subtracted from the weight of mother-with-the-child to obtain the child's weight.

Table 3.1 Nutritional status classification criteria

Nutritional Status	Indicator and cut-off value compared to the median
Overweight	Weight-for-length/height or BMI-for-age >2 SD and ≤3 SD of the median
Moderately underweight	Weight-for-age <−2 SD and ≥−3 SD of the median
Severely underweight	Weight-for-age <−3 SD of the median
Moderate acute malnutrition	Weight-for-length/height or BMI-for-age ≤−2 SD and ≥−3 SD of the median, or mid-upper arm circumference ≥115 mm and <125 mm
Severe acute malnutrition	Weight-for-length/height or BMI-for-age <− 3 SD of the median or mid-upper arm circumference <115 mm, or bilateral pitting oedema
Moderately stunted (moderate chronic malnutrition)	Length/height-for-age ≤−2 SD and ≥−3 SD of the median
Severely stunted (severe chronic malnutrition)	Length/height-for-age <−3 SD of the median
Moderately wasted	Weight-for-length/height ≤−2 SD and ≥−3 SD of the median
Severely wasted	Weight-for-length/height <−3 SD of the median

3.5.2.3 Household Food Insecurity Access Scale

Household Food Insecurity Access Scale [HFIAS (FANTA, FAO & FHI 360 v.III, Washington DC, US)] was employed in the assessment of household food (in)security status (Coates et al., 2007). The said tool was developed by a joint platform involving experts from FANTA and 'FHI 360'organizations. This food insecurity measurement tool was initially adapted from the United States Food Security Survey Module (USFSSM). The development of HFIAS was based on the premise that certain reactions, anxieties, perceptions, and behaviours become associated with a cohort of people that have experienced food insecurity (Coates et al., 2007).

HFIAS is unidimensional; it measures the food access domains of food security and as such when 'food Insecurity' is written with reference to HFIAS, 'access' is written in brackets after it. Thus, it is recommended that researchers should triangulate responses of HFIAS with anthropometric data that assess food utilization and food consumption tools (*like* 24HrR). HFIAS contains nine (9) food insecurity (access) occurrence questions with each containing a sub-question that elicits frequency-of-occurrence (*more like 18 questions*). The occurrence questions are divided into three main domains viz: anxiety/uncertainties associated with being food insecure, perceptions of food inadequacies (both quality and quantity) as well as behavioural modifications in response to food insecurity situation (Coates et al., 2007); (Coates, 2004) (**Table 3.2 below)**

Table 3.2: HFIAS component occurrence questions for measuring food Insecurity

1.a. How often did this happen?

1 = Rarely (once or twice in the past four weeks)

2 = Sometimes (three to ten times in the past four weeks)

3 = Often (more than ten times in the past four weeks)

No.	Occurrence Questions
1.	In the past four weeks, did you worry that your household would not have enough food?
2.	In the past four weeks, were you or any household member not able to eat the kinds of foods you preferred because of a lack of resources?
3.	In the past four weeks, did you or any household member have to eat a limited variety of foods due to a lack of resources?
4.	In the past four weeks, did you or any household member have to eat some foods that you really did not want to eat because of a lack of resources to obtain other types of food?
5.	In the past four weeks, did you or any household member have to eat a smaller meal than you felt you needed because there was not enough food?
6.	In the past four weeks, did you or any household member have to eat fewer meals in a day because there was not enough food?
7.	In the past four weeks, was there ever no food to eat of any kind in your household because of lack of resources to get food?
8.	In the past four weeks, did you or any household member go to sleep at night hungry because there was not enough food?
9.	In the past four weeks, did you or any household member go a whole day and night without eating anything because there was not enough food?

The occurrence questions were organized in order of increasing severity of food insecurity situation from Q1 to Q9. The first question expresses anxiety and uncertainty state associated with lack of food in the household. Questions 2 – 4 expressed perceptions of the inadequacy of food in terms of quality i.e. variety and inaccessibility of preferred foods. Questions 5 – 9 were in the domains of insufficiency of food consumption with respect to quantity and its associated consequences. Each of the occurrence indicator questions has the question "How often does this happen?' as a sub-question to elicit the frequency of occurrence-related data. The options were rarely=1, sometimes=2, and often=3.

On questionnaire administration, trained research assistants were trained to ask every question and not to pick and choose as recommended (Coates, Swindale, and Bilinsky, 2007). Also, the

frequency component of each main occurrence question is skipped if the respondent provides a 'NO' response for the occurrence question.

HFIAS scores were computed using the responses for the frequency of occurrence questions i.e. 0 = no for that occurrence question, 1 = rarely happens, 2 = sometimes happens and 3 = often happens. Thus, the minimum HFIAS score could be 0 or 1 denoting 'food secure' and the maximum could be 27 denoting the highest state of severe food insecurity (access). HFIAS scores were calculated as the sum of response codes for the frequency of occurrence questions or sub-questions (Q1a to Q9a) as follows;

$$HFIAS\ score = \sum_{i=1}^{9} (response\ code\ for\ Sub - Question\ (Qia)$$

These scores form a continuous ratio-scale variable and were compared to categories of child nutritional status (severe, moderate, normal) using independent sample t-testing.

According to the official communique for HFIAS v.3 (Coates, Swindale, and Bilinsky, 2007), there is no clear cut and universally accepted cut-off points for distinguishing the levels of food insecurity (access) yet. However, the recommended cut-offs should be calculated as follows:

The HFIAS module was administered based on a recall period of 1-month (four weeks). The main strength of HFIAS was that it produced population-level estimates of food insecurity that were comparable across countries, cultures, and sub-populations (Jones et al., 2013), and its validity had also been tested in Sub-Saharan Africa, including Ghana (Wambogo et al., 2018).

3.5.2.4 Pre-testing

As part of data quality control and assurance of the validity of findings, the research questionnaire was pretested in two other communities in the Tamale South not selected by the study's sampling designs. This was to surmise modifiable errors, ambiguities, and the response time per questionnaire. As a result, some changes were made with respect to a cultural-friendly approach to the context of food insecurity. According to responses, Islam frowns on full disclosure of a household food security situation, and as such, advice was sought from community elders on the appropriate approach to avoid intentional over-reporting of food situation to avoid shame and under-reporting in a bid to seek favours from the strangers (the research team).

Also, a peremptory regression analysis was conducted between the two communities using the split-half technique (using Spearman's correlation co-efficient [R] as a measure of association). The results showed that R=0.83 implies a linear relationship between the responses of the two communities and as such, strong reliability of findings.

3.6 Operational Definition of variables

3.6.1 Dependent variables

The dependent variables of the study were child undernutrition indicators which were chronic malnutrition (stunting) and acute malnutrition (wasting).

3.6.2 Explanatory variables

HFIAS and sociodemographic variables of mother-child pairs were the independent variables that were used to explain potential changes in child nutritional status. The sociodemographic variables included age of the mother, religion, ethnicity, mother's marital status, mother's educational level attained, occupation of mother, occupation of the household head, sex of household head, household monthly income (in GH₵), sex of the child, and child's age in months among others.

3.7 Data analysis

Data synthesis and analysis were carried out using Statistical Products and Services Solutions, SPSS (version 21, Illinois, USA). Descriptive statistics were calculated; counts and proportions for categorical variables, and means and standard deviations for continuous variables. Factors associated with nutritional status and household food insecurity were computed using the Pearson Chi-square test of independence. The effects of household food insecurity and sociodemographic variables on child malnutrition indicators were assessed using the binary logistic regressions model. First, bivariate tests were conducted and all factors significant were entered into a multivariate binary logistic regressions model which reported both unadjusted and adjusted Odds Ratios at 95% confidence intervals. The principle of adjusting for other equally contending influences reveals the approximate truth of the relationship between potential predictors and nutritional status of children 6 – 59 months. Therefore, a comparison of the associations before and after adjustment for socio-demographic and other confounders could be made. In the analyses, a p-value less than 0.05 was considered statistically significant.

WHO AnthroPlus version 1.0.4 software was used to convert linear growth measurements and weight of children i.e. length/height and weight together with age in months to compute

nutritional status indicators namely weight per height, weight per age, and height per age measures. These indicators of nutritional status were compared with recent WHO 2017 updated standards for defining malnutrition to identify acute malnutrition and chronic malnutrition levels as portrayed in **Table 3.1**. The prevalence of acute malnutrition was defined as children 6 – 59 months with weight per height z-score less than minus two standard deviations of that of the WHO median reference population. In the same vein, the prevalence of chronic malnutrition in children 6 – 59 months was defined as those with height per age z-scores being less than minus two standard deviations of WHO median reference population.

3.10 Quality control

The questionnaires were developed in English and translated to Dagbani by two people who were well versed in both languages. The administration of the questionnaire was done in the English language but for those who could not speak English, the translated version of the questionnaire was used. All questionnaires were checked for completeness in the field at the end of the interview. Each interviewer was visited on the field and spot checks were done on interviews, filling of questionnaires as well as anthropometric measurements of children.

Regarding the anthropometric measurements, the height and length of children were measured depending on their age; children less than two years old are measured lying down (recumbent length). Children, more than two years are measured standing up (height). While measuring children's weight, they were in light clothing and were made to remove all things that may add to their weight. All these measurements were conducted in accordance with WHO standards.

3.11 Ethical Considerations

The Informed consent of participants was sought before any information was taken. Codes and pseudonyms were used for participants and they were also assured of the confidentiality of their responses. Also, all participants of this study were informed that no part of this study's data collection process would be physically or morally invasive. All information obtained was used for the sole purpose of answering these research questions. All participants were informed that the exercise was voluntary and that they had the right to withdraw at any point within the study period.

3.12 Limitations of the study

Due to the use of a cross-sectional design, the study was unable to establish a causal link between the exposure variable and the outcome variables.

A short version of the HFIAS tool which applies to the study population was used. Nevertheless, the variables that were used still reflected the core domains of food security which allowed us to make an estimate of the overall prevalence of household food insecurity.

3.13 Plan for dissemination of the results

Findings of this study would be published in scientific journals and stored copies in the University Library as a means of knowledge sharing. Also, the findings would be shared with the health authorities within the Tamale South District to aid in their formulation of nutrition education programmes.

CHAPTER FOUR

RESULTS

This section of the study covers the findings. The findings are shown based on the predetermined objectives as indicated in chapter one. They are presented in tables. A total of 280 participants were recruited for the study. Socio-demographic, household characteristics, household food insecurity, and anthropometric data were collected. The results of the study are presented in this chapter. Independent samples t-test statistics, Chi-square test of independence, and logistic regression analysis were done for the quantitative data whilst the qualitative data were analyzed using framework analysis.

4.1 Socio Demographic Characteristics of Mothers/Caregivers and children

In the study, the ages in the month of children range from 6 months to 59 months (Mean, M = 24.9; standard deviation, SD 14.5) as well as the ages of the mother/caregiver ranged from [20-56 years mean (M) = 31.4; standard deviation (SD) = 6.2]. Over half of children [Count=124(Percent=51.7%)] were 6 – 23 months old and 48.3% (116) of them were within the age cohort 24 – 59 months. The majority of mothers were in the age groups 20 – 29 years [97(40.4%)] and 30 – 39 years [105(43.8%)]. Those 40 – 49 years were approximately 15% [35(14.6%)] and those 50 – 59 months were the least [3(1.3%)]. On religious affiliation, the majority of participants were Muslim [226(94.2%)] relative to Christians [14(5.8%)]. Also, almost all participants were married [233(97.1%)] versus one unmarried and six divorced [6(2.5%)]. Over three-quarters, [188(78.3%)] of mothers were native Dagomba relative to the proportion of other minority ethnic groups that accounted for 22% [52(21.7%)]. The assessment of the educational level of the mothers/caregivers showed that the majority of the mothers or caregivers did not have any level of formal education [195(81.3%)] compared to

18.8% (45) of them that were only educated to the basic level. Most study participants were engaged in farming [159(66.3%)] relative to those that were unemployed [48(20.0%)] and those that were engaged in trading [33(13.7%)].

Table 4.1: Sociodemographic characteristics of mother-child pairs

Background Variable	Response Categories	Frequency	Percentage (%)
Respondent relationship	Parent	237	98.8
with the child	Grandparent	3	1.3
	$\bar{x} \pm \sigma: min - max$	$31.4 \pm 6.2: 20 - 56$ years	
Age of Mother/Caregiver in years	20-29	97	40.4
	30-39	105	43.8
	40-49	35	14.6
	50-56	3	1.3
Religion	Christianity	14	5.8
	Islam	226	94.2

	No formal education	195	81.3
Mother/caregiver (Education)			
	Formal education	45	18.8
Mother (Marital Status)	Married	233	97.1
	Not married	1	0.4
	Divorced	6	2.5
Ethnicity	Dagomba	188	78.3
	Others*	52	21.7
Occupation of Mother/Caregiver	Trader	33	13.7
	Farmer	159	66.3
	Unemployed	48	20.0

	Male	100	41.7
Sex of child	Female	140	58.3
	$\bar{x} \pm \sigma: min - max$	$24.1 \pm 14.5: 6 - 59\ months$	
Child's age in months	6 – 23	124	51.7
	24 – 59	116	48.3

Formal education: the attainment of at least primary education, *: Gonja, Akan, Waala, and Frafra.

Further, among the participants, their monthly income ranged from GH₵ 0 to above GH₵ 1000 (Mean, M = 205.5; Standard Deviation, SD = 1.7). Specifically, most of them [108(45.0%)] earned less than GH₵200 per month. Also, 16.7% of participants earned GH₵ 200 – 500 per month and 27.5% had minimal or no monthly income at all as shown in **Table 4.2**. Moreover, the household size ranges from 2 to 11 (M =4.5; SD =1.8) and the number of years respondents living in this community from 1 to 46 years (M =17.6; SD =11.7). The household food insecurity access scale score ranges from 0 to 14 (M =6.8; SD =2.6). **Table 4.2** results showed that the majority of household heads were males [220(91.7%)] relative to those that were female [20(8.3%)]. Also, most household heads were Farmers [175(72.9%)] compared to those that were traders [19(7.9%)] and unemployed [35(14.6%)] among others as shown in **Table 4.2**

Table 4.2: Household characteristics of mother-child pairs

Household variable	Response Categories	Frequency	Percentage (%)
Mother/Caregiver relation with the household head	Wife of the household head	182	75.8
	Daughter of the household head	56	23.3
	Uncle	2	0.8
Sex of Household Head	Male	220	91.7
	Female	20	8.3
Occupation of Household Head	Trader	19	7.9
	Farmer	175	72.9
	Unemployed	35	14.6
	Others	11	4.6
	$\bar{x} \pm \sigma : min - max$	$205.5 \pm 1.7 : 0 - 2000$	

	Less than 200 ₵ a month	108	45.0
	Between ₵200-₵500 a month	40	16.7
Household monthly income (GH₵)	Between ₵500 - ₵1000	17	7.1
	Above ₵1000	9	3.8
	No income	66	27.5

GH₵: Ghana Cedis

4.2 Prevalence of underweight, acute malnutrition, and chronic malnutrition

For the anthropometric data, the average z-scores for the weight for height z-score, height for age z-score and weight-for-age z-score -0.2±1.0, -1.3±1.1 and -0.85±0.87 respectively [**Not shown in Table**].

From the table below (**Table 4.3**): The magnitude of malnutrition among the children was quantified using three anthropometric indicators: Weight-for-height (acute malnutrition/wasting), Height-for-age (chronic malnutrition/stunting), and Weight-for-age (underweight). Among the participants, the prevalence of moderate and severe wasting was 7.1% and 0.4%, respectively. Moderate and severe stunting was 27.5% and 1.7%, respectively, while 10.4% were moderately underweight and 0.4% were severely underweight as shown in **Table 4.3**.

Table 4.3: Prevalence of underweight, acute malnutrition, and chronic malnutrition

Variable	Response Categories	Frequency	Percentage (%)
	Moderate Acute Malnutrition	17	7.1
Weight for Height Z-score Classification	Normal	222	92.5
	Wasted	1	0.4
Height for Age Z-score	Severely stunted	4	1.7
Classification	Moderately stunted	66	27.5
	Normal	170	70.9
Weight-for-age Z-score Classification	Severely underweight	1	0.4
	Moderately underweight	25	10.4
	Normal	214	89.2

Moderate acute malnutrition=weight-for-length/height ≤–2 SD and ≥–3 SD of the median, normal = weight-for-length/height > –2 to ≤ +2 SD of the median, overweight=weight-for-length/height >2 SD and ≤3 SD of the median; Severely stunted (severe chronic malnutrition) =length/height-for-age <–3 SD of the median, moderately stunted (moderate chronic malnutrition) =length/height-for-age ≤–2 SD and ≥–3 SD of the median, normal= height/length-for-age > –2 to < +2 SD of the median; Severely underweight=weight-for-age <–3 SD of the median, moderately underweight=weight-for-age <–2 SD and ≥–3 SD of the median, normal= weight-for-age > –2 to ≤ +2 SD.

4.3 Distribution of food insecurity status of households

Based on FANTA 2007 monitoring tool for food insecurity; Household Food Insecurity Access Scale (HFIAS) was used to score and categorize households. From **Table 4.4** as shown below, 3.8% of the participant that is 9 out of 240 were food secure, 109 of the participants representing 45.4% were moderately food insecure well as 43.8 % that is 105 of the household survey were severely food insecure.

Table 4.4: Distribution of household food insecurity

Variable	Categories	Frequency	%
Household Food Insecurity Access Scale (Category)	Food Secure	9	3.8
	Mildly Food Insecure Access	17	7.1
	Moderately food insecure access	109	45.4
	Severely food insecure access	105	43.8

Food Insecure has HFIAS score of zero (0), mildly food insecure has HFIAS score (1 – 9), moderately food insecure has HFIAS score (10 – 18) and Severely food insecure has HFIAS score (19 – 27)

Using an analysis of the component occurrence questions of the HFIAS model, the prevalence of each component of the HFIAS is illustrated in Figure 2 as shown below. On anxiety; 80.4% (193) of mothers were worried that their HH would not have enough to eat. On the perception of dietary quality; 80% (192) were unable to eat their preferred foods, 73.1% (174) had to eat meals with limited variety and 67.9% (163) reported they had to eat foods they did/do not like in the past four weeks. On quantity domains; 46.6% (110) had to eat smaller meals, 65.1 (154) had to eat fewer meals per day and 33.6% (78) reported that there was no food of any kind to eat as shown in **Figure 2.**

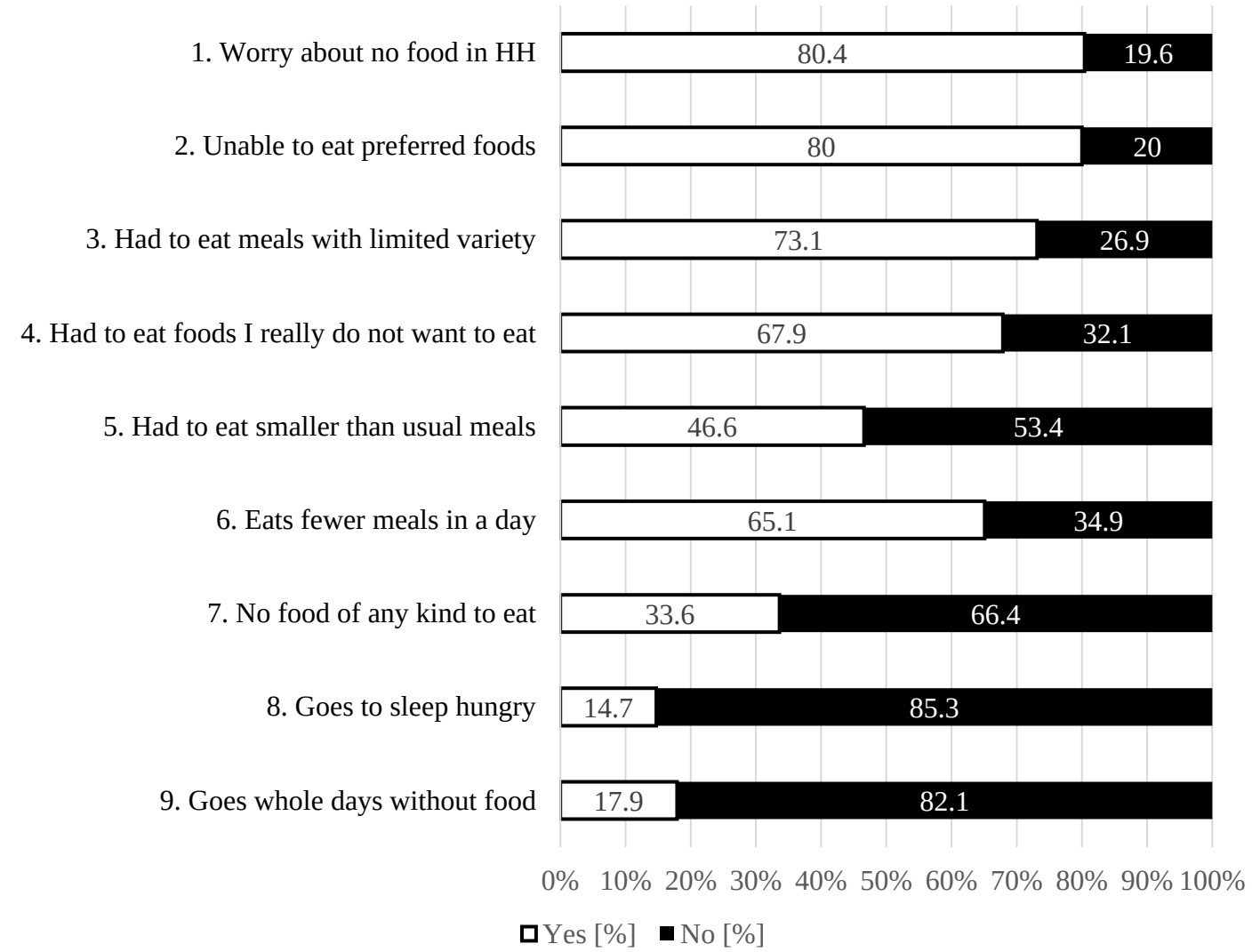

Figure 2: Illustration of food Insecurity (access) using a prevalence of HFIAS components

4.4 Child malnutrition and household food Insecurity

Child malnutrition taken to be chronic and acute malnutrition (ceteris paribus) was tested with household food Insecurity Access Scale (HFIAS) scores using the independent sample t-test feature of SPSS.

4.4.1 Relationship between household food insecurity and chronic malnutrition

Children were dichotomized into those without chronic malnutrition (*reference group, code=1*) and children with chronic malnutrition. This variable was correlated with household food insecurity (*using HFIAS*) scores using the independent sample t-test feature of SPSS. The results as shown in **Table 4.5** revealed that there was no statistically significant relationship between chronic malnutrition and household food insecurity t(*degrees of freedom* 1, sample size 238) =0.50, significance level p= 0.617]. Children without chronic malnutrition had higher mean HFIAS scores (6.9±2.7) relative to children with chronic malnutrition (6.7±2.5).

Table 4.5: Association of household food security with chronic malnutrition

	Chronic malnutrition status		**Inferential statistics**		
	Without chronic malnutrition	**With chronic malnutrition**	**t-value**	**N**	**P-value**
Household food insecurity (HFIAS)score	6.9±2.7	6.7±2.5	t = 0.50	238	0.617

t: Independent samples t-test statistic used for calculating means and standard deviations of quantitative variables among children with chronic malnutrition and those without chronic malnutrition. Chronic malnutrition is defined as height-for-age ≤ -2 of the medians of the WHO growth standards based on the 2017 new updates.

4.4.2 Relationship between household food insecurity and acute malnutrition

Children 6 – 59 months were dichotomized into those without acute malnutrition (*reference group*, *code=1*) and children with acute malnutrition. This variable was correlated with household food insecurity (*using HFIAS*) scores through the independent sample t-test feature of SPSS. The results as shown in **Table 4.6** showed that there was a statistically significant association between acute malnutrition and household food insecurity t(1, 238)= -4.83, p< 0.001]. Children without acute malnutrition had lower mean HFIAS scores (6.7±2.6) relative to children with chronic malnutrition (8.2±1.1).

Table 4.6: Association of household food security with acute malnutrition

	Acute malnutrition status		**Inferential statistics**		
	Without acute malnutrition	**With acute malnutrition**	**t-value**	**n**	**P-value**
Household food insecurity (HFIAS) score	6.7±2.6	8.2±1.1	t = -4.83	237	P < 0.001

t: Independent samples t-test statistic used for calculating means and standard deviations of quantitative variables among children with chronic malnutrition and those without chronic malnutrition. Acute malnutrition is defined as height-for-age ≤ -2 of the medians of the WHO growth standards based on the 2017 new updates.

4.5 Sociodemographic determinants of child malnutrition

Child malnutrition status in the form of chronic or acute malnutrition (*1=child without vs. 0=child with chronic malnutrition*) was compared with various sociodemographic characteristics of participants i.e. with categorical variables through Chi-square test of significance and with continuous variables through independent sample t-tests.

4.5.1 Association of sociodemographic variables with chronic malnutrition

Child chronic malnutrition status (*1=child without vs. 0=child with chronic malnutrition*) was compared with educational status, Occupation of mother, sex of a child, maternal age, age of the child (months), and household size. The findings of the study revealed that out of six variables, only one variable was statistically significant with chronic malnutrition. The six variables include educational status, Occupation of mother, sex of a child, maternal age, age of the child (months), and household size.

Formal education of mothers was not significantly associated with chronic child malnutrition [$\chi^2(1, 238) = 1.51, p = 0.219$], so is occupation of mother [$\chi^2(2, 238) = 1.37, p = 0.505$] and sex of the child [$\chi^2(1, 238) = 1.15, p = 0.701$]. for the aforementioned variables, the significance level (p-value) was greater than the margin of acceptable error (0.05).

Also, using an independent sample t-test; maternal age, household size, and age of child in months were compared with chronic nutrition status of children 6 – 59 months. As a result, household size [$t(1, 238) = 2.24, p = 0.026$] and child age [$t(1, 238) = -1.96, p = 0.021$] were shown to be significantly related to child chronic nutrition status given that $p<0.05$ unlike maternal age in years [$t(1, 238) = -0.20, p = 0.846$].

Furthermore, on household size; children without chronic malnutrition were observed to come from households with higher mean household sizes (4.7±1.8) relative to children with chronic malnutrition (4.1 ±1.6). Besides this, children without chronic malnutrition had higher mean ages (23.8 ±14.6) relative to children with chronic malnutrition (27.8 ±13.8) as shown in **Table 4.7**

Table 4.7: Association of sociodemographic variables with chronic malnutrition

Variable	**Without chronic malnutrition**	**With chronic malnutrition**	**Test statistic**	**Df**	**P-value**
Educational status					
Formal education	28(62.2)	17(37.8)			
No formal education	142(72.8)	53(27.2)	$\chi 2$=1.51	1	0.219
Occupation of mother					
Trader	24(72.7)	9(27.3)	$\chi 2$=1.37	2	0.505
Farmer	109(68.6)	50(31.4)			
Unemployed	37(77.1)	11(22.9)			
Sex of child					

Male	69(69.0)	31(31.0)	$\chi 2$=0.15	1	0.701
Female	101(72.1)	39(27.9)			
Maternal age (years)	31.3±6.2	31.5±6.5	t = -0.20	238	0.846
Household size	4.7±1.8	4.1±1.6	t = 2.24	238	0.026
Age of child (months)	23.8±14.6	27.8±13.8	t = -1.96	238	0.021

p-value: statistical significance level; df: degree of freedom; $\chi 2$: Chi-square test of independence; Pearson chi-squared test was used for 3 by 2 tables whereas, Yate's continuity correction was used for all bivariate associations with 2 by 2 categories. t: Independent samples t-test statistic used for calculating means and standard deviations of quantitative variables among children with chronic malnutrition and those without chronic malnutrition. Chronic malnutrition is defined as height-for-age ≤ -2 of the medians of the WHO growth standards based on the 2017 new updates.

4.5.2 Association of sociodemographic variables with acute malnutrition

Table 4.8 shows the relationship between sociodemographic variables with acute malnutrition. Out of the six variables included in the analysis, none of the variables showed any statistically significant relationship with acute malnutrition given that for all of them p<0.05. The six variables include educational status, occupation of mother, sex of the child, maternal age, household size, and age of the child (months).

Using the Chi-square test of significance as a frame of reference; the educational status of the mother (formal versus no formal education) was not statistically significant in comparison with acute child nutritional status $[\chi^2(1, 238) = 0.04, p = 0.847]$. The same was observed for the

occupation of mother [$\chi^2(2, 238) = 0.26, p = 0.880$] and sex of child [$\chi^2(1, 238) = 0.56, p = 0.456$]. Using independent sample t-test, continuous variables such as maternal age [$t(1, 237) = -0.61, p = 0.545$], household size [$\chi^2(1, 237) = -0.20, p = 0.843$] and age of the child in months [$t(1, 237) = 0.99, p = 0.321$] were also not significantly associated with acute child malnutrition.

Table 4.8: Association of sociodemographic variables with acute malnutrition

Variable	Without acute malnutrition	With acute malnutrition	Test statistic	df	P-value
Educational status					
Formal education	41(91.1)	4(8.9)			
No formal education	181(93.3)	13(6.7)	**χ2**=0.04	1	0.847
Occupation of mother					
Trader	30(90.9)	3(9.1)	**χ2**=0.26	2	0.880
Farmer	147(93.0)	11(7.0)			
Unemployed	45(93.8)	3(6.3)			
Sex of child					
Male	90(90.9)	9(9.1)	**χ2**=0.56	1	0.456
Female	132(94.3)	8(5.7)			

Maternal age (years)	31.3±6.3	32.3±5.8	t = -0.61	237	0.545
Household size	4.5±1.8	4.6±1.7	t = -0.20	237	0.843
Age of child (months)	25.2±14.5	21.5±14.2	t = 0.99	237	0.321

p-value: statistical significance level; df: degree of freedom; $\chi 2$: Chi-square test of independence; Pearson chi-squared test was used for 3 by 2 tables whereas, Yate's continuity correction was used for all bivariate associations with 2 by 2 categories. t: Independent samples t-test statistic used for calculating means and standard deviations of quantitative variables among children with acute malnutrition and those without acute malnutrition. Acute malnutrition is defined as having a weight-for-height z-score of -3.0 to < -2.0 or weight-for-height z-score < -3.0 of the median of the WHO growth standards based on the 2017 new updates.

4.6 Household food insecurity and sociodemographic predictors of child nutritional status

4.6.1 HFIAS, sociodemographic factors and acute malnutrition of children

Table 4.9 shows an unadjusted and multivariate regression tests for the predictors of acute malnutrition using the sociodemographic factors and HFIAS as covariates. The results of the analysis revealed that only HFIAS was significantly correlated with acute child malnutrition**:** Children with higher HIAS scores were 1.29 times [odds ratio, OR =1.29, 95% Confidence interval, CI: $1.05 - 1.60$, $significance\ level, p = 0.018$] more likely to contract acute malnutrition in the unadjusted model of multivariate regression analysis as well as 1.34 times more likely [adjusted odds ratio, aOR= 1.34; 95% CI: 1.07 – 1.68; p= 0.010] in a subsequent analysis adjusting for other significant covariates.

Furthermore, female headed households had higher odds of acute child malnutrition in both the unadjusted analysis [OR= 1.50; 95% CI: 0.19 – 11.92; p= 0.703] and the adjusted analysis

[aOR= 1.47; 95% CI: 0.17 – 12.37; p= 0.725]. However, these tests were not significant given p< .05.

In addition, children 24 – 59 months were seen to have higher odds of acute child malnutrition in an initial unadjusted analysis [OR= 1.77; 95% CI: 0.63 – 4.95; p= 0.278] as well as in another test that adjusted for other potential significant covariates [aOR= 1.99; 95% CI: 0.68 – 5.78; p= 0.209]. However, these tests were also not statistically significant given the p-values were greater than 0.05.

Table 4.9 HFIAS and sociodemographic determinants of acute malnutrition

	Unadjusted		Adjusted	
Variable	OR (CI at 95%)	P-value	OR (CI at 95%)	P-value
HFIAS Total	1.29(1.05-1.60)	0.018	1.34(1.07-1.68)	0.010
Mothers' education				
No formal education (0) (**Ref.)**				
Formal education (1)	0.74(0.23-2.37)	0.610	0.57(0.17-1.99)	0.379
Sex of household head				
Female (0) **(Ref.)**				

Male (1)	1.50(0.19-11.92)	0.703	1.47(0.17-12.37)	0.725
Age of child				
24 - 59 (0) **(Ref.)**				
6 - 23 (1)	1.77(0.63- 4.95)	0.278	1.99(0.68-5.78)	0.209
Sex of child				
Male (0) **(Ref.)**				
Female (1)	0.61(0.23-1.63)	0.321	0.64(0.23-1.76)	0.384

Dependent variable: Weight-For-Height Z-score (acute malnutrition) is defined as W/H z-score ≤ - 2 SD of the median reference population

4.6.2 HFIAS, sociodemographic characteristics and chronic malnutrition in children

Table 4.10 shows the predictors of chronic malnutrition through unadjusted and multivariate binary logistic regressions using sociodemographic characteristics and HFIAS as covariates. The findings revealed that the age group of children (months) was statistically significant with chronic child malnutrition given a p-value <0.05. In the unadjusted analysis, children 24 – 59 months were less likely [OR= 0.40; 95% CI: 0.22 –0.77; p= 0.002] to be chronically malnourished relative to children 6 – 23 months of age. after the adjustment, children between the age range (24 to 59 months) were still less probable to be chronically malnourished relative to children aged (6 to 23 months) [aOR=0.36, 95% CI: 0.16-1.20, p= 0.001).

Table 4.10: HFIAS and socio-demographic determinants of chronic malnutrition (low height-for-age Z-score)

	Unadjusted		Adjusted	
Variable	OR (CI at 95%)	P-value	OR (CI at 95%)	P-value
HFIAS Total	0.97 (0.87-1.09)	0.616	0.97 (0.86-1.09)	0.573
Mothers' education				
No formal education (0) (**Ref.)**				
Formal education (1)	0.615 (0.31-1.21)	0.161	0.55 (0.27-1.15)	0.112
Sex of household head				
Female (0) **(Ref.)**				
Male (1)	0.38 (0.15-0.95)	0.038	0.42 (0.16-1.09)	0.076
Age of child				
24 - 59 (0) **(Ref.)**				
6 - 23 (1)	0.40 (0.22-0.71)	0.002	0.36 (0.16-1.20)	0.001
Sex of child				

Male (0) **(Ref.)**				
Female (1)	0.86 (0.49-1.51)	0.598	0.84 (0.47-1.51)	0.566

Dependent variable: Height for Age z-score; chronic malnutrition is defined as H/A z-score ≤ - 2 SD of the median reference population

CHAPTER FIVE

DISCUSSION

5.1 Caregiver Description

Mothers were the caregivers for children 6 – 59 months in this current study. The typical participants in this study were mother-child pairs; where the mothers were predominantly native Dagomba, Muslim, and married with little or no formal education. These findings suggest that there might be ethnic, religious, filial, and education-related dimensions to these caregivers' child nutritional status and household food insecurity. Aside from that, the predominance of Dagomba, married, and Islamic participants together with those of little education could also account for the homogeneity of responses. Relative to the Ghana Statistical Service profile of the Tamale Metropolitan Area of which Tamale South is a part; the people are mostly Dagombas with other minority tribes giving the place the cosmopolitan mix. Also, Islam is the principal religious affiliation for the province with its tenets of procreation within the confines of marital unions. Deductively, the description of participants of the study is in tandem with the profile of the study area and its people.

5.2 Prevalence of stunting, wasting, and underweight among children (6 to 59 months)

In this study, prevalence of child underweight was 10.8% (10.4% moderate, 0.4% severe), stunting was 29.2% (27.5% moderate, 1.7% severe) and wasting was 7.5% (7.1% moderate, 0.4% severe). Comparative to other anthropometric malnutrition computed for the Northern Region (Saaka, 2014), the prevalence of stunting in this current study was lower (29.2% *versus* 32.5%), wasting was lower (7.5% *versus* 12.9%) and underweight was also lower (10.8% *versus* 21.8%). A more recent study (Wemakor & Iddrisu, 2018) uncovered the prevalence of stunting to be 40% in the Tamale Metropolis where the Tamale South forms a part.

According to (Cooke, 2015), the higher than usual prevalence of child nutrition in the Northern Region is accounted for chiefly by compromised nutrition practices (i.e. diets that are highly starch-reliant and poor intake of fruits, vegetables, and proteins), poverty, low access to health services as well as poor sanitation, unsafe water sources and hygiene (WASH) practices also correlate to undernutrition. In this current study, the computed determinants of child malnutrition were household food insecurity (*specific to acute malnutrition*) and household size together with the age of children impacting on chronic malnutrition. In corroboration with this, David et al. found that anthropometric indices in children were determined by household size, the age disparities between older and younger siblings, as well as the household's income levels (David et al., 2004).

More significantly, the prevalence of stunting determined by this present study was defined as 'critical' (prevalence ≥ 15%) and that of wasting and underweight were deemed 'poor' [*defined by 5% ≤ prevalence ≤ 15%*] according to De Onis (2019) thresholds for public health action.

Juxtaposing this current study with malnutrition reported for Ghana as a whole (GSS; GHS; ICF International, 2015), the national prevalence of stunting (chronic malnutrition) is lower than the figure observed in this study (19% *versus* 29.2%) and the national prevalence of wasting (acute malnutrition) was also lower than the figure computed by this research (5% *versus* 7.5%).

Child malnutrition in either acute or chronic malnutrition form is associated with growth faltering, poor cognitive development (bad school performance), susceptibility to infections due to compromised immune response, risks of cardiovascular diseases in later adulthood in addition to the risk of child mortality (Candler et al., 2017).

5.2.1 Prevalence of stunting among children (6 to 59 months)

The current study's finding on chronic child malnutrition (stunting) showed that 27.5% and 1.7% of children 6 – 59 months suffer from moderate and severe forms of stunting respectively. This implies that the composite prevalence for stunting was 29.2%. According to (De Onis et al., 2019) on prevalence thresholds anthropometric indices that determine the urgency of public health action; this current study's chronic malnutrition prevalence falls into the category dubbed 'critical' defined by prevalence $\geq 15\%$. This denotes the need for prompt, sustainable, and a mix of both nutrition-specific cum nutrition-sensitive interventions to ameliorate the situation.

In terms of relativity to international, national, regional, and provincial stunting prevalence: This finding was more than what was previously reported by the Ghana demographic and health survey for the whole nation of Ghana i.e., stunting prevalence of 18.8% (WHO, 2016). This present study's result was however found to be lower than what was reported for the northern Region [33%] (Saaka, 2014) and specifically the stunting rate for the Tamale Metropolitan area [40%] (Wemakor & Iddrisu, 2018). In Sub-Saharan Africa, an estimated 40% of children aged five (5) and below are estimated to be stunted (De Groot et al, 2017). In other countries across the globe some prevalence rates were found to be higher than the figure recorded for this current study; for instance, Pakistan with a prevalence of 44% (Atsu et al., 2017), Bangladesh with a prevalence of 36% (Das, 2017), and Nepal with a prevalence 35.8% (DHS, 2018).

Further, the stunting prevalence is lower than other reports in other countries such as 37.2% reported in Amharan region (Asres & Eidelman, 2011), 39.3% reported in the Hawasa region, and 38% in EDHS 2016 (K. G. Dewey & Begum, 2011). Additionally, the study's finding was

lower than a study which was conducted by UNICEF with a prevalence of 40% in sub-Saharan countries and 39% prevalence reported in South Asia (UNICEF, 2013)

Child stunting is regarded as the most prevalent form of malnutrition since millions of children are suffering from its worldwide (De Onis & Branca, 2016) and not only in Sub-Saharan Africa. Some of the plausible explanations for this varied finding could be the size of the samples used, socioeconomic factors, study subjects, the periods of study, and choice of study designs compared with the present study.

5.2.2 Prevalence of wasting

The proportion of acute child malnutrition (wasting) computed for this present study was 7.5% (7.1% moderate *versus* 0.4% severe) among the sampled participants. Juxtaposing this figure with De Onis (2019) thresholds for public health significance, the prevalence of wasting found was 'poor' [*defined by 5% ≤ prevalence ≤ 9%*]. The proportion of children with acute malnutrition reported in this study is more than the national wasting prevalence (7.5% *versus* 5%) as reported by (WHO, 2016). Also, the prevalence is comparable to what was previously reported in the region (8.2%) according to the works of (Glover-Amengor et al., 2016). According to (Saaka, 2014), prevalence of wasting in this current study was lower (7.5% *versus* 12.9%) compared to the figure for the Northern Region. Moreover, this present study's acute malnutrition prevalence was also found to be lower than what was reported in Pakistan (10.7%) (Islam et al., 2013).

Wasting among children is an indication of not acquiring sufficient and proper nutrition in the short-term conditions or some instances the result of debilitating infections. The northern region of Ghana is located in the Savana vegetation zone that has a long dry season within the year. Moreover, children in this area of study maybe susceptible to food insecurity due to the

increasing rate of climate change. In situations of food insecurity dietary intake and access to optimum care practices like an infant and young child feeding (IYCF) become compromised which could explain the rate of wasting in the region.

5.3 Socio-demographic factors that influence child malnutrition

In this study, the multivariate analysis revealed two sociodemographic variables to be significantly associated with child malnutrition and both of them were correlates of stunting. These variables include: household size and age of the child (months). Previous studies have indicated that household size is significantly related to stunting similar to the current finding. Two studies conducted elsewhere in Ethiopia showed that children from households with large sizes were more at risk of being stunted compared with children from small household families (Asfaw et al., 2015; Bogale et al., 2018). Another author of nutrition observed similar results in Bangladesh (Islam et al., 2013).

This finding insinuates that families with more people would have more people to take care of which may lead to household food insecurity and for that matter are more likely to be stunted relative to people in smaller families (Victora et al., 2017). A study conducted in the Afar region of Ethiopia specified that children of mothers with four or more children were at risk of becoming stunted in comparison with children of mothers with only a child (Fentaw et al., 2013). As the family size expands, more resources are needed to meet the requirements of the growing family. Thus, a family that is not able to meet these important needs, for instance, children may become stunted especially if there is food insecurity for a prolonged time period. Also, parents spend a small amount of time with the children in cases of big family size which can consequently affect the provision of optimum child care practices like IYCF, WASH and health seeking practices increasing susceptibility to chronic malnutrition.

Moreover, the finding of the current study reveals the age of the child (in months) to be statistically significant with stunting. On further meta-analysis, it was deduced that children 6 – 23 months old were more likely to be stunted than those 24 – 59 months old. This is consistent with a previous in the northern Oromia and Amhara regions of Ethiopia (Kibr & Yazew, 2021; Mengiste et al., 2020). Seasoned researches into childhood have purported that early childhood indicators are sensitive to drastic changes in household shock situations such as food insecurity conditions, unsanitary environmental conditions, socio-economic upheavals among others (Bhandari & Chhetri, 2013; Cunha et al., 2018; Singh et al., 2016). Driving more proximate to this study, up to 70% of stunting is said to occur before a child's second birthday – a period of grave levels of susceptibility usually referred to as the first 1,000 days of a child's life (Leroy et al., 2014). In consonance with the aforementioned, this current study showed that child age with respect to those 6 – 23 months was significantly correlated with child stunting. The dietary intake of children is most critical and important during the first 24 months of life (Som et al., 2018). The period between birth and the first 24 months is the first phase of active growth spurt continues with embryonic development. Thus, resource scarcity during this period easily reflects in the linear growth measurements of such children. Poor nutrition during pregnancy or pre-pregnancy as well as non-compliance with the holistic care package for pregnant women potentially could have a negative impact on starting weight for newborns (Intrauterine growth retardation and poor birth weight). In addition, poor utilization of infant and young child feeding practices such as exclusive breastfeeding, timely initiation of complementary feeding, adequacy of complementary meals, sick child care, dietary diversity, age-appropriate meal frequency and minimum acceptable dietary intake could affect nutritional status of under twos. According to the WHO, children should be breastfed exclusively for six months and it should be followed by introducing nutritious foods as complementary feeding. The critical control points in the child feeding continuum are the points of transition; for instance, the point of

introducing other foods in addition to breastmilk and the point of weaning. Timely initiation (at six months), safety of foods to prevent infection as well as adequacy of complementary foods are recommended to prevent malnutrition and infections. Good weaning practices are important in enhancing the nutritional status of the children (Schoenbuchner et al., 2019). A previous study showed that children who did not undergo good weaning practices were found to be stunted and underweight (Seyda et al., 2020).

Also, for children 6 – 23 months, infections count as another risk to their malnutrition. Infections manifest due to feeding children with contaminated foods originating from both the use of dirty water, dirty foodstuffs, improper preparation, and the use of contaminated utensils. Another dimension of the source of infections is water, sanitation, and hygiene concerns of households, caregivers, and the children themselves as a unit.

5.4 Household Food Insecurity and prevalence of child malnutrition

Household food (in)security status was assessed with HFIAS and the findings showed that almost all households suffer from one shade of food insecurity (access) or the other. The findings showed that 45.4% were moderately food insecure and 43.8 % were severely food insecure (access). Consequently, only 3.8% of households were deemed food secure and the composite prevalence of food insecurity was 96.2% of households. In tandem with this, the World Bank 'World Development Report' (2008) points out that three-quarters of the world's food insecure persons live in low me countries like Ghana. Also, relative to this exponentially immense rate of food insecurity, the Food and Agriculture Organization reports that one in eight people (*tantamount to 12.5%*) are more at risk of suffering from chronic food deficiency globally (Food and Agriculture Organization, 2013). Some of the explanations for the escalating household food insecurity in most low and middle-income countries include low

levels of agricultural production, poverty, alarming food prices, and natural disasters (Xiao et al., 2011). Households food security has also been shown to be connected with agricultural production in several studies (Birhane et al., 2014; Gelli et al., 2017). Seasonal production in African countries is the major cause of transient unemployment in the dry season which culminates in transitional food insecurity. Community empowerment in the area of irrigation technologies could offer opportunities to continue all year-round production.

This current study's results showed that the incidence of acute child malnutrition in Tamale South was intricately linked with household food insecurity. In support of this, a previous study in East Badawacho of South Ethiopia has discovered that household food insecurity is correlated with an increased risk of malnutrition among children under 5 years (Betebo et al., 2017). A litany of studies has correlated household food insecurity situations and incidences of poor child nutritional status (Berra, 2020; Betebo et al., 2017; Bukania et al., 2014). A study by Madiba et al. purported those children who are food insecure are predisposed to poor nutritional status since they depend on inappropriate levels of food intake (Madiba et al., 2019). Moreover, the consumption of low quantity food and monotonous diets could put children at risk of malnutrition with micronutrient deficiencies (Ntila et al., 2017). Food insecurity influences dietary intake: Household food insecurity has a negative impact on food consumption, including nutrient intake, dietary diversity, and subsequently, the nutritional status of household members.

Furthermore, household food insecurity was observed to be significantly correlated with prevalence of acute child malnutrition but had no significant relationship with chronic malnutrition. Contrary to this, a study in Nepal found that food insecure households had a higher prevalence of underweight and stunting (Pandey & Fusaro, 2020) relative to wasting. The realms of influence of household food insecurity on acute child malnutrition include

inadequate access to nutritious and safe food supply all year round and insufficient utilization of these foods by the members of the household through the effects of infections or bioavailability nuances associated with diet (Coates et al., 2006, 2007; Furness et al., 2004). However, acute malnutrition is usually manifested as a consequence of short-term shocks and as such its link to household food security could be as a consequence of transitional food insecurity chiefly caused by seasonal engagement in farming. It is envisaged that chronic food insecurity would have manifested as chronic child malnutrition in children 6 – 59 months.

Thus, transitional food insecurity would best explain the occurrence of acute malnutrition since it is transient. until the rains in April signal another production season (*speaking with respect to northern Ghana*). In the same vein, acute malnutrition in children under two is an indicator that is easily altered by peremptory events relative to chronic malnutrition.

CHAPTER SIX

SUMMARY OF KEY FINDINGS, CONCLUSION AND RECOMMENDATIONS

6.1 Summary of Key Findings

This study assessed the association between the nutritional status of children 6 – 59 months and household food security in the Tamale South Sub-Metropolitan Area. Mothers selected were mostly Native Dagomba (78.3%), affiliated with Islamic religious worship (94.2%), and mostly married (97.1%) with little formal education (81.3%). The majority of households of these mother-child pairs are male-headed (91.7%) and earned less than GHC 200.00 a month.

FANTA, FAO and FHI 360 HFIAS showed that only 3.8% of households were food secure, 7.1% were mildly food insecure, 45.4% were moderately food insecure and 43.8% were severely food insecure.

In this study, prevalence of moderate and severe underweight (10.4%, 0.4%), stunting (27.5%, 1.7%), and wasting (7.1%, 0.4%) was reported among the sampled participants. The determinants of stunting include the age of the child (months) and household size. Only household food insecurity status (measured with *HFIAS*) was significantly correlated with acute malnutrition in the logistic regression analysis.

6.2 Conclusions

The following salient conclusions were drawn from the key result areas of the study and as a response to the predesigned research questions cum hypothesis.

The prevalence of child malnutrition with respect to acute and chronic forms was very immense trumping Ghana national and global estimates but was lower than northern regional prevalence. Acute and chronic malnutrition levels were also greater than the 15% borderline prevalence level delineated for establishing Public Health implicated trends.

Prevalence of severe and moderate food insecurity levels was over 40% respectively and this is monumental relative to few households that enjoy food security all year round.

Acute child malnutrition is influenced to a large extent by increasing HFIAS scores (food insecurity) and on the other hand, chronic child malnutrition is predicted by household size as well as young age (6 – 23 months old) of children under-five.

6.3 Recommendations

Some numbers of recommendations have been made below considering the findings of the present study:

- Nutritionist, Ghana Health Service Professionals and Public Health Officials should guide mothers of children 24 – 59 months to continue observe the optimal IYCF practices to improve chronic malnutrition in children.
- Government, the Ministry of Food and Agriculture and NGOs should implement economic empowerment, social protection and emergency remittance services to decrease the incidence of food insecurity.

- Health Service professionals especially community health workers should be trained on CMAM to enable them monitor and assess the growth of children under five years.
- Government should also strengthen all activities targeted at women empowerment in order to enhance household food situation.

Recommendation For Further Research: In subsequent researches, food consumption tools like 24Hr Recall should be added to complete the continuum of predictors from food insecurity to compromised dietary intake to child malnutrition.

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APPENDICES

Appendix 1: Study Questionnaire

QUESTIONNAIRE ON THE ASSOCIATION BETWEEN THE LEVEL OF HOUSEHOLD FOOD SECURITY AND NUTRITIONAL STATUS OF CHILDREN FROM 6 TO 59 MONTHS IN TAMALE SOUTH IN THE NORTHERN REGION OF GHANA

Good day, i am a student conducting my research on the association between the level of household food security and nutritional status of children under 5 years in tamale south. This is solely for academic purposes and in partial fulfillment of the requirements for the award of master of public health. The outcome of the study would contribute to the already existing literature on food security and nutritional status in the region and the nation as a whole.

All information obtained would be treated confidentially. I hereby seek your consent to administer this questionnaire to your household which will take possibly 45mins of your time. Are you willing to participate in the survey?

Thank you.

IDENTIFYING INFORMATION

SECTION A: SOCIO-DEMOGRAPHIC CHARACTERISTICS OF RESPONDENT

1. Respondent code _ _ _ _

2. What is your relationship with the sampled child?

A. Parent B. Grandparent

C. Other (Specify)……

3. Age (years) of child's mother/caregiver: ……

4. Highest level of education of mother/caregiver

A. No formal education B. Primary education

C. Middle/JHS D. S.S.S/Vocational / Technical

E. Tertiary education

5. Marital Status of mother

A. Married B. Cohabitating

C. Single D. Divorced

E. Separated F. Widowed

6. Occupation of the mother/caregiver of the child.

A. Trader B. Artisan (Dressmaker, hairdressers, etc)

C. Farmer D. Professionals (Teacher, Nurse, etc.)

E. Unemployed F. Others……...

7. Relation of the respondent to the household head

A. Wife of the household head B. Daughter of the household head

C. Other (specify)……

8. Sex of household Head

A. Male B. Female

9. Occupation of the head of the household.

A. Trader B. Artisan (Dressmaker, hairdressers, etc)

C. Farmer D. Professionals (Teacher, Nurse, etc.)

E. Unemployed F. Others……...

10. Size of Household (this includes only residents): ……

11. Monthly income level of the household.

A. Less than ₵200 Ghana a month B. Between ₵200- ₵500 a month

C. Between ₵500 - ₵1000 a month D. Above 1000 Ghana Cedis a month

E. No income

12. How many years have you been living in this community? ……

SECTION B: YOUNG CHILD FEEDING KNOWLEDGE AND PRACTICE (TO BE ANSWERED BY THE MOTHER).

13. Has (name) ever been breastfed?

A. Yes B. No

14. How long after birth did (name) start breastfeeding?

A. Less than one hour of birth B. Between 1-23 hours

C. A Day after birth D. Several days after birth

15. First feed to (name) after delivery

A. Breastmilk B. Infant Formula

C. Water D. Other……

16. How many times did/do you breastfeed (name) in a day?

A. Less than 8 times B. Between 8 to 12 times a day

C. More than 12 times a day

17. At what age did you introduce water?

A. Below 3 months B. 3-5months

C. 6 months D. 7 months and above

18. At what age did you introduce food?

A. Below 3 months B. 3-5months

C. 6 months D. 7 months and above

19. Has (name) stopped breastfeeding?

A. Yes B. No.

20. If yes, at what age did (name) stop breastfeeding completely?

A. Before 6 months B. Between 6 to 12months

C. Between 13 – 23months D. 24 months and after

21a. How many times do you give (name) complementary foods in a day? (*If the child is breastfeeding*)

A. Once B. 2 times

C. 3 times D. 4 times

E. 5 or more times

21b. How many times do you give (name) main meals in a day? *(If the child has stopped breastfeeding)*

A. Once B. 2 times

C. 3 times D. 4 times

E. 5 or more times

22. Apart from main meals and/or breast milk, do you give your child any snacks between meals?

A. Yes B. No

23. How many times a day?

A. Once B. Twice

C. Thrice D. 4 or more times

24. Which foods do you give?

A. Fruits B. Pastries

C. Others, Specify

SECTION C: ANTHROPOMETRIC MEASUREMENT

(Seek permission from mother/caregiver and take the MUAC, weight and height/length of the child)

Child ID	**Date of Birth (d/m/y)**	**Sex**	**Weight (Kg)**	**Height (cm)**	**MUAC**

SECTION D: 24-HOUR DIETARY RECALL (TO BE ANSWERED BY MOTHER OR CAREGIVER)

Please, mention all the foods and drinks that were eaten by (Name of child) over the past 24 hours whether at home or outside the home. (Hint: start with meal eaten at supper yesterday).

Eating moment	Name of dish	Ingredients

Breakfast		
Snack before lunch		
Lunch		
Snack before dinner		
Dinner		
Snack after dinner		

Drinks		

From the meals mentioned by the mother, indicate whether (Name of child), ate from the following food groups during the past 24 hours whether at home or outside the home.

Food group	**Examples**	**0 No, 1 Yes**
1. Grain, roots and tubers	E.g. cereals, white tubers and roots	
2. Dairy products	E.g., milk and milk products	
3. Flesh foods	E.g. organ meat, flesh meats and fish	
4. Eggs	E.g. guinea fowl egg,	
5. Legumes	E.g. legumes, nuts and seeds	
6. Vitamin A-rich fruits and vegetables	E.g. dark green leafy vegetables, fresh vitamin A-rich fruits, vitamin A-rich vegetables and tubers, oils and fats	
7. Other fruits and vegetables	E.g. dried fruits and vegetables	

SECTION E: HOUSEHOLD FOOD INSECURITY ACCESS SCALE

(To be answered on behalf of the household by the person in the household who is most involved with the food preparation and meals).

No	Question	Response Options	Code
1.	In the past four weeks, did you worry that your household would not have enough food?	0 = No (skip to Q2) 1=Yes	
1a.	How often did this happen?	1 = Rarely (once or twice in the past four weeks) 2 = Sometimes (three to ten times in the past four weeks) 3 = Often (more than ten times in the past four weeks	

2.	In the past four weeks, were you or any household member not able to eat the kinds of foods you preferred because of a lack of resources?	0 = No (skip to Q3) 1=Yes	
2a.	How often did this happen?	1 = Rarely (once or twice in the past four weeks) 2 = Sometimes (three to ten times in the past four weeks) 3 = Often (more than ten times in the past four weeks	
3.	In the past four weeks, did you or any household member have to eat	0 = No (skip to Q4) 1 = Yes	

	a limited variety of foods due to a lack of resources?		
3a.	How often did this happen?	1 = Rarely (once or twice in the past four weeks) 2 = Sometimes (three to ten times in the past four weeks) 3 = Often (more than ten times in the past four weeks	
4.	In the past four weeks, did you or any household member have to eat some foods that you really did not want to eat because of a lack of resources to obtain other types of food?	0 = No (skip to Q5) 1 = Yes	

4a.	How often did this happen?	1 = Rarely (once or twice in the past four weeks) 2 = Sometimes (three to ten times in the past four weeks) 3 = Often (more than ten times in the past four weeks	
5.	In the past four weeks, did you or any household member have to eat a smaller meal than you felt you needed because there was not enough food?	0 = No (skip to Q6) 1 = Yes	
5a.	How often did this happen?	1 = Rarely (once or twice in the past four weeks) 2 = Sometimes (three to ten times in the past four	

		weeks) 3 = Often (more than ten times in the past four weeks	
6.	In the past four weeks, did you or any other household member have to eat fewer meals in a day because there was not enough food?	0 = No (skip to Q7) 1 = Yes	
6a.	How often did this happen?	1 = Rarely (once or twice in the past four weeks) 2 = Sometimes (three to ten times in the past four weeks) 3 = Often (more than ten times in the past four weeks	

7.	In the past four weeks, was there ever no food to eat of any kind in your household because of lack of resources to get food?	0 = No (skip to Q8) 1 = Yes	
7a.	How often did this happen?	1 = Rarely (once or twice in the past four weeks) 2 = Sometimes (three to ten times in the past four weeks) 3 = Often (more than ten times in the past four weeks	
8.	In the past four weeks, did you or any household member go to sleep at night hungry because there was not enough food?	0 = No (skip to Q9) 1 = Yes	

8a.	How often did this happen?	1 = Rarely (once or twice in the past four weeks) 2 = Sometimes (three to ten times in the past four weeks) 3 = Often (more than ten times in the past four weeks	
9.	In the past four weeks, did you or any household member go a whole day and night without eating anything because there was not enough food?	0 = No (the questionnaire is finished) 1 = Yes	
9a.	How often did this happen?	1 = Rarely (once or twice in the past four weeks) 2 = Sometimes (three to ten times in the past four	

		weeks) 3 = Often (more than ten times in the past four weeks	

Appendix 2: Ethical clearance and letter of introduction

GHANA HEALTH SERVICE

OUR CORE VALUES:
1. People-Centered
2. Professionalism
3. Team work
4. Innovation
5. Discipline
6. Integrity

Regional Health Directorate
Ghana Health Service
P.O. BOX 99
Tamale

Tuesday, 20 April 2021

My Ref No: GHS/NR/18-0/668

Your Ref No: .....

Tel: (233) (03720) 22912, 22710, 22146
Fax: (233) (03720) 22941
Email: rdhs.nr@ghsmail.org

NTIM SARPONG NATHANIEL
DEPARTMENT OF PUBLIC HEALTH
SCHOOL OF ALLIED HEALTH SCIENCES
UDS, TAMALE

RE: APPLICATION FOR CLEARANCE

I write to acknowledge the receipt of your letter dated 13th April 2021. The office has granted you the permission to conduct the study in the region subject to you getting approval from Ghana Health Service Ethics Review Committee on the research topic: **"ASSESSING THE ASSOCIATION BETWEEN THE LEVEL OF HOUSEHOLD FOOD SECURITY AND NUTRITIONAL STATUS OF CHILDREN FROM 6 TO 59 MONTHS IN TAMALE SOURTH IN THE NORTHERN REGION OF GHANA "**

You will be given an introductory letter to the study area upon submitting ethical clearance approval letter from Ghana Health Service Ethics Review Committee to this office.

Thank you.

.....

DR. JOHN BERTSON ELEEZA

REG. DIRECTOR OF HEALTH SERVICES, NORTHERN REGION