UNIVERSITY FOR DEVELOPMENT STUDIES

ASSOCIATION BETWEEN HOUSEHOLD FOOD INSECURITY, NUTRITIONAL STATUS AND ACADEMIC PERFORMANCE OF JUNIOR HIGH SCHOOL (JHS) PUPILS IN THE TOLON DISTRICT OF THE NORTHERN REGION OF GHANA

BUSAGRI EMMANUEL

2024

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(B. ED HOME ECONOMICS)

(UDS/MPHN/0009/21)

A THESIS SUBMITTED TO THE DEPARTMENT OF NUTRITIONAL SCIENCES, SCHOOL OF ALLIED HEALTH SCIENCES, UNIVERSITY FOR DEVELOPMENT STUDIES IN PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR THE AWARD OF A MASTER OF PHILOSOPHY DEGREE IN PUBLIC HEALTH NUTRITION

MAY, 2024

DECLARATION

Student's Declaration

I hereby declare that this thesis is the result of my original work and that no part of it has been presented for another degree in this University or elsewhere:

Candidate:

Signature:  Date: 27-05-2024

Name: BUSAGRI EMMANUEL

Supervisor's Declaration

I hereby declare that the preparation and presentation of this thesis was supervised following the guidelines on supervision of thesis laid down by the University for Development Studies.

Supervisor:

Signature:  Date: 27-05-2024

Name: DR. SUARA BAKURI SUFYAN

ABSTRACT

Baldwin (2006) asserted that food security and insecurity are terms used to describe the extent to which people can obtain an adequate quantity and quality of food. There have been a number of studies that focused on food insecurity and its impact on the nutritional status of children and adolescents but very few studies expanded their scope to cover the impact of the household food insecurity on educational outcomes. The aim of this study was to assess the association between food insecurity, nutritional status, and academic performance of JHS pupils. The design of the study was a cross-sectional study design. The sample size was 220 pupils and their households. The individual and the household food insecurity experience scale (FIES) questionnaire was administered to pupils and their households, respectively through face to face interviews. Anthropometric measurements of children were also taken using Seca-scale and stadiometer. The data were analyzed using IBM SPSS and WHO Anthro Plus. Descriptive statistics were done for all the socio-demographic variables, nutritional status, and food insecurity variables. Chi-square test was used to evaluate the relationship between individual food insecurity status and household food insecurity status. Moreover, linear regression models were conducted to determine the relationship between covariates, school attendance, and academic performance. Further, binary logistic regression models were also used to assess associations of covariates with stunting and underweight. For all the tests of associations, a P-value of 0.050 or less was considered statistically significant. The overall underweight prevalence was 11.3%. The percentage of overweight was 2.3%. The total prevalence of stunting among the study participants was 17.7%. Many of the households were moderately food insecure with a prevalence of 80 (36.4%). Also, 34.1% of the households were severely food insecure and 29.5% of the households were food secured. Overall, 145 (65.9%) of the pupils were either moderately or severely food insecure. Based on the chi-square analysis, there was a significant relationship between household food insecurity status and

individual food insecurity status (P<0.001). Both household and Individual Food insecurity variables were not associated with nutritional status and academic performance of the pupils. Surprisingly, there was a positive relationship between severe individual food insecurity status and school attendance [Beta (β) = 10.39; Confidence Interval (CI) = 1.44-19.34; Statistical significance (P) = 0.023] thus, upon the adjustments for the effects of other covariates. Thus, the severe individual food insecurity status however had a positive relationship on attendance but not performance and nutritional status. Hence, household food insecurity status was not significantly associated with nutritional status and academic performance. I suggest that, family support and poverty alleviation programmes be rolled by government of Ghana, to curb the negative impact of food insecurity on households and individuals.

Key words: Food insecurity, nutritional status and academic performance.

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Finally, I also thank my dad and the entire family for their unflinching support during this project.

DEDICATION

This thesis is dedicated to the Almighty God and to the blessed memory of my late mom.

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LIST OF ABBREVIATIONS/ACRONYMS AND THEIR MEANINGS

AOR……Adjusted Odds Ratio

ATR…… African Traditional Religion

BAZ…… BMI for Age Z- Score

CI……..Confidence Interval

DHS …… District Health Service

FAO……. …… Food and Agriculture Organization

FIES ……...…….. Food Insecurity Experience Scale

GES ……Ghana Education Service

GHS ……...…….. Ghana Health Service

GSFP ……...…….. Ghana School Feeding Programme

GSS…….. ……Ghana Statistical Service

HAZ……Height for Age Z-Score

HFIS…….……..Household Food Insecurity Status

IFAD.....International Fund for Agricultural Development

IFIS……Individual Food Insecurity Status

JHS….……Junior High School

LMIC…… …… Low- and Middle-Income Countries

MOH…… …… Ministry of Health

NGOS……... …… Non-Governmental Organizations

NNP…….. ……...National Nutrition Policy

OR ……Odds Ratio

SD …….Standard Deviation

SDG……Sustainable Development Goals

SHS…….……...Senior High School

SMP…….……..School Meal Programme

SPRING ….……Strengthening Partnerships, Results, and Innovations in Nutrition Globally

SSA ……Sub Saharan Africa

UN …….United Nations

UNESCO……United Nations Educational, Scientific and Cultural Organizations

UNICEF……. United Nations International Children's Emergency Fund

UOR……Unadjusted Odds Ratio

WAZ……Weight For Age Z-Score

WFP …...……World Food Programme

WHO……...World Health Organization

WHZ ……...Weight For Height Z-Score

CHAPTER ONE

1.0 INTRODUCTION

1.1 Background

Poverty is one of the most serious threats to human well-being and lifelong potential, and thus, affects children's educational and developmental outcomes later in life both directly and indirectly (Faught et al., 2017; Laura Kim, 2016; Weaver et al., 2019); Engle and Black 2008). Food insecurity is one of the many inevitable consequences of poverty and economic hardship which can negatively impact children's well-being because it leads to poor diet quality with its attendant consequences on the child's development (Fram, M. S., L. D. Ritchie, 2015; Khalil & Elmulthum, 2021). Particularly, food insecurity is a common public health issue and poses a significant deterrent to attaining educational excellence among school children and adolescents in developing countries (Tamiru & Belachew, 2017).

The defining principle of food security given by the Food and Agriculture Organization (FAO) is that this is a state "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" (Food and Agriculture Organization, 1996). Household food insecurity on the other hand is defined as "the insufficiency of access to adequate and nutritious food options that support a healthy and dynamic lifestyle considered socially acceptable and predominantly due to economic limitations and or various natural or human-induced disasters" (FAO, 2013). (Cook, J. and Jeng, 2009) intimated that children raised in food-insecure households may experience delays in cognitive development compared to their counterparts from food-secure environments. Such

children suffer poor cognitive performance which is manifested in lower intelligence quotient (IQ) and poor learning outcomes throughout their school years, with some having to be placed in special education at some point (Belsky, D. W., T. E. Moffitt, L. Arseneault, 2010).

Like many other developing countries in sub-Saharan Africa, household food insecurity is a worrying social, economic and public health problem in Ghana (Agbadi et al., 2017; Atuoye et al., 2017), This issue persists, significantly impacting school-age children, as indicated by the elevated levels of stunting, wasting, and underweight cases, particularly in the northern part of the country (Ghana National Nutrition Policy, 2013; Ghana Statistical Service, 2014). Gaining access to an ample supply of nourishing food poses a major challenge for most Ghanaian families, especially those residing in the five Northern Regions, which are known to be the poorest regions in the country and frequently endure harsh weather conditions (UNDP Report, 2010). Acknowledging this nation's problem of household food insecurity, the Ghanaian government formulated the National Nutrition Policy (NNP) in 2013. Its primary aim is to guarantee optimal nutrition and well-being for all citizens, with a particular focus on school-age children (Ghana National Nutrition Policy, 2013). It was a subsequent policy following the Ghana School Feeding Program (GSFP) which was implemented in 2005 to eliminate hunger among school children to achieve universal primary education.

Despite the frantic efforts to mitigate the influence of the impact of food and nutrition insecurity on the educational achievements of Ghanaian children, household food insecurity persists. Given that household food insecurity has profound repercussions on children's health and well-being through poor diet (American Dietetic Association, 2010; Vozoris NT & Tarasuk VS, 2003), poor childhood development (Gundersen C & Ziliak JP, 2015; Olson CM, 1999), and poor psychological and cognitive functioning (Baiden et al., 2019; Faught et al., 2017), government and

other stakeholders must develop strategies to address this multifaceted challenge. Even in the developed world, several cross-sectional studies (Huang & Potochnick, 2018; Payne-sturges et al., 2019; Shanafelt et al., 2017), and longitudinal studies (Hernandez, D. C., & Jacknowitz, 2009; Howard, 2011) have shown household food insecurity to have long-term negative impacts on the academic performance of children.

Conversely, this correlation has not been thoroughly explored in low-middle-income countries (LMICs) including Ghana. The present study therefore investigated the extent to which household food insecurity is affecting the academic performance of Junior High School pupils in the Tolon Community. The study seeks to answer whether students from food-insecure households were more likely to exhibit poorer academic performance compared to their peers from food-secure households. The findings may be useful to health and nutrition policymakers aimed at food security improvements and may also serve as a reference for future studies in similar fields.

1.2 Problem Statement

Available statistics from the West African Examinations Council (WAEC) indicate that the overall performance of pupils in the Basic Education Certificate Examination (BECE) has tremendously improved in recent years in terms of the pass rate in the four core subjects (Mathematics, Integrated Science, English Language and Social Studies), with national pass rates (grade 1-5) of 65.7% in 2021, 68.5% in 2020, 64% in 2019, 23.3% in 2018 and 21.47% in 2017 respectively (WAEC reports, 2021). Notwithstanding this consistent improvement in the overall national performance, the data also reveal the highest failure rates are recorded in schools in the Northern region of the country. In 2015, out 36,536 pupils who sat for the examination, only 7,147 representing 19.56% passed within aggregate 6 to 30. Also, in 2018, with 42,623 who took part in the B.E.C.E., only 15,874 representing 37.24% passed within an aggregate of 6 to 30 (Odaatu, 2020). Absenteeism

attributed to hunger have been identified as a significant factor contributing to the gap in academic achievement between students in the northern regions compared to those in the southern regions (Baiden et al., 2019; Masa Rainier & Gina Chowa, 2020).

In a national survey investigating the connection between household food insecurity and educational achievements among school-aged adolescents in Ghana, (Masa Rainier & Gina Chowa, 2020) revealed that 68% of the adolescents in Ghana resided in households facing food insecurity with 43% of these adolescents living in the northern region. This substantial portion of students from food-insecure households in the Northern region of the country indicates a considerable number of elementary school pupils who may face academic challenges due to the adverse effects of food insecurity on both cognitive and non-cognitive educational results.

Ghana in 2005 implemented the School Feeding Programme in a bid to increase enrolment and educational outcomes through the provision of lunch meals to students at selected Primary and Junior High Schools. This School Meal Programme (SMP) not only led to an increase in enrolment rates but also delivered moderate improvement in academic performance (Dari & Nyatsikor, 2023). This included improvement in Mathematics and literacy scores among the average pupils, with notable advancements in learning and cognitive skills observed in students from poor/deprived communities (Gelli A, Aurino E, 2019). Despite the many positive contributions of the School Feeding Programme to educational outcomes since its implementation, research also indicates a heterogeneous effect of SMP on educational outcomes in high-resource settings (Masa & Chowa, 2021). This heterogeneity implies that poverty indicators, such as household food insecurity, may cause students from food insecure households to underperform academically compared to their peers from food secure households.

In 2009, the school feeding program underwent expansion to encompass a specific group of Junior High Schools in the Northern region. This expansion aimed to utilize an existing nutrition initiative as a means to tackle the adverse effects of food insecurity on the educational achievements of high school students, particularly among girls and students living in poverty. Without doubt, the programme since its implementation has had a significant impact on nutritional and educational outcomes for marginalized students, such as girls, the poor, and those living in the country's Northern regions (Gelli A, Aurino E, 2019), but not all Junior High Schools in deprived districts are covered under the programme.

Studies on the relationship between food insecurity and academic performance of basic school pupils are few in Ghana. The Northern region has been identified as having one of the highest rates of household food insecurity (Agbadi et al., 2017; Atuoye et al., 2017), and the Tolon district is one of the districts where majority of the populace are food insecure. However, no research has explored the association between inadequate household food access and poor academic performance of students in the district. As a result, there is a need for research that will provide empirical evidence on the phenomenon. The current study aims to shed light on the issue by producing findings on how household food insecurity is affecting the academic performance of Junior High School students in the Tolon District.

1.3 Research Questions

1.3.1 Main Research Question

What are the relationships between household food insecurity, nutritional status, and the academic performance of Junior High School pupils in the Tolon District of the Northern Region of Ghana?

1.3.2 Specific Research Questions

The study was guided by the following research questions.

I. What is the prevalence of household and individual food insecurity among Junior High School pupils in the Tolon District?

II. What is the association between household and individual food insecurity status and school attendance among the pupils?

III. What is the relationship between household and individual food insecurity status and academic performance among Junior High School pupils in the Tolon District?

IV. What is the prevalence of malnutrition (stunting, wasting, underweight, overweight and obesity) among the JHS pupils?

V. What is the association between household and individual food insecurity status and nutritional status of the pupils?

1.4 Objectives of the study

1.4.1 Main Objective of the Study

The main objective of the study was to evaluate the relationship between household food insecurity, nutritional status, and the academic performance of Junior High School students in the Tolon District of the Northern Region of Ghana.

1.4.2 Specific Objectives

Specifically, the study sought:

I. To assess the prevalence of household and individual food insecurity among Junior High School students in Tolon.

II. To assess the association between household and individual food insecurity status and school attendance among the students.

III. To determine the relationship between household and individual food insecurity status and academic performance among Junior High School students in Tolon.

IV. To assess the prevalence of malnutrition (stunting, underweight, overweight and obesity) among the pupils.

V. To determine the association between household and individual food insecurity and nutritional status of the pupils.

1.5 Relevance of the study

In Ghana, household food insecurity is a significant problem that does not appear to be getting better, particularly in the Northern region where the majority of families live in abject poverty. Findings from the current study may provide empirical evidence that a child's academic performance and attendance at school may be negatively impacted by food insecurity in their households and how this happens.

The study's findings are expected to be shared with the Ghana Health Service through the Tolon Education Directorate to guide future programs and policies to address student hunger and improving district educational outcomes. The study's results may significantly contribute to enhancing the impact of the School Feeding Programme and provide a systematic body of knowledge that can be used for appropriate policy formulation. The researcher is confident that the present findings may also be a source of essential information on the extent to which food insecurity is affecting the academic achievements of Junior High School students in the Tolon

District, which may serve as useful data to the Ghana Education Service to expand and improve on its School Lunch Programme and turn the tide in the dwindling academic performance in the district.

To conduct more extensive research and clarify a causal relationship between food insecurity and academic achievement in Ghanaian basic school students, future researchers who are interested in investigating the relationship between adequate nutrition and educational outcomes may find value in using the current data as a baseline information.

1.6 Conceptual Framework for the Study

The Conceptual Framework underpinning the current study is derived from (N'Danikou et al., 2017) and (Gross, R.; Schoeneberger, H.; Pfeifer, H.; Preuss, 2000). It relies on mediating variables such as demographics, school environment and psychosocial factors to explain the association between food insecurities in households and student academic performance. Independently, the primary variable which is the main exposure variable the study is investigating, is the household food insecurity status, which is defined as the inability of a household to obtain sufficient and wholesome food due to financial limitations or other reasons (Carter, M. A., Dubois, L., & Tremblay, M. S., 2014). Food insecurity can result in a diet low in nutrients and have detrimental effects on children's well-being and development, including their academic performance. The dependent variables are the outcome variables of school attendance, nutritional status and academic performance of the students. In this study, academic performance was assessed based on test scores obtained by each student in the English Language and Mathematics test administered by the researcher. Household food insecurity may negatively impact academic performance by affecting school attendance, nutritional status, cognitive development, intelligence quotient (IQ), and students' learning outcomes.

Mediating variables include school environment, and socio-demographic and psychosocial factors that can alleviate the impact of food insecurity on the pupils' academic achievement. The conceptual framework recognizes that these mediating factors may have an impact on the relationship between households' food insecurity and academic achievement. The framework acknowledges the potential influence of mediating factors and aims to provide empirical evidence on the phenomenon to inform strategies for improving educational outcomes in food-insecure households (N'Danikou et al., 2017).

Independent variables Mediating variable Dependent variable

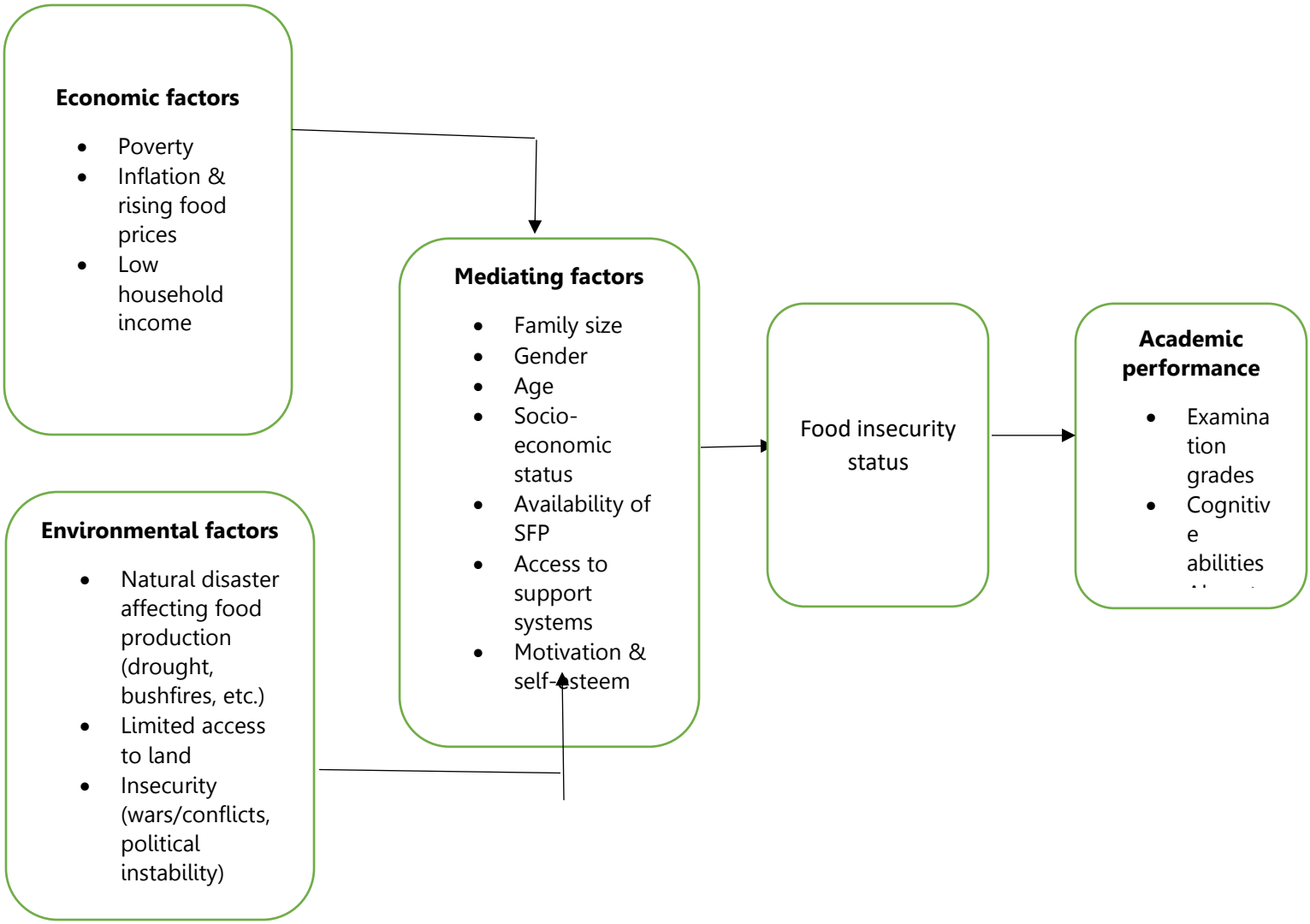


Figure 1.1: Conceptual framework on relationship between household food insecurity and academic performance of school children.

Source: Derived from a synthesis of literature from (N'Danikou et al., 2017) and (Gross, R.; Schoeneberger, H.; Pfeifer, H.; Preuss, 2000).

CHAPTER TWO

2.0 LITERATURE REVIEW

2.1 Introduction to the Literature Review

A review of literature is a summary of current knowledge about a specific practice or problem including what is known and what is unknown. According to Shinde & Anjum (2007), literature review is conducted to explore what is already known about a subject matter of interest, synthesize findings from published related works and identify any knowledge gaps proposed research seeks to bridge. A review of empirical literature also helps to determine how the research can contribute to furthering the understanding of a phenomenon while also assisting in developing hypotheses and framing the research question.

This chapter thoroughly analyses the body of research on the connection between students' poor academic performance and home food hardship. It also covers the influence of food insecurity in households on school attendance. The review further explored the prevalence of household food insecurity, its impact on educational outcomes, and the specific contexts of Junior High Schools in Tolon. Furthermore, the previous findings on the relationship between household food security and individual food security status will be explored. Additionally, the chapter contains up-to-date information on the relationships between student nutritional status and home food security. The literature review was started by searching for relevant literature using terms and phrases like "household food insecurity," "academic performance," "educational attainment," "school attendance," "hunger," "nutritional status," and "cognitive development" in databases like PubMed, Scopus, Medline, and Google Scholar.

High impact factor papers published in the aforementioned databases met the inclusion criteria. The researcher used indicators such as the number of related papers that supported or refuted the

conclusions of a certain article when choosing high-impact factor articles. All the studies' findings that satisfied the inclusion requirements were then carefully examined, combined, and utilized in the write-up.

2.2.0 Introduction to Household Food Security: Definitions, Dimensions, and Measurement Indicators

Household food security is a critical concept that has gained significant attention in recent decades due to its implications for human health, economic stability, and social well-being. This review aims to provide a comprehensive overview of the definitions, dimensions, and measurement indicators of household food security, drawing on insights from the provided research papers.

2.2.1 Definitions of Household Food Security

Household food security is generally defined as a condition where all members of a household have consistent access to sufficient, safe, and nutritious food to maintain an active and healthy life. This concept is often extended to include the ability to acquire food in a socially acceptable manner, without resorting to emergency or unconventional sources (Babu et al., 2013) ("Introduction to food security", 2021). The most widely accepted definition, as per the 1996 World Food Summit, emphasizes that food security exists when all people, at all times, have physical, social, and economic access to sufficient, safe, and nutritious food that meets their dietary needs and preferences for an active and healthy life (Babu et al., 2013).

The concept of food security is multifaceted and can be applied at various levels, including national, regional, and household or individual levels. At the household level, food security is often measured by assessing the availability, access, and utilization of food, as well as the stability of these dimensions over time (Babu et al., 2013) ("Introduction to food security", 2021). According

to the World Bank (1986, cited in Quaye, 2008), food security ensures that all individuals have continuous access to adequate amount of food that supports an active and healthy life. Similarly, food security is defined by the World Bank (2002) as the state of having stable, sustained access to enough food for an active, healthy life.

Baldwin (2006) asserted that food security and insecurity are terms used to describe the extent to which people can obtain an adequate quantity and quality of food. Additionally, Maharjan and Khatri-Chhetri (2006) proposed that food insecurity is commonly understood as the condition where all individuals have access to enough food to meet their required levels of consumption as a result of fluctuations in production, prices, and income whereas food security is generally the condition where all individuals have access to enough food to maintain an active life.

Food security is a crucial aspect when considering the overall well-being of a population (Ahenkan, A. and Boon, 2008; Rose-Jacobs et al., 2008; World Health Organization, 2020). It is a function of several factors such as the social and economic environment, physical conditions, and individual characteristics and behaviors, all of which are recognized as key determinants of health (Khalil & Elmulthum, 2021; Mohd Irwan Maarof, 2017; Perez-Escamilla et al., 2012; Wagner, 2021).

Food insecurity, in its broadest sense, is the condition in which all people lack the means to obtain enough safe, nourishing food to meet their dietary needs. This definition was provided by the Food and Agriculture Organization in the World Food Summit policy document (FAO, 1996). Food insecurity can be experienced by individuals, households, communities, regions, and even entire nations, with significant variations across different countries which are categorized as first, second, and third world (FAO, 1996). Poverty and inadequate food production systems make the situation

in emerging nations grave (FAO, 2011). In Ghana, it is primarily assessed and reported at the household level (Masa Rainier & Gina Chowa, 2020).

Household food security is defined by the International Fund for Agricultural Development (IFAD) as the ability of households to consistently and sustainably obtain an adequate variety of food (IFAD, 1996, cited in De Waal &Tumushabe, 2003). According to Khalil and Elmulthum (2021), a household reaches food security when all of its members have access to adequate food to live healthy lives without undue risk of losing that access. However, Agbadi et al. (2017) outlined two reasons why food security in the home may not always equate to food security for every member of the household.

Firstly, even if households have the ability to obtain sufficient food, there may still be challenges in translating that ability into actual food procurement. Secondly, the distribution of food within the household may not be based on the needs of each individual member. Pinstrup-Andersen (2000) further notes that accessibility of food can be impacted by a number of variables, including income levels, population expansion, infrastructure, lifestyles and tastes, and human resource development.

Achieving food security involves addressing the various factors that contribute to food insecurity. The World Food Summit identified four pillars of food security: food availability (ensuring an adequate and consistent food supply), food access (having the necessary resources to obtain nutritious food), food utilization (appropriate utilization based on knowledge of nutrition, along with sufficient water and sanitation), and stability of the food supply. Ensuring that everyone has constant access to enough safe, nourishing food to live a healthy and active life is the ultimate goal of food security (Food and Agriculture Organization, 1996).

2.2.2 Dimensions of Household Food Security

The World Food Summit (1996) laid out four main pillars upon which the food security of households, communities, and nations is hinged on. These pillars were reaffirmed in the second summit in 2009. This aspect of the literature review aims to explore and analyze the existing research on these four pillars while examining their impact on food security.

The measurement of household food security is typically based these four core dimensions: availability, access, utilization, and stability. These dimensions are interconnected and collectively determine the food security status of a household.

i. Food Availability

Food availability refers to the physical presence of food in sufficient quantities within a household or geographic area. It is often measured by the production, import, and distribution of food. At the household level, availability can be assessed by the quantity and variety of food stored or purchased (Gadiso et al., 2023) (Ike et al., 2015). The availability of food is determined by the amount of food that is available at the national, regional, and household levels. It is determined by agricultural production levels, food stocks, and imports. Ensuring food availability involves enhancing agricultural productivity, promoting sustainable farming practices, and reducing post-harvest losses. Studies have shown that factors such as climate change, land degradation, and agricultural policies significantly influence food availability (Kimbro & Denney, 2015).

Three major factors affect food availability: exchange, distribution, and production (Gregory et al., 2005). Numerous factors, such as land ownership and use, soil management, crop selection, breeding, and management, animal breeding and management, and harvesting techniques, all have

an impact on food production (FAO, 2013). Crop productivity can be greatly impacted by variations in temperature and rainfall patterns (Gregory et al., 2005). Food production frequently faces competition from other purposes, such as urbanization, for the use of land, water, and energy (Godfray et al., 2010).

Food distribution encompasses activities such as storage, processing, transportation, packaging, and marketing of food (FAO, 2013). Insufficient transportation infrastructure can result in increased costs for supplying water and fertilizer, as well as transporting food to national and global markets (Godfray et al., 2010). These challenges in transportation infrastructure can contribute to price fluctuations in the food market.

ii. Food Access

Food access refers to the ability of individuals or households to acquire food through purchase, production, or other means. It is influenced by economic factors such as income, prices, and employment, as well as physical factors such as proximity to food markets and transportation infrastructure (Babu et al., 2013) (Malkanthi et al., 2010). Limited access to food can lead to food insecurity, even if food is available in the broader region. Food access encompasses the affordability, allocation, and preferences of individuals and households when it comes to obtaining food (Gregory et al., 2005). Poverty can hinder the access of individuals and households to food, and it can also make them more vulnerable to sudden increases in food prices (Ecker &Breisinger, 2012). The availability of food for individuals, households, or communities is contingent upon two essential elements: financial accessibility and physical accessibility. The availability of social support networks, food prices, and disposable income all have an impact on economic access. Conversely, the availability and caliber of infrastructure—such as ports, highways, trains, communication systems, food storage facilities, and other facilities that support market

operations—have an impact on physical access (FAO, 2013). Access to food can also be impacted by a person or household's location in regard to food supplies (Garrett and Ruel, 1999). Various assets, including household income, land ownership, labor products, inheritances, and gifts, also influence a household's access to food (FAO, 2013).

Household food insecurity may arise from financial constraints, particularly in terms of accessing food (Tarasuk V, Mitchell A, 2013). It is characterized by circumstances such as prioritizing other household and living expenses over food expenses, insufficient knowledge or resources to allocate funds adequately to ensure a balanced diet across food groups, persistent hunger, frequent meal skipping, or, in severe cases, enduring extended periods without food due to a lack of availability or financial means to acquire it (Huang & Potochnick, 2018).

While physical access is related to infrastructure, transportation, and food delivery networks, economic access is impacted by variables including income, employment, and food pricing. Social and cultural factors such as gender inequalities, social norms, and dietary preferences have also been reported as important determinants of food access. Poverty, inequality, and limited access to markets have been found to be directly correlated with difficulties in food access (Chilton et al., 2007).

iii. Food Utilization

Food utilization refers to the proper use of food to ensure nutritional well-being. It involves the preparation, consumption, and absorption of food, and is influenced by factors such as dietary diversity, food safety, and health status. Poor utilization can result in malnutrition, even if food is available and accessible (Babu et al., 2013) (Kepple & Segall-Corrêa, 2010). Food security goes beyond access to food to include the proper intake and utilization of nutrients from food to meet dietary requirements and maintain good health. Thus, for an individual, a household or an entire

nation to be food and nutrition secure, critical attention must be put into ensuring food safety, hygiene, dietary diversity, and nutritional knowledge. Malnutrition, stunted growth, and other health issues can result from low food consumption, even in cases where people have enough access to food. This is especially true for vulnerable groups like children and pregnant women.

The utilization of food involves two significant dimensions. Anthropometric markers, which are impacted by an individual's nutritional state, comprise the first dimension. Stunting (being too short for one's age), underweight (being too thin for one's age), and wasting (being too thin for one's height) are some of these signs. Anthropometric measurements are thought to be a fair approximation of the nutritional condition of the entire population, particularly for children under five.

The second dimension encompasses a range of input indicators or determinants that represent, food preparations, quality health and hygiene conditions. These factors collectively determine the effectiveness of available food in being utilized (FAO, 2013).

The results of insufficient food intake and ill health are frequently shown by outcome indicators of food use. For example, wasting is typically caused by short-term insufficient food intake, illness, or infection. On the other hand, stunting can be the result of chronically low food intake, recurrent illnesses, and/or recurrent episodes of acute under-nutrition (FAO, 2013).

However, availability alone does not guarantee food security, as other factors such as access and utilization also play a crucial role.

iv. Food Stability

Food stability refers to the consistency of food availability, access, and utilization over time. It is particularly important in contexts where food supplies may be disrupted due to factors such as climate change, economic crises, or political instability. Households with high stability are better equipped to maintain food security during shocks or stressors (Gadiso et al., 2023) (Ike et al., 2015). It is necessary to always have continuous access to enough food in order to attain food security, whether at the population, household, or individual level. In order for this to occur, there must be no chance of food insecurity brought on by cyclical occurrences like seasonal food insecurity or abrupt shocks like economic or climatic disasters (FAO, 2013).

The stability of the food supply relates to the ability to maintain access to food over time, even in the face of shocks and disruptions. It involves strategies such as food reserves, social safety nets, and disaster management systems. Instability in the food supply can result from natural disasters, conflicts, and economic crises, leading to increased food insecurity. Research has examined the effectiveness of various interventions and policies aimed at enhancing the stability of the food supply (USDA, 2012).

2.2.3 Measurement Indicators of Household Food Security

The measurement of household food security involves the use of various indicators that reflect the four dimensions of food security. These indicators can be broadly categorized into objective and subjective measures.

i. Objective Indicators

Objective indicators are based on observable and quantifiable data. Common examples include:

Calorie Adequacy: This indicator measures the total number of calories available per person in a household. It is often used to assess food availability and access (Manikas et al., 2023) (Headey & Ecker, 2013).

Dietary Diversity: This indicator assesses the variety of foods consumed by a household, which reflects food utilization and nutritional quality. A higher dietary diversity score is associated with better food security (Manikas et al., 2023) (Headey & Ecker, 2013).

Household Food Insecurity Access Scale (HFIAS): This scale measures the severity of food insecurity by assessing the frequency of food access problems within a household (Ike et al., 2015) (Nguyen et al., 2016).

ii. Subjective Indicators

Subjective indicators are based on the perceptions and experiences of household members. These indicators are often used to capture the psychological and social dimensions of food insecurity. Examples include:

Experience-Based Indicators: These indicators assess the experiences of food insecurity, such as worrying about running out of food, reducing the quantity of food eaten, or feeling hungry because there is not enough food. The Food Insecurity Experience Scale (FIES) is a widely used example of this type of indicator (Manikas et al., 2023) (Nguyen et al., 2016).

Coping Strategies Index (CSI): This index measures the strategies households use to cope with food shortages, such as borrowing money to buy food or relying on less preferred foods (Ike et al., 2015) (Malkanthi et al., 2010).

iii. Composite Indicators

Composite indicators combine multiple dimensions of food security into a single measure. These indicators are useful for capturing the complexity of food security and for comparing food security

status across different households or regions. Examples include the Household Food Insecurity Index (HFSI) and the Multidimensional Food Security Index (MFSI) (Malkanthi et al., 2010) (Wineman, 2013).

2.2.4 Challenges in Measuring Household Food Security

Despite the availability of various indicators, measuring household food security remains challenging. Key challenges include:

Conceptual Complexity: Food security is a multifaceted concept, and its measurement requires capturing multiple dimensions simultaneously (Gadiso et al., 2023) (Ike et al., 2015).

Data Limitations: Many indicators rely on self-reported data, which may be subject to biases and inaccuracies. Additionally, the cost and complexity of data collection can limit the use of certain indicators in resource-constrained settings (Manikas et al., 2023) (Headey & Ecker, 2013).

Cultural and Contextual Variations: Food security measures must be adapted to the cultural and contextual realities of different regions. For example, coping strategies may vary significantly across different cultural and socioeconomic contexts (Renzaho & Mellor, 2009).

2.3 The Burden of Food Insecurity

The burden of food insecurity talks about the negative impacts, consequences and effects of food insecurity on individuals, households, communities and societies as whole. This section reviewed the literature in relation to the magnitude of the impact of food insecurity at both local and global context.

2.3.1 Global Burden

The percentage of the world's population that is thought to experience varying degrees of food insecurity represents the global burden of food insecurity. Thus, prevalence serves as a crucial

indicator of the global burden of this widespread public health issue. A recent World Health Organization (WHO) research states that in 2021, almost 2.3 billion people, and representing 29.3% of the global population, faced moderate to severe food insecurity. From pre-COVID-19 levels, this indicates a 350 million rise in population. The news that approximately 924 million people, or 11.7% of the world's population, experienced extreme food insecurity—a rise of 207 million in just two years—is even more concerning (World Health Organization, 2022).

Food insecurity has far-reaching consequences for individuals and communities because it poses risks to physical health, contributing to malnutrition, stunting, and various diet-related non-communicable diseases (Laddu DR. Huizar MI, Arena R, 2020). The COVID-19 pandemic has exacerbated food insecurity worldwide. Lockdown measures and disruptions in supply chains have disrupted food access for vulnerable populations. Studies show that during the pandemic's early stages found that lockdown measures significantly impacted household food security, with more than 50% of households experiencing food insecurity (Elsahoryi et al., 2020; Zhang Y, Yang K, Hou S, Zhong T, 2021). Without a shred of doubt, the multifaceted impact of the pandemic has further magnified the global burden of food insecurity.

Due to the pandemic's impact on earnings and disruption of food supply networks, which has resulted in skyrocketing food costs, food insecurity has worsened in practically every nation. This has worsened the plight of many middle-class workers and has pushed more children in developing countries into extreme hunger and malnutrition (Elsahoryi et al., 2020). The high unemployment levels occasioned by the disruption caused by the pandemic's high unemployment rates have raised rates of food insecurity in both adults and children. And it is due to poverty and limited access to school nutrition programs because of school closures.

2.3.2 Burden of Food Insecurity in Ghana

Despite the significant economic growth Ghana has witnessed in recent years, majority of the people struggle to make a living, with an estimated 25% of the population still living below the poverty line (Cooke & Sarahhague, 2016). Ghana like many other developing nations has a larger proportion of its citizenry being poor and unable to gain adequate access to sufficient amounts of nutritious food that meet their needs. Food insecurity is very widespread; research indicates that 1.2 million Ghanaians are food insecure and that an additional two million are highly vulnerable to food insecurity (MoFA, 2019).

Researchers have established that even though household food insecurity in Ghana is prevalent in both rural and urban settings, there is a relatively higher prevalence in rural communities than in urban settings (Kuku-Shittu, O., Mathiassen, A., Wadhwa, A., Myles, L., & Ajibola, 2013). While food insecurity is traditionally higher in rural areas, recent findings highlight the specific challenges faced by urban dwellers, particularly those in economically vulnerable groups such as slum dwellers (Bongaarts, 2021; Kuku-Shittu, O., Mathiassen, A., Wadhwa, A., Myles, L., & Ajibola, 2013). Urban inhabitants in most towns and cities have challenges relating to food access, quality, safety, and cost as rural-urban migration continues to rise, making them more susceptible to food insecurity and malnutrition (Bongaarts, 2021).

The complex interplay of structural and behavioral determinants affects food supply because of a reduction in the farming workforce and the loss of arable land near urban areas, which is often converted for residential and industrial purposes. Consequently, the diminished food supply capacity results in increased food costs, further compounded by high population density and growing demand. Low-income families are particularly vulnerable to shocks and situations that impact their income generation and savings. The rising costs of food associated with urbanization

exacerbate the food security challenges faced by these families (Zimon, D., Madzik, P., & Domingues, 2020).

Food insecurity is more common in low- and middle-income homes, according to another study done in Accra by Tuholske et al. (2020), with about 70% of the studied households being classed as slightly to severely food insecure. Nonetheless, there was a low prevalence of worry and experiences connected to food insecurity. The Household Food Insecurity Assessment Protocol (HFIAP) and the Household Food Insecurity Access Scale (HFIAS) did not correlate with the Food Consumption Score (FCS), but HFIAS and HFIAP were closely correlated. Spatial analysis revealed high heterogeneity in household-level food security outcomes. Factors such as household size, educational attainment, household assets, remittances, total monthly food expenditures, and travel times to markets influenced food security outcomes. However, labor type and daily expenditures on prepared food away from home had minimal impact.

The Upper East, Upper West, Northern, Savannah, and North East regions that make up Ghana's northern region are especially vulnerable to food insecurity due to its geographical location and climatic conditions. These regions experience frequent droughts, unreliable rainfall, and poor soil fertility, making agriculture and food production difficult (Baiden et al., 2019; Sraku-Lartey, 2014).

The prevalence of food insecurity in the Northern region is alarmingly high. Numerous studies have indicated that a significant proportion of households in this region struggle to access sufficient and nutritious food on a regular basis. According to reports by (Agbadi et al., 2017) and (Atuoye et al., 2017), household food insecurity rates in the Northern region range from 60% to 70%, indicating a severe problem that affects a large number of families and children.

2.4 Nutritional Status in Adolescents

The nutritional status of adolescents in the Northern region of Ghana is influenced by a variety of factors, including socio-economic conditions, dietary patterns, and micronutrient intake. Adolescents in this region face significant nutritional challenges, such as micronutrient deficiencies and poor dietary quality, which are exacerbated by socio-economic and environmental determinants. These factors collectively impact their health and development, necessitating targeted interventions to improve their nutritional outcomes.

2.4.1 Key Nutritional Indicators

Micronutrient Deficiencies: Adolescents in Northern Ghana are particularly vulnerable to deficiencies in micronutrients such as iron and vitamin A. A study on fortified biscuits showed mixed results, with no significant improvement in iron status but a reduction in vitamin A deficiency among post-menarche girls (Azupogo et al., 2023).

Dietary Patterns: Poor-quality diets are common, characterized by insufficient nutrient intake and a lack of diversity, which are critical during the rapid growth phase of adolescence (Heslin, 2023) (Rah et al., 2016).

2.4.2 Determinants of Nutritional Status

Socio-Economic Factors: Household food insecurity and poverty significantly affect adolescents' nutritional status, limiting access to diverse and nutritious foods (Nimo et al., 2024).

Cultural and Environmental Influences: Social norms and environmental factors, such as availability of food resources, play a crucial role in shaping dietary behaviors and nutritional outcomes (Heslin, 2023).

Health and Developmental Transitions: The physiological demands of puberty, coupled with early marriage and adolescent pregnancy, further complicate nutritional needs and outcomes in this demographic (Rah et al., 2016).

While the focus is on the Northern region of Ghana, it is important to consider that similar nutritional challenges are observed globally among adolescents. The interplay of socio-economic, cultural, and environmental factors is a common theme, highlighting the need for comprehensive strategies that address these determinants to improve adolescent nutrition worldwide.

2.5 Academic Performance of Junior High School Pupils

The academic performance of Junior High School (JHS) pupils in Northern Ghana is influenced by various assessment metrics and factors. Research indicates that both home and school environments significantly impact students' outcomes, with assessment metrics often reflecting these influences. The following sections outline key aspects affecting academic performance in this region.

Assessment Metrics

Standardized Testing: The Basic Education Certificate Examination (BECE) serves as a primary assessment metric, revealing a concerning pass rate decline from 55% in 2016 to 36% in 2017 in the Ho West District (Agbleze & Boateng, 2019).

Curriculum Completion: Inability to complete the planned curriculum due to co-curricular activities has been linked to poor performance in subjects like English, Mathematics, and Science (Davis et al., 2022).

Influencing Factors

Home Environment: Factors such as low socio-economic status, inadequate parental supervision, and excessive household responsibilities hinder academic performance (Agbleze & Boateng, 2019).

School Environment: Large class sizes, low teacher motivation, and insufficient instructional strategies contribute to students' poor academic outcomes (Agbleze & Boateng, 2019) (Anamuah-Mensah et al., 2008).

Teacher Effectiveness: The quality of teaching and the educational background of teachers significantly affect student performance, with better-educated parents correlating with higher student achievement (Anamuah-Mensah et al., 2008).

While these findings highlight critical areas for intervention, it is essential to consider that some students may excel despite adverse conditions, suggesting resilience and individual motivation can also play a role in academic success.

The interrelationship between food security and nutritional status is critical, particularly regarding the impact of food insecurity on nutrition. Food insecurity can lead to inadequate dietary intake, resulting in malnutrition and associated health issues. This overview will explore the effects of food insecurity on nutrition, supported by case studies and empirical evidence.

2.6 Interrelationship Between Food Security and Nutritional Status

2.6.1 Impact of Food Insecurity on Nutrition

The impact of food insecurity is strongly associated with stunting in children. Food insecurity is closely linked to stunting in children under five, as inadequate food intake leads to chronic nutritional deficiencies. In Indonesia, a staggering 36.4% of toddlers were found to be stunted due to food insecurity (Sihite, 2022). The development of every child during the early formative years

of life is critical to their lifelong potential and capabilities. This development encompasses the growth and integration of cognitive, physical, and socio-emotional abilities. It is a period characterized by rapid physical and neurological development, which highlights the importance of adequate nutrition in enabling children to attain their full potential. In addition to improving their general quality of life, good nutrition at this time is essential for their academic success and long-term earning potential (Walker et al., 2007).

Food insecurity has profound consequences for children's nutritional status and overall development and future life achievement (Johnson & Markowitz, 2018; Previšić, 2007). In households experiencing food insecurity, children are more likely to suffer from malnutrition, including stunting, wasting, and underweight (Chilton et al., 2007; de Oliveira et al., 2020; Huang & Potochnick, 2018). These nutritional deficiencies can have long-term implications for children's physical and cognitive development which goes a long way to negatively affect their ability to concentrate, learn, and perform well academically (Shankar et al., 2017).

The presence of food insecurity in the house has been found to significantly influence a child's ability to interact and engage with peers, and that it impacts their psychological and social behavior within the classroom. (Alaimo, K., CM Olson, and EA Frongillo, 2018) and (Casey et al., 2015) demonstrate that food insecurity is associated with lower levels of social interaction skills. Insufficient food intake resulting from food insecurity increases a child's the likelihood of truant behavior in school which may lead to suspension and the need for psychological support (Alaimo, K., CM Olson, and EA Frongillo, 2018). In another study, (Stormer, Ame; & Harrison, 2013) observed a negative correlation between household food insecurity and social interaction abilities specifically among girls. Similarly, (Howard, 2010) reveals that food insecurity is linked to a decline in children's interpersonal relationships, including difficulties in forming friendships and

expressing themselves. However, the research does not establish a significant relationship between food insecurity and other problematic behaviors such as fighting or disrupting classroom activities.

Studies have repeatedly shown that there is a negative relationship between food insecurity and a number of variables that may have a negative effect on school-age children's academic performance. According to Kimbro and Denney (2015), these variables include cognitive growth, mental health, and psychosocial outcomes. Food insecure households put their children at risk for behavioral and emotional problems that can seriously impair their school engagement and performance (Ashiabi & O'Neal, 2008). Moreover, children who experience food insecurity are more likely to consult a psychologist during their formative years, have a larger chance of hyperactivity, and are less likely to get along with their peers (Belsky, Moffitt, Arseneault, 2010).

Additionally, children in their early years who face food insecurity may encounter detrimental impacts on their cognitive skill development, setting the stage for potential academic underachievement when they transition into formal education (Jyoti et al., 2005; Saha KK, Tofail F, 2010).

In Ghana, one in every five children under five years old is severely malnourished (Boadi & Kobina, 2017). This high malnutrition rate has a direct correlation with child learning outcome as more than one-third of children under five (5) in Ghana do not meet essential developmental milestones when tested in these four-cardinal areas; ability to work independently, ability to avoid distractions, getting along with others, and managing aggression. Furthermore, just 33.1% of Ghanaian children had been read to in the previous three days, compared to an average of 54.1% in all lower-middle-income countries (Mccoy et al., 2016). This indicates that Ghanaian children receive little at-home stimulation.

The impact of food insecurity is not limited to children alone but the elderly is also vulnerable. Among the elderly, food insecurity significantly increases the risk of malnutrition, frailty, and chronic diseases, ultimately affecting mortality rates and quality of life (Valbuena et al., 2024).

2.6.2 Case Studies and Empirical Evidence

Nutrition Interventions: Various interventions, such as produce prescription programs, have been evaluated for their effectiveness in improving dietary intake among food-insecure populations, highlighting the need for further research in this area (Norris et al., 2023).

Agricultural Commercialization: In sub-Saharan Africa, agricultural commercialization has been linked to inequities in food security and nutrition, emphasizing the need for policies that address these disparities (Setiyoko, 2022).

While food insecurity poses significant challenges to nutritional status, it is essential to consider the potential for targeted interventions and policies to mitigate these effects and improve overall health outcomes.

2.7 Influence of Nutritional Status on Academic Performance

The influence of nutritional status on academic performance is significant, particularly regarding cognitive and physical development in children. Empirical studies consistently demonstrate that adequate nutrition is crucial for cognitive functions, which directly impacts academic achievements. The following sections outline key findings from various studies that illustrate this correlation.

2.7.1 Nutritional Status and Cognitive Performance

A review highlighted that children with poor nutritional status exhibit diminished cognitive performance, with deficiencies in macronutrients and micronutrients leading to negative academic outcomes (Khushnuma et al., 2025).

A study found a moderate negative correlation (r = -0.55) between malnutrition and academic performance, indicating that as malnutrition increases, academic outcomes decrease (O.A. et al., 2024).

2.7.2 Dietary Practices and Academic Achievement

Research indicated that balanced dietary practices, including regular consumption of fruits and vegetables, correlate with higher academic performance. Children with poor dietary habits showed lower academic results (Rajan et al., 2024).

Micronutrient supplementation, particularly iron and zinc, has been shown to enhance cognitive functions such as memory and attention, further supporting academic success (Siddika & Chakraborty, 2024).

2.7.3 Long-term Implications of Malnutrition

Malnutrition not only affects immediate cognitive functions but also has long-term consequences on educational attainment and socio-economic mobility, emphasizing the need for nutritional interventions (Siddika & Chakraborty, 2024) (Senthamizhan et al., 2024).

Conversely, while the studies emphasize the importance of nutrition, some argue that socio-economic factors may overshadow nutritional status in determining academic performance, suggesting a more complex interplay between various determinants of educational success.

2.8 Direct and Indirect Effects of Household Food Security on Academic Performance

The relationship between household food security and academic performance is multifaceted, encompassing both direct and indirect effects. Food insecurity significantly impairs students' cognitive abilities and overall academic achievement, as evidenced by various studies across different contexts. The following sections outline the key aspects of this relationship.

2.8.1 Direct Effects of Food Insecurity on Academic Performance

One of the direct effects of food insecurity on academic performance is cognitive impairment. Food insecurity leads to malnutrition, which adversely affects cognitive development and learning capabilities (Fitawek, 2024).

Decline in academic performance is another direct effect of food insecurity on academic performance. Studies show that students from food-insecure households exhibit lower academic performance, with a notable prevalence of poor performance among these groups (e.g., 71.05% of food-insecure adolescents performed poorly) (Adam et al., 2024).

Moreover, learning gaps is another direct effect of food insecurity on academic performance. In New Zealand, students facing hunger demonstrated a learning gap of up to four years compared to their peers (Sebileau et al., 2024).

Children from food insecure households suffer serious repercussions on not only their health, but also their future educational achievement. There is abundance of empirical evidence from both developed and developing countries which point to the fact that food insecurity adversely affects the academic performance of school children.

Maltzahn (2019) looked into the connection between academic achievement and household food insecurity in elementary school students in Nova Scotia, Canada. She found that there was a significant correlation between the students' academic performance in general and mathematics in particular. Students from food-insecure households were more likely to exhibit poor performance in this subject. Additionally, the study revealed that household food insecurity was associated with lower diet quality, as measured by the Youth Healthy Eating Index (YHEI). This suggests that

food-insecure households tend to have suboptimal dietary habits. Furthermore, the research demonstrated a connection between diet quality and academic performance, particularly in English Language Arts and Mathematics. Students with lower diet quality scores, measured by the Dietary Quality Index-International (DQI-I) and YHEI, were more likely to face difficulties in these subjects. The study's findings, when compared with other research, point to a possible mediation role for diet quality in the association between home food insecurity and academic achievement, even if the study's findings did not prove anything.

In the United States, (Rosenberg, 2020) investigated the correlation between food insecurity and academic achievement among children in K-12 public schools in the state of Florida. The results indicate that while food insecurity is a significant determining factor in the academic performance of students, other social determinants such as transportation, health, and cost of living also contribute to academic disadvantages experienced by the children who performed poorly. These factors were found to be more prominent among the surveyed students.

Children in developing countries are more severely affected by household food insecurity compared to their counterparts in developed nations. A South Africa study found that university students who experienced minimal to no hunger, regardless of their food security status, had a higher likelihood of advancing academically compared to those who face food insecurity with hunger (Chilton et al., 2007). However, there is a crucial gap in the literature on the evaluation of the mediating role of diet on the relationship between academic achievement and food insecurity—very little research has been done in this area.

Many children from food-insecure homes tend to stay away from school due to hunger. Many cross-sectional studies (Huang et al., 2018; Payne-sturges et al., 2019; Shanafelt et al., 2017) and longitudinal studies (Hernandez, D. C., & Jacknowitz, 2009; Howard, 2010) have demonstrated

the detrimental long-term effects of household food instability on kids' absence from school. Food insecurity at the household level was found to be highly correlated with school absence in a related systematic study (Shankar et al., 2017). In a similar vein, Baiden et al. (2019) in their study on how junior high school children in Ghana missed school due to household food insecurity established that household insecurity status is strongly associated with school absenteeism among students, and observed that as much as 43% of students from food insecure homes missed about 17 days of classes due to hunger.

As per the 2017 World Food Programme Report, approximately one-third of Ghanaian school-age children suffer from moderate to severe hunger. In the year 2005, the then president Kuffuor-led government took steps to remedy the impact of food insecurity on educational outcomes, a phenomenon which threatened the success of the free compulsory basic education policy. The government through the ministry of education and the Ghana Education Service implemented the Ghana School Feeding Program (GSFP) in 2005 in a bid to mitigate the detrimental effects of food insecurity on children's education. The GSFP aimed to eliminate hunger among schoolchildren, improve their nutritional status, and enhance educational outcomes. The program provides free meals to students in selected primary and junior high schools, with a focus on marginalized communities and vulnerable groups.

Almost two decades since its implementation, the policy has shown promising results in improving educational outcomes among participating schools, especially in the north. Several studies have reported increased school enrollment rates, attendance, as well as improved academic performance among students, particularly in mathematics and literacy (Gyasi G.E.O., Asante, M.M.N., 2018; Tagoe I., 2018). The provision of regular meals through the GSFP has not only addressed hunger

but has also positively impacted students' concentration, cognitive abilities, and overall well-being (Oduro-Ofori E. and Adwoa-Yeboah G., 2014).

Like many other developing countries in Sub-Saharan Africa, household food insecurity is a worrying socio-economic and public health problem in Ghana (Agbadi et al., 2017; Atuoye et al., 2017), which continue to severely affect school-age children as evidenced by the high rates of stunting, wasting and underweight prevalence, particularly in the northern part of the country (Ghana National Nutrition Policy, 2013; Ghana Statistical Service, 2014).

For most Ghanaian families, getting enough nourishing food is a big difficulty, especially in the five northern regions which are the poorest in the nation and experience extremely harsh weather conditions (UNDP Report, 2010). According to the World Food Programme Report (2022), roughly one-third of Ghana's school-age children experience moderate-to-severe hunger. The National Nutrition Policy (NNP) was created by the Ghanaian government in 2013 in response to the issue of household food insecurity in the nation. The primary objective of the NNP is to guarantee optimal nutrition and good health for all Ghanaians, particularly school-age children (Ghana National Nutrition Policy, 2013). This came about following the establishment of the Ghana School Feeding Program (GSFP) in 2005, which aimed to end child hunger in order to provide universal access to primary education.

Despite the frantic efforts to mitigate the impact of food and nutrition insecurity on the educational achievements of Ghanaian children, household food insecurity persists at the home level. Given that household food insecurity has profound negative repercussions on children's health and wellbeing through poor diet (American Dietetic Association, 2010; Vozoris NT & Tarasuk VS, 2003), poor childhood development (Gundersen C & Ziliak JP, 2015; Olson CM, 1999), and poor

psychological and cognitive functioning (Baiden et al., 2019; Faught et al., 2017), it is imperative for government and other stakeholders to develop strategies to address this multifaceted challenge.

(Awojobi, 2019) in a systematic review examined the role of the Ghana School Feeding Programme (SFP) in educational and health outcomes. The results point to consensus in the literature on the fact that the SFP has had a positive impact on school enrolment, attendance, academic performance and several other variables of educational attainment. The review also revealed mixed outcomes for health-related measures, with some studies showing improved nutritional status among beneficiaries while others found that certain food nutrients did not meet the required standards for child development. Some children experienced health complications due to the repetitive consumption of specific foods. The impact of the SFP on cognitive development was not clearly established due to the lack of studies utilizing administrative data and employing a pre-post research design. Nevertheless, the SFP was widely acknowledged as a component that improves students' academic achievement. The results emphasize the need for more investigation, especially in the form of randomized control studies, to confirm the beneficial effects of the SFP on health and educational outcomes in Ghana.

However, it is important to note that the GSFP coverage does not extend to all junior high schools, particularly in deprived districts like the Tolon District in the northern region. As a result, many students in food-insecure households are still excluded from the program and face ongoing challenges in accessing adequate nutrition, which may hinder their educational achievements. The GSFP aims to eliminate hunger among schoolchildren, improve their nutritional status, and enhance educational outcomes. The program provides free meals to students in selected primary and junior high schools, with a focus on marginalized communities and vulnerable groups.

The GSFP coverage does not extend to all junior high schools, particularly in some deprived districts such as the Tolon District. This exclusion leaves many pupils in food-insecure households without access to adequate nutrition, potentially hindering their educational achievements.

2.8.2 Indirect Effects of Food Insecurity

One of the indirect effects of food insecurity on academic performance is low school attendance levels of pupils. Food insecurity correlates with higher rates of school absenteeism, further hindering academic success (Adam et al., 2024).

Also, socioeconomic factors indirectly affect academic performance through food insecurity. The interplay between food security and socioeconomic status indicates that lower-income families struggle to provide adequate nutrition, which in turn affects educational outcomes (Ojiya et al., 2023).

Food insecurity also has long-term consequences on academic performance. Chronic food insecurity can lead to persistent educational deficits, impacting future opportunities and economic stability (Sebileau et al., 2024).

While the evidence strongly supports the negative impact of food insecurity on academic performance, it is essential to consider that educational interventions, such as school feeding programs, can mitigate these effects and promote better learning outcomes. Addressing food security through policy changes can thus enhance educational achievement and overall well-being.

2.9 Socioeconomic and Demographic Factors in Tolon

The economic landscape of Tolon District in Northern Ghana plays a critical role in shaping household food security and access to nutritious food. This assessment examines how factors such as family size, parental education, and occupation influence food security outcomes, drawing on insights from various studies conducted in Tolon and similar areas.

2.9.1 The Economic Landscape of Tolon District

Tolon District, located in the Northern Region of Ghana, is predominantly rural, with a significant portion of its population engaged in agriculture. The district faces challenges such as limited access to credit, poor infrastructure, and reliance on rain-fed agriculture, which makes households vulnerable to environmental shocks (Azumah et al., 2015) (Salifu & Salifu, 2023). Microenterprise development has been identified as a potential strategy to improve household savings and economic resilience, with factors such as gender, income level, and access to credit influencing participation in such activities (Azumah et al., 2015).

2.9.2 Household Food Security in Tolon

Food security in Tolon is influenced by multiple factors, including food availability, access, utilization, and stability. Studies indicate that household food security is often compromised due to limited access to nutritious food, particularly in rural areas (Romanova, 2023) (Nouicer et al., 2022). The district's reliance on subsistence farming and the lack of diversified income sources exacerbate food insecurity, especially during lean seasons (Salifu & Salifu, 2023).

The Role of Family Size in Food Security

Family size is a significant determinant of household food security in Tolon. Larger households often face challenges in meeting their food needs due to limited resources and income. Research

shows that households with more dependents are more likely to experience food insecurity, as their consumption needs outpace their production or purchasing power (Asaki et al., 2024) (Mustapha et al., 2016). Additionally, larger families may struggle to afford diversified diets, leading to nutritional deficiencies (Sienso et al., 2022).

The Impact of Parental Education on Food Security

Parental education plays a crucial role in improving household food security. Educated parents are more likely to adopt innovative farming practices, diversify their income sources, and make informed decisions about food consumption (Romanova, 2023) (Frempong et al., 2023). Studies have shown that higher levels of education among household heads are associated with better dietary diversity and reduced food insecurity (Sienso et al., 2022) (Tsiboe et al., 2018).

The Role of Occupation in Shaping Food Security

Occupation is another key factor influencing food security in Tolon. Farmers and rural households often face seasonal fluctuations in income, which can lead to food insecurity during periods of low agricultural productivity (Salifu & Salifu, 2023). Off-farm employment and income diversification have been shown to improve food access and reduce vulnerability to food insecurity (Salifu & Salifu, 2023) (Salifu & Salifu, 2024). However, limited access to credit and poor infrastructure hinder the ability of many households to diversify their income sources (Azumah et al., 2015) (Salifu & Salifu, 2023).

The Interplay Between Economic Factors and Food Security

The interplay between economic factors, such as income level, access to credit, and occupation, significantly influences food security outcomes in Tolon. Households with higher incomes and better access to credit are more likely to achieve food security, as they can afford to purchase food during periods of scarcity and invest in productive assets (Azumah et al., 2015) (Mustapha et al.,

2016). Conversely, poverty and limited access to financial services exacerbate food insecurity, particularly in rural areas (Asaki et al., 2024) (Salifu & Salifu, 2023).

Policy Implications and Recommendations

To address the challenges of food insecurity in Tolon, policymakers should focus on the following strategies:

Promote Income Diversification: Encourage households to engage in off-farm activities and microenterprises to reduce reliance on subsistence farming (Azumah et al., 2015) (Salifu & Salifu, 2023).

Improve Access to Credit: Provide affordable credit facilities to households to enable them to invest in productive assets and diversify their income sources (Azumah et al., 2015) (Salifu & Salifu, 2023).

Enhance Agricultural Productivity: Support farmers through training, access to improved seeds, and irrigation systems to improve crop yields and reduce vulnerability to environmental shocks (Nouicer et al., 2022) (Frempong et al., 2023).

Invest in Education: Prioritize education for both men and women to empower households to make informed decisions about food consumption and income management (Romanova, 2023) (Tsiboe et al., 2018).

Address Infrastructure Challenges: Improve transportation networks and storage facilities to reduce postharvest losses and enhance market access for farmers (Salifu & Salifu, 2023) (Egyir et al., 2023).

2.10 Cultural and Environmental Context of Tolon

2.10.1 Traditional Diets and Cultural Practices

Traditional diets in Tolon are rich in locally available and indigenous foods, which are often more nutritious and better adapted to local conditions (Kwarteng et al., 2024).

Cultural practices include traditional culinary preparations and land management techniques that support sustainable food production ("Local, Traditional and Indigenous Food Systems in the 21st Century to Combat Obesity, Undernutrition and Climate Change, 2nd edition", 2022).

These diets and practices are vital for preserving cultural heritage and ensuring food security, as they are embedded in the local environment and community life (Sidiq et al., 2022).

2.10.2 Impact of Climate and Agricultural Practices

Climate change poses significant threats to traditional agricultural practices, affecting crop yields and food availability (Lumbroso, 2022).

Traditional foods are often more resilient to climate-induced stresses, making them crucial for maintaining food security under changing environmental conditions (Kwarteng et al., 2024).

Agricultural practices in Tolon have shifted due to external influences, impacting the inclusivity of traditional food systems and dietary intakes ("Local, Traditional and Indigenous Food Systems in the 21st Century to Combat Obesity, Undernutrition and Climate Change, 2nd edition", 2022).

2.10.3 Food Availability and Security

The availability of traditional foods is essential for food security, as they provide essential nutrients and support local economies (Kwarteng et al., 2024).

Promoting the cultivation and consumption of underutilized traditional foods can enhance food security and sovereignty by diversifying diets and reducing reliance on imported foods (Lumbroso, 2022).

Community-based initiatives and policies are needed to empower local farmers and support sustainable food systems (Domingo et al., 2021).

While traditional diets and practices offer a pathway to improved food security, challenges such as climate change and modern agricultural practices necessitate adaptive strategies. Emphasizing the resilience and nutritional value of traditional foods can help mitigate these challenges and promote sustainable food systems in Tolon.

2.11 Policy and Intervention Programs

Improving food security and nutrition among students in Ghana involves a multifaceted approach through local and national policies, alongside various programs such as school feeding schemes, nutritional education, and supplementation initiatives. These efforts aim to enhance student health and educational outcomes, particularly in vulnerable populations.

2.11.1 School Feeding Programs

School feeding programs in Ghana have shown significant positive impacts on student attendance and academic performance, especially for girls and children in rural areas (Appiah, 2024).

A randomized trial indicated that these programs led to moderate increases in literacy and math scores, particularly benefiting disadvantaged groups (Aurino et al., 2022).

The integration of these programs into national educational policies is recommended to ensure sustainability and effectiveness (Appiah, 2024).

2.11.2 Nutritional Education and Supplementation

The Improved Feeding Practices for the First 1000 Days project focused on enhancing dietary practices among women and children, resulting in improved dietary diversity and awareness (Konlan et al., 2024).

Despite the success of these initiatives, gaps remain in addressing the nutritional needs of specific demographics, such as adolescent girls (Sibanda & Murage, 2023).

2.11.3 Policy Framework

A review of over 70 government documents revealed that while many policies exist, they often lack direct references to nutrition objectives, limiting their effectiveness in addressing malnutrition (Aryeetey & Coomson, 2022).

The need for a comprehensive national nutrition strategy that encompasses various sectors is critical for improving overall nutrition outcomes in Ghana (Aryeetey & Coomson, 2022).

Conversely, while these programs and policies show promise, challenges such as inadequate funding, poor governance, and limited monitoring systems hinder their full potential. Addressing these barriers is essential for achieving lasting improvements in food security and nutrition among students in Ghana.

2.12 Theoretical Frameworks Linking Food Security, Nutrition, and Education

This aspect deals with theories that establish connection between food security, nutrition and academic performance. The theory explored here is the educational disadvantage theory (Kellaghan, 2001).

2.12.1 Educational Disadvantage Theory (Kellaghan, 2001)

To evaluate the correlation among Junior High School pupils in Tolon between household food insecurity, nutritional status, and academic performance, it is recommended to underpin the study with theories such as associationism theory, social learning theory, anxiety theory, and educational disadvantage theory. These theories provide a framework for understanding the potential impact of household food insecurity on students' academic performance and offer avenues for further exploration. However, it is crucial to conduct a thorough literature review specific to your study's context and consult with your research advisor to ensure the selection and application of the most appropriate theories.

The Educational disadvantage theory focuses on how socioeconomic factors, including household food insecurity, can contribute to educational disadvantage. It implies that students from households where there is food-insecurity can experience additional difficulties, like having less access to nutritious meals, which could have a detrimental effect on their focus, cognitive function and overall academic performance. Investigating the effects of household food insecurity on academic performance within the framework of educational disadvantage can provide valuable insights (Kellaghan, 2001).

2.13 Gaps in the Existing Literature

The relationship between food security, nutrition, and academic performance in Tolon, Ghana, presents several underexplored aspects. Understanding these connections is crucial for developing effective interventions to enhance educational outcomes in the region.

Impact of Hidden Hunger

Micronutrient Deficiencies: Many schoolchildren in Sub-Saharan Africa, including Tolon, suffer from hidden hunger, which affects cognitive and physical development, ultimately hindering academic performance (Mangusho, 2012).

Socioeconomic Factors: The interplay between hidden hunger and socioeconomic conditions remains inadequately addressed, suggesting a need for integrated approaches that combine nutrition and education initiatives (Mangusho, 2012).

Children's Perspectives on Food Insecurity

Lived Experiences: Research indicates that children's own accounts of food insecurity differ from adult perceptions, highlighting the necessity of incorporating children's voices in studies to better understand their academic challenges (Mohammed, 2022).

School Feeding Programs: The effectiveness of programs like the Ghana School Feeding Programme is compromised by austerity measures, affecting meal quality and quantity, which directly impacts children's nutrition and learning capacity (Mohammed, 2022).

Localized Food Systems

Economic Accessibility: The potential of localized food systems to improve food security in Tolon is significant, yet the high costs associated with certain agricultural practices limit access to nutritious food, affecting students' academic performance (Nouicer et al., 2022).

Energy Utilization: The relationship between energy use in agriculture and food security outcomes is critical, as it influences the availability of nutritious food for schoolchildren (Nouicer et al., 2022).

While these aspects highlight the intricate connections between food security, nutrition, and academic performance, there is also a need to consider broader systemic issues, such as policy frameworks and community engagement, that may further influence these relationships.

2.14 Summary and Synthesis

Household food security is a critical issue that requires a comprehensive understanding of its definitions, dimensions, and measurement indicators. By addressing the challenges in measurement and leveraging the strengths of both objective and subjective indicators, policymakers and practitioners can develop effective interventions to improve food security at the household level. Further research is needed to refine existing indicators and to develop new tools that can capture the complexity of food security in diverse contexts.

The economic landscape of Tolon District, characterized by limited access to credit, poor infrastructure, and reliance on subsistence farming, significantly impacts household food security. Family size, parental education, and occupation are critical factors that shape food security outcomes. Addressing these challenges through targeted policies and interventions is essential to improving food security and access to nutritious food in Tolon.

Traditional diets and cultural practices in Tolon are deeply intertwined with the region's food security, influenced by climate, agricultural practices, and food availability. Traditional food systems, which have been in balance with local ecosystems for centuries, play a crucial role in maintaining nutrition and cultural identity. However, modern challenges such as climate change and agricultural shifts have impacted these systems. Understanding these dynamics is essential for enhancing food security in Tolon.

The aspects of food insecurity which are underexplored in the literature within the Tolon District includes; Impact of Hidden Hunger, Children's Perspectives on Food Insecurity and localized food systems.

This current study attempted to bridge this gap in the literature by examining the specific challenges faced by pupils in deprived districts and propose interventions to address their food insecurity and support their educational outcomes. Again, while there is evidence of the negative impact of food insecurity on academic achievement, there is a scarcity of research evaluating the mediating effect of diet on this relationship. This study will fill this gap by examining the role of diet quality as a potential mediator between food insecurity and academic achievement.

CHAPTER THREE

3.0 METHODS

3.1 Introduction to the Methods

The planned actions in research that entail obtaining the data or materials required for a certain study are referred to as the methodology (Bryman, 2016; Robson, 2002). This aspect of the thesis presents an in-depth description of the research area, the target population, sample size calculation, sampling methods, data collection instruments and processes, data management and analysis methods, and steps the researcher took to ensure ethical rules were not breached in the process of the data collection.

3.2 Background to the Study Area: The Northern Region of Ghana

The Northern region is divided into 16 districts, each with its own administrative center. These districts differ in size and population density, with some areas being more developed than others. The regional capital, Tamale, is the largest city in the region and serves as a center for trade, education, and healthcare (Kröger & Meier, 2002).

The region has a population of about 2,310,939 representing approximately 7.5% of Ghana's total population which was 30,832,019 in 2021. Out of the total population of 2,310,939 in the Northern

region, the population of the males was 1,141,705 representing 49.4% whiles the Female population was 1,169,234 representing 50.4% of the total population of the region (GSS, 2021). The population is dispersed across 16 districts, with the majority living in villages. The region has a high population growth rate, which has put burden on land and natural resources. The average household size is large, with many families depending on subsistence agriculture for their livings (Ewusi & Kuma, 2014).

The Northern region occupies an area of nearly 70,384 square kilometers, making it one of the largest regions in the country. The region is part of the West African savanna ecosystem, which is characterized by a rise of vegetation zones that change from thick forests in the south to dry conditions in the north (Agyepong et al., 1998) (Boateng, 2017).

The Northern Region is home to a diverse array of ethnic groups. These groups have unique cultural practices and traditions that are profoundly entrenched in their history and environment. For instance, the Dagomba people have a rich custom of chieftaincy and a robust social distinctiveness tied to their land and natural resources (Kröger & Meier, 2002) (Aapengnuo, 2013).

Agriculture is the main livelihood for most communities in the region, with crops such as yam, maize, and groundnuts being staple crops. The region's cultural practices are closely tangled to its ecological conditions, with many communities practicing survival farming and relying on natural resources for their livelihoods. Traditional practices, such as the use of fire for land preparation and the integration of trees into farmland, are rampant (Alare et al., 2018) (Tomomatsu, 2014).

Farming is the backbone of the economy in the Northern Region, with the majority of the population involved in agriculture. The region is recognized for its cultivation of main crops such as yam, maize, and rice, as well as cash crops like groundnuts and shea nuts. However, agricultural

productivity is constrained by factors such as erratic rainfall, poor soil fertility, and inadequate access to contemporary farming machineries (Alare et al., 2018) (Dedzoe et al., 2001).

Migration is a substantial phenomenon in the region, with many residents traveling to southern Ghana or other West African countries in search of improved economic prospects. This migration has led to cultural exchange and the amalgamation of traditions, predominantly in urban areas. However, it has also raised worries about the safeguarding of minority languages and cultural practices in the face of external influences (Addaney et al., 2022).

The region has substantial potential for renewable energy production, mainly from agricultural residues such as straw. The energy potential of crop residues in the region has been projected at 42,256 terajoules, with yam and groundnut residues being the most momentous contributors. This resource could play a vital role in sponsoring sustainable energy expansion in the region (Seglah et al., 2022).

The Northern Region encounters numerous environmental challenges, including land degradation, soil fertility decline, and water scarcity. These challenges are worsened by climate change, which has led to more recurrent droughts and floods. The region's dependence on rain-fed agriculture makes it particularly susceptible to these vicissitudes (Songsore, 1995) (Atanga & Tankpa, 2021).

Poverty and inequality are noteworthy problems in the region, with many households lacking access to basic services such as healthcare and education. The region also faces challenges associated to governance and conflict resolution, mostly in connection to chieftaincy disputes and land ownership (Aapengnuo, 2013).

To tackle these challenges, there is a need for integrated policies that support sustainable land use, advance agricultural productivity, and enhance livelihood security. Strengthening local institutions

and fostering community involvement in natural resource management are also critical for safeguarding the region's long-term development (Mabe et al., 2021) (Akudugu & Alhassan, 2012).

3.2.1 Background to the Study Area: The Tolon District

Majid, U., (2018) suggests that the study setting encompasses the nature, context, surroundings, and logistical considerations, all of which may have an impact on how the study is conducted. A good knowledge of the geospatial dynamics of the study setting helped the researcher anticipate any practical difficulties posed by the location, layout, or structure of the setting, and take steps to address any challenges that may affect data collection processes and/or procedures.

This study was carried out at Tolon District Assembly (D/A) Model Junior High School and Tolon D/A Junior High School "A" located within the Tolon District. In Ghana's Northern Region, there are sixteen (16) districts, including the Tolon District. Prior to the eastern portion of the Tolon/Kumbungu district being divided off to form Kumbungu District on June 28, 2012, and the remaining portion being renamed Tolon District, it was a part of the then-larger Tolon-Kumbungu District in 1988. Tolon was the district capital of the former Tolon/Kumbungu District. The Tolon district assembly is located in its northwest corner, situated between latitudes 9° 15' and 10° 02' north and longitudes 0° 53' and 1° 25' west. Its borders Sagnarigu Districts to the east, Central Gonja to the west, Kumbungu to the north, and North Gonja to the east (GSS, 2010). The population of the District according to 2021 population and housing census stands at 118,101 with 58,512 males and 59,589 females. The population of the Tolon District represents 5.1% (118,101) of the total population of the Northern Region. The distribution of the population by sex in the districts stands at 49.5% (58,512) males and 50.5% (59,589) females (GSS, 2021).

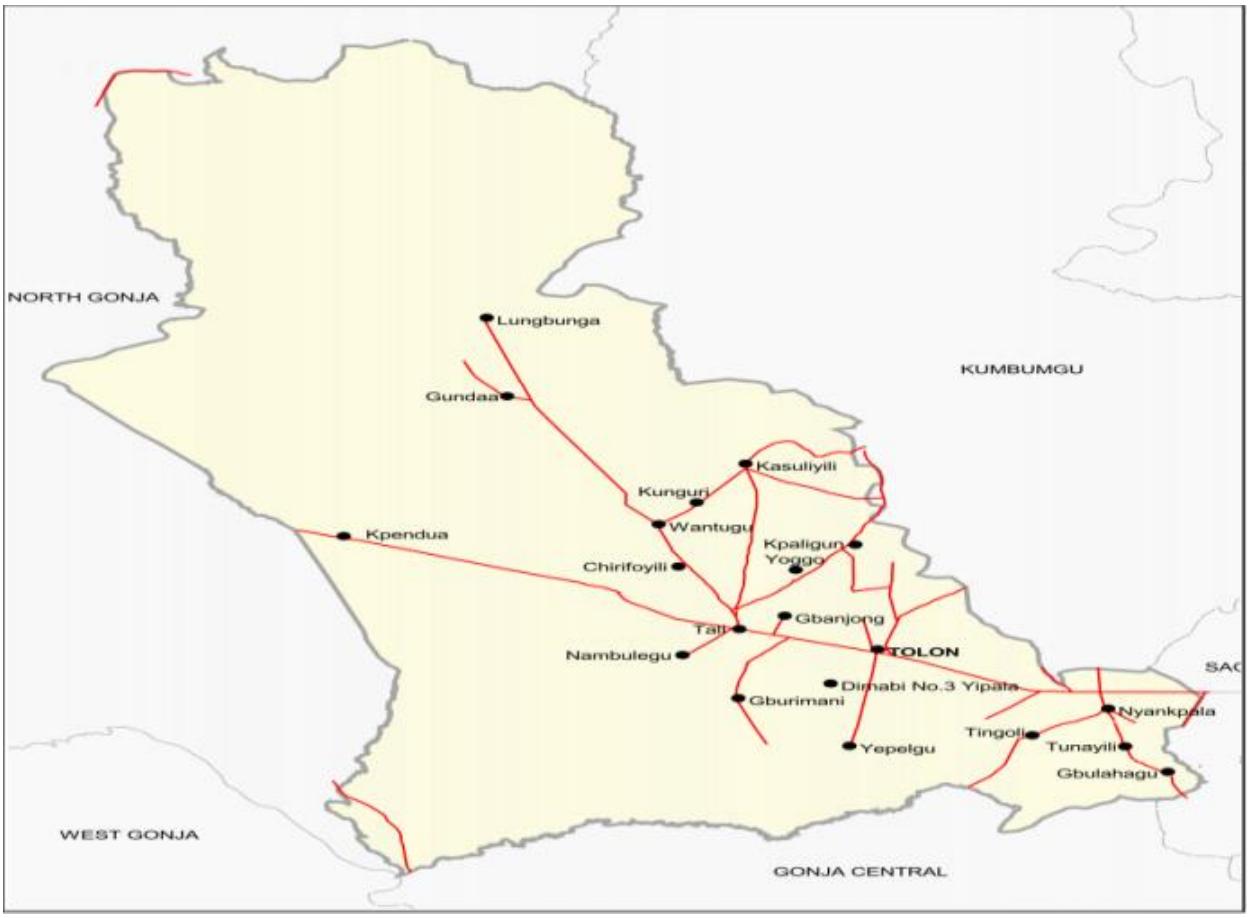


Figure 3:1: District map of Tolon District

Source: Adopted from 2010 population and housing census district analytical report – Tolon District (GSS, 2014).

3.2.2 Justification for Choice of Study Area

The Tolon District is identified as one of the poorest districts in Ghana (GSS, 2021). It also has high prevalence of food insecurity, stunting, underweight and wasting (Azupogo et al., 2022)

The district has high poverty rate with many households struggling to access basic necessities including food. The district also has relatively low levels of education which can limit opportunities for economic empowerment and food security. Many households rely on subsistence farming which can make them susceptible to low crop yields and food insecurity.

Despite these high levels of poverty and food insecurity, the relationship between food security, nutrition, and academic performance in Tolon, has not been adequately explored. Thus, this forms the basis for the justification of choosing Tolon as the study area.

3.3 Study Design

Creswell J., (2007) defines research design as the theoretical framework that guides research activities. A researcher's capacity to collect crucial data for a study as quickly and effectively as possible is aided by the type of research design adopted (Yin, 2011).

The associations of Junior High School pupils' academic performance, school attendance and nutritional status with measures of food security status, were investigated using an analytical cross-sectional study methodology. Examining data from a population at a single point in time when both exposure variables and the desired result variables are measured is known as a cross-sectional study design (Polit & Beck, 2008). This approach was considered appropriate for the study because it allowed for the simultaneous collection of the independent variables (socio-demographic variables, and food insecurity variables) and the dependent variables (attendance, academic performance and nutritional status)

3.4 Study Setting

The setting for this study was Tolon District. The Tolon District is generally agrarian in nature. The agricultural sector accounts for 74% of the District's workforce (Tolon District Assembly 2020 Annual Progress Report, 2021). There is also high level of poverty within the District which has a negative impact on food insecurity both at the household and individual levels. In Tolon, 57.5 per cent of the population live in multidimensional poverty. Tolon is placed 256th out of the 261 districts in terms of the percentage of population living in multidimensional poor households.

Within the Northern Region it is placed 16th out of 16 districts (Tolon District Multidimensional Poverty Fact Sheet - GSS, 2021). The Tolon District as part of the Northern region experiences one rainy season and one dry season for a year. The District agricultural system is mainly rain-fed, so the impact of drought on crop yield is usually massive (Tolon District Assembly, 2014). Farmers experience low yield of crop harvest which also in-turn affect household food security and economic well beings of the farmers. Food insecurity has a prevalence of 30.7% in the Northern Region of which the Tolon District is part (GSS, 2022). A study conducted in Tolon District showed the prevalence rates of stunting, underweight and wasting among children 24-59 months to be 58.3%, 20.3% and 4.2%, respectively (Azupogo et al., 2022). This was the setting within which the study was carried out.

3.5 Study Population

Sekaran & Bougie, (2016) argue that the population of a study refers to the overall membership of a group of individuals, incidents, or a phenomenon of concern into which the researcher is investigating. The target population for this study was pupils of Tolon D/A Model Junior High School and Tolon D/A Junior High School "A" within the Tolon District. The population comprised of pupils of these two schools. The total number of pupils from the two schools was 484 pupils. From this number, Form one pupils constituted 174 pupils, Form two pupils constituted 170 pupils and form three pupils were 140. The total number of students in Tolon D/A Model Junior High School was 219 out of which form two students were 75 and form three students were 63. Form 2A boys were 22 and girls were 14 making the class total to be 36. Form 2B boys were 24 and girls were 15 making a total of 39. Out of the 63 form 3 students, form 3A students were 32 with a composition of 20 boys and 12 girls whiles form 3B students were 31 with a composition of 16 boys and 15 girls. The total enrolment at Tolon D/A Junior High School "A was 265 with

the form 2 students being 95 and the form 3 students being 77. The composition of the form 2 students in terms of gender stood at 72 boys and 23 girls making a sum of 95. The form 3 students comprised of 55 boys and 22 girls making a total of 77. The sample was systematically and randomly drawn from the above population. The above description of the population is summarized and simplified in the table below.

Table 3.1 Summary of the study population by school, class and gender.

Name of school		Form 1A	Form 1B	Total	Form 2A	Form 2B	Total	Form 3A	Form 3B	Total	Overall Total
Tolon D/A Model JHS	Male	21	21	42	22	24	46	20	16	36	219
	Female	20	19	39	14	15	29	12	15	27	
	Total	41	40	81	36	39	75	32	31	63	
Tolon D/A JHS "A"	Male	32	32	64	35	37	72	28	27	55	265
	Female	14	15	29	12	11	23	11	11	22	
	Total	46	47	93	47	48	95	39	38	77	
Total population of the 2 schools		Form one			Form Two			Form Three			484
	Male	106			118			91			
	Female	68			52			49			
	Total	174			170			140			

Source: Records from admission and class registers

3.5.1 Inclusion Criteria

The study included students of Tolon D/A Model Junior High School and Tolon D/A Junior High School "A" who have been in the school for at least one academic year.

3.5.2 Exclusion Criteria

Since one of the objectives of the study was to measure the association between household food security status and school attendance, form one (1) students who had not completed one full academic year in the school at the time of the study were excluded from participating in the survey.

3.6 Sampling Technique

Random sampling enables researchers to collect data from the target population through a methodical process that allows a part of the study population to be selected for the research in a manner that gives every member an equal opportunity of being chosen to take part in the research. First, Tolon D/A Model Junior High School and Tolon D/A Junior High School "A" were chosen at random from among the five junior high schools in Tolon in order to create a representative sample. In order to choose students from each class to take part in the study during the data collection, the names of the boys were randomly assigned even and odd numbers. The names of the boys in each class, which were assigned even numbers were included in the sample and the names of boys who were assigned odd numbers were excluded from the sample. Also, the names of the girls in each class were randomly assigned even and odd numbers, the names of girls who were assigned even numbers were included in the sample but the names of the girls in each class who were assigned odd numbers were excluded from the study. This is a multi-stage sampling technique where out of five schools which were assigned even and odd numbers two schools were selected at random. Also, at the class levels both boys and girls were selected still by the even and odd numbers allocation. Thus, each in class, both boys and girls were randomly selected by this technique of even and odd number allocation to avoid selection biases. As a probability method of sampling, it reduces the likelihood of selection bias in the study. Every phase of the sampling process was finished in a single step, and each subject was selected separately from the other population members.

3.6.1 Sample Size Determination

According to Jooste (2010), a sample is a subset of individuals, things, units, or objects drawn from the wider population by choosing a subset to represent the complete population.

The Miller and Brewer (2003) formula was utilized to approximate the sample size;

$$\boldsymbol{n = \frac{N}{1 + N(\alpha)^2}}$$

n = the sample size required,

N = the total population under investigation, and

α = the margin of error = 5%

The total enrollment for Tolon D/A Model Junior High School and Tolon D/A Junior High School "A" for the 2022/2023 academic year was 219 and 265, respectively. Thus, the overall population of the two schools was 484. Hence, the study population for this research was 484 students from which the sample size was drawn (Admission records of Tolon Model J.H.S. & Tolon J.H.S. "A" 2022/2023 academic year)

Therefore, the sample size for the study (n) = $\frac{484}{1+484(0.05)2}$ = 220 students

The Miller and Brewer (2003) sampling technique was used because it is suitable for a descriptive study. This study described the characteristics of the study population. It was also deemed as the most suitable sampling technique because, it allows for a high level of precision by ensuring that the sample size was sufficient enough to achieve the desired level of precision. This formula was also adopted because it is a cost-effective and time efficient approach for determining sample size.

3.7 Study Variables

The variables of this study included the socio-demographic variables such as household size, occupation of the household heads and sex of the household heads. The main independent variables of this study were household food insecurity and individual food insecurity. The dependent variables for the study were school attendance of the pupils, academic performance of the pupils and nutritional status of the pupils. The various socio-demographic variables were also held constant to control for confounding when the main independent variables were assessed with the dependent variables. The literature review has already expounded the possible relationships between these variables and their potential to influence one another. Therefore, the variables of this study were, socio-demographic variables, household and individual food insecurity, attendance, academic performance and nutritional status of the pupils.

3.8 Indicators assessed in the Study

The indicators that were assessed in this study comprised of Body Mass Index (BMI), BMI-for-age Z-scores (BAZ), and Height-for-age Z-scores (HAZ). These were the anthropometric indicators assessed to determine the nutritional status of the pupils. For household and individual food insecurity status the indicator that was assessed was Food Insecurity Experience Scale (FIES). For school attendance of the pupils, the indicator that was assessed was the Number of Days Attended (NDA) by pupils in an academic year. This was achieved through the attendance recorded in the various class registers for the past one academic year. Moreover, concerning academic performance the indicator that was assessed was Academic Achievement Scores (AAS) through standard test scores in English Language and Mathematics.

3.9 Data Collection Instruments

The data collection instruments for this study were Seca-scale for weight measurements, Stadiometer for height measurements, Food Insecurity Experience Scale (FIES) questionnaire for

food insecurity measurements, attendance registers and standard test questions in English and Mathematics for academic performance measurements.

3.10 Data Collection Procedure

Data collection is a methodical process of gathering data from study participants. This procedure is essential for the reliability and validity of the results that will emanate from the study (Creswell, J. W., & Poth, 2016). In the domain of food insecurity, data was gathered at the individual and family levels. Additionally, information on the students' dietary habits, academic achievement, and attendance was gathered. Each of these and the procedures used to collect the data is described in the ensuing subsections.

3.10.1 Collection of Primary Data for Food Insecurity Status Assessment

Data was gathered using a researcher-administered semi-structured questionnaire which was administered to the respondents through face-to-face interviews. The respondents to the household food insecurity questionnaire were parents or guardians of the pupils selected to participate in this study. The pupils themselves were also interviewed to measure individual food insecurity status. The Food Insecurity Experience Scale (FIES) makes provision for measuring both household food insecurity and individual food insecurity status (FAO, 2017). The food insecurity experience scale has a set of eight questions that helps to measure both individual and household food insecurity status.

These eight (8) questions are widely recognized as a means of assessing a person's or a household's level of food insecurity (FAO, 2017). These FIES questions are scored overall, with totals ranging from 0 to 8. According to Sheikomar et al. (2021), the scores for these studies were divided into three groups based on the worldwide standard: 1) food secure (0–3), 2) moderately Food Insecure FI (4–6), and 3) severely Food Insecure FI (7, 8). The proportion of children living in food insecure

families can be estimated, even if food insecurity among children cannot be directly evaluated using the FIES survey module, according to FAO (2018). This indicates that children's levels of food insecurity cannot be determined using the FIES. Thus, participants who were less than 15 years old were excluded from the Individual food insecurity measure. For this reason, 14 of the pupils representing 6.4% were not interviewed with the food frequency questionnaire because they were under 15 years of age. However, their food insecurity status was determined by the measure of their household food insecurity status. The set of eight (8) questions were answered by each of the pupils. Thus, their individual food insecurity statuses were measured based on their responses to the set of eight questions.

3.10.2 Collection of Primary Data for assessment of School attendance of the Pupils

The attendance of the pupils was taken from the class registers for the previous three (3) terms as at the time of the data collection. The total number of times the registers were marked (opened) during those 3 terms was 164 days. A pupil's attendance was measured against this yardstick. A pupil's attendance was determined by the number of the days the pupil was marked present out of the 164 days.

3.10.3 Collection of Primary Data for assessment of the academic performance of the Pupils

Academic performance of the pupils was also one of the variables that was measured during the research. The academic performance of the pupils was measured through a researcher administered test in English Language and Mathematics. The test questions in both English and Mathematics were adopted from Manuel news website (https://www.manuelnewsgh.net) and edited by the researcher to suit the test requirement for the research. The test questions were drawn from this

private website because it had up-to-date standard questions that could meet my research demands with little editing. The researcher took the academic performance of the pupils through self-administered test questions to ensure that, the results of the academic performance truly reflects the performance of the pupils and not overshadowed by the influence of exams malpractice. The test questions drawn from that domain was standard and it was edited to suit the strengths of the pupils. This was done to ensure that, academic performance variable really measures what it ought to measure.

The test score for each of the subjects was 50 marks and the total score for the two subjects which constituted the academic performance variable was 100%. A pupil's performance was an aggregate of the marks obtained both in English Language and Mathematics.

3.10.4 Collection of Primary Data for assessment of the nutritional status of the Pupils

The nutritional statuses of the pupils were determined through anthropometric measurements. The students' heights and weights were recorded with stadiometer and Seca-scale respectively. These were measured to two decimal places. The data were computed using the World Health Organization (WHO) Anthro plus software and the Statistical Product and Service Solutions (IBM SPSS) software. Using the Body Mass Index (BMI) for Age Z-score (BAZ), and Height for Age Z-scores (HAZ), the nutritional health of the students was assessed. A child was considered stunted if they are too short for their age (low height-for-age), and underweight if their BMI-for-age is below the average Z-score for their age and sex. Z-scores for height-for-age and BMI-for-age based on reference children of the same age and sex were computed by utilizing the 2007 WHO child growth reference, which is suggested for use in global contexts. Severe stunting is defined as a height-for-age z score (HAZ) <-3 SD, moderate stunting as <-2 SD but ≥ -3 SD and HAZ $\geq$-2 SD

as Normal Height for Age Z-scores from the 2007 WHO Growth Reference for children and adolescents 5–19 years.

When a child's BMI-for-age z-score (BAZ) is < -3 SD, then the child is severely thin/underweight. BAZ < -2 ≥ -3 SD indicates thinness or underweight. Also, a BMI-for- Age Z-scores (BAZ) ≥-2≤1 indicates normal nutritional status. Moreover, a BAZ > +1 SD ≤ +2 SD indicates overweight and a BAZ > +2 indicates obesity.

The Body Mass Index (BMI) was also used to categorize pupils in the study who were more than 19 years of age. The cut off points for the BMI in determining nutritional status includes; BMI less than 16.5kg/m^2 is considered as severe underweight, a BMI less than 18.5 kg/m^2 as underweight, BMI greater than or equal to 18.5 to 24.9 kg/m^2 as normal weight, a BMI greater than or equal to 25 to 29.9 kg/m^2 as overweight and a BMI greater than or equal to 30 kg/m^2 as obesity. The above information is presented in the table below for clarity.

Table 3.2 Nutritional status indicators, categories and cut-off-points.

Nutritional Status Index	Cut-Off-Points	Category
Height for Age Z-scores (HAZ)	HAZ ≥-2 SD	Normal
	HAZ<−2 SD≥−3 SD	Moderate Stunting
	HAZ <−3 SD	Severe Stunting
Body Mass Index (BMI) for pupils more than 19 years of age	BMI greater than or equal to 30 kg/m^2	Obese
	BMI≥ 25 kg/m^2 ≤ 29.9 kg/m^2	Overweight
	BMI≥18.5 kg/m^2 ≤ 24.9 kg/m^2	Normal
	BMI less than 18.5 kg/m^2	Moderate underweight
	BMI less than 16.5kg/m^2	Severe Underweight
BMI-for-Age Z-scores (BAZ)	BAZ > 2SD	Obese
	BAZ >1≤2SD	Overweight
	BAZ ≥-2≤1SD	Normal
	BAZ < -2 ≥ -3 SD	Moderate underweight
	BAZ < -3 SD	Severe Underweight

Source: Adopted from the 2007 WHO Growth Reference for children and adolescents 5–19 years.

3.11 Data Quality Control

In research, validity and reliability pertain to the degree of consistency in measuring the study variables through the use of the research instrument. The validity and reliability of the instruments used to gather the data are among the most crucial factors in determining the quality of research work (Bryman, 2016). Reliability requires that the results of a study have high reproducibility. The greater the reliability of the scale, the smaller the standard error (J. W. Creswell, 2009). In this study, the validity of the data collection instruments was achieved through pretesting of the instruments on 10 respondents outside the study area (Tolon) prior to commencement of the actual study. During the pre-test, question or items which were identified to be inconsistent with the objectives of the study were tweaked or expunged.

3.12 Limitations of the Study

The study did not explore the full scope of the impact of household food insecurity but focused only on nutritional status and academic performance of Junior High School pupils. Other future studies on food insecurity should endeavor to explore other areas of the impact of food insecurity in the Tolon District.

3.13 Strengths of the Study

The study addressed adequately all the research objectives set for this study. The study also adopted the most appropriate study methodology to achieve the set objectives.

3.14 Ethical Consideration

Ethical approval was sought from the Institutional Review Board (IRB) of the University for Development Studies before the commencement of data collection. The Institutional Review Board (IRB) of the University for Development Studies granted the ethical approval with reference

number UDS/RB/021/23. A copy of the ethical approval letter is attached in the appendices. The headmasters of the chosen schools were consulted.

3.15 Informed consent

Prior to conducting interviews for the study, all participants provided their informed consent. Participants received guarantees of the highest privacy and anonymity. No one was coerced or forced to participate in the research. The respondents were informed about the research and the potential indirect advantages, but were free to choose whether or not to engage in the interview. They were urged to participate voluntarily and without any strings attached. Furthermore, respondents were made aware that there were no incentives for participation, and that they could withdraw at any time during the study. They were also assured of suffering no or minimal harm both physically and mentally as a result of their participation in the study. Respondents were informed that data generated will be used for academic purposes only, and that under no circumstances shall the data be used for any other purposes unless another ethical clearance was acquired.

3.16 Data Analysis Plan

The Statistical Product and Service Solutions (IBM SPSS STATISTICS version 26), the WHO Anthro plus and excel were employed in the data entry and analysis. For continuous data, means and standard deviations were computed. For categorical variables, frequencies and percentages were reported. The relationship between a household's and an individual's level of food insecurity was examined using the chi-square test. Also, linear regression analysis was carried out to assess the association between the socio-demographic variables, food insecurity variables and school attendance and academic performance. Moreover, binary logistic regression analysis was used to examine the associations of food insecurity variables, socio-demographic variables and nutritional

status of the pupils. Results were presented in tables and charts, and interpreted in line with the study's objectives. For all the tests of associations, a statistical significance level of ≤ 0.050 was deemed statistically significant.

CHAPTER FOUR

4.0 RESULTS/FINDINGS OF THE STUDY

4.1 Introduction to the Results

This chapter of the study presents the results from 220 pupils and their households. It presents findings of the obtained through the food insecurity questionnaires, anthropometric measurements, students' attendance registers, academic test results, and socio-demographic data of the students and their household heads. Descriptive statistics were conducted for the socio-demographic data and for the test of associations: chi-square, binary logistic and linear regression analyses were done.

4.2 Socio-demographic characteristics of the pupils and their household heads

The socio-demographic characteristics of 220 pupils and their household heads are presented in this section. The ages of students in the study ranged from 12 to 21 years [mean age, M= 16.49; standard deviation, SD= 1.479 (Not in the table)]. Slightly over 6% (14) of the pupils fell within 12-14 years. Almost 85% (186) of the pupils were within 15-18 years while about 9% (20) of them fell within the 19-21 years bracket. The analysis revealed that 139(63.2%) of the pupils were male and 81(36.8%) of them were females.

The heads of households were predominantly male 205 (93.2%). Furthermore, the majority of the heads of households were Muslims being 207 (94.1%) with over 98% (216) of the heads of household belonging to the Dagomba ethnic group. The results further showed that, approximately, the heads of households without formal education accounted for about 81% (179). Farming was found to be the major occupation of the household heads 181 (82.3%). The Socio-demographic characteristics of the pupils and their household heads are presented in Table 4.1

Table 4.1 Socio-demographic characteristics of the pupils and their household heads

Variable	Category	Frequency	Percentage (%)
Age of Pupils (in years)	12-14	14	6.4
	15-18	186	84.5
	19-21	20	9.1
Sex of Pupils	Males	139	63.2
	Females	81	36.8
Sex of Household Head	Males	205	93.2
	Females	15	6.8
Religion of Household Head	Islam	207	94.1
	Christianity	13	5.9
Ethnicity of Household Head	Dagombas	216	98.2
	Others*	4	1.8
Educational Level of Household Head	No Formal Education	179	81.3
	Basic Education	14	6.4
	SHS/Vocational	14	6.4
	Tertiary Education	13	5.9
Occupation of Household Head	Farming	181	82.3
	Salary Workers	14	6.4
	Trading	21	9.5
	Unemployed	4	1.8
Household Size	1-10	68	30.9
	11-15	56	25.5
	16-20	38	17.3
	21 and above	58	26.4
Household Food Decision Maker	Husband	186	84.5
	Wife	7	3.2
	Both	2	0.9
	Others**	25	11.4

Others*: Frafras and Ewes Others**: Children and other household members

Source: The source of the information above is data obtained through the face-face interview with the semi-structured questionnaire

4.2 Food Insecurity Status

The results of the food insecurity status were reported in two ways in this section. The first element concerns pupils' personal food insecurity situation, while the second component concerns pupils' household food insecurity situation. I evaluated and compared the food insecurity status of the pupils individually and the food insecurity status of their households.

4.2.1 Individual Food Insecurity Status of the Pupils.

The statistics regarding the responses of the pupils to the eight (8) food insecurity questions are presented in Table 4.2. The data showed that over the 12 months preceding the study, 147(67%) of the pupils had concerns themselves with the possibility of not having enough food to eat. Also, 155 (70.5%) of the pupils reported being unable to afford and eat healthy or nutritious foods due to lack of money or other resources. Moreover, 186 (85%) of the pupils stated that they ate only a limited variety of foods due to lack of money or other resources.

Furthermore, 139(63%) of the pupils admitted to having to skip a meal as a result of lack of money or other resources to get food. In addition, 143(65%) of the pupils reported eating less than they expected to eat because of lack of money or other resources in the 12 months preceding the study. More so, 93 (42.1%) of the pupils ran out of food due to lack of money or other resources in the 12 months preceding the study. Additionally, 121(55%) of the pupils reported experience of hunger but refrained from eating due to lack of money or other resources to get food in the 12 months preceding the study. Finally, 158(72%) of the pupils stated never going an entire day without food as a result of lack of money or other resources.

Table 4.2 Responses of pupils to food frequency questionnaire and individual food insecurity status (IFIS)

Variable	Category	Frequency	Percentage (%)
Participants worried about not having enough food to eat	No	59	26.8
	Yes	147	66.8
Participants unable to eat healthy and nutritious food.	No	51	23.2
	Yes	155	70.5
Participants ate only a few kinds of foods.	No	20	9.1
	Yes	186	84.5
Participants skipped a meal.	No	67	30.5
	Yes	139	63.2
Participants ate less than they thought they should.	No	63	28.6
	Yes	143	65.0
Participants ran out of food.	No	113	51.4
	Yes	93	42.3
Participant was hungry but did not eat.	No	85	38.6
	Yes	121	55.0
Participant went without eating for a whole day.	No	158	71.8
	Yes	48	21.8

Source: Data from Food Insecurity Experience Scale (FIES) questionnaire

4.2.1.1 Individual Food Insecurity Status (IFIS)

The prevalence of moderate individual food insecurity status (Moderate IFIS) of the pupils was 72(35%). Also, the prevalence of severe individual food insecurity status (Severe IFIS) stood at 64 (30.9%) and the prevalence of secured individual food insecurity status (Secured IFIS) was 57 (27.7%) as shown in the Figure 4.1. The overall prevalence of food insecurity among the pupils was 136 (65.9%) (Not shown in the figure)

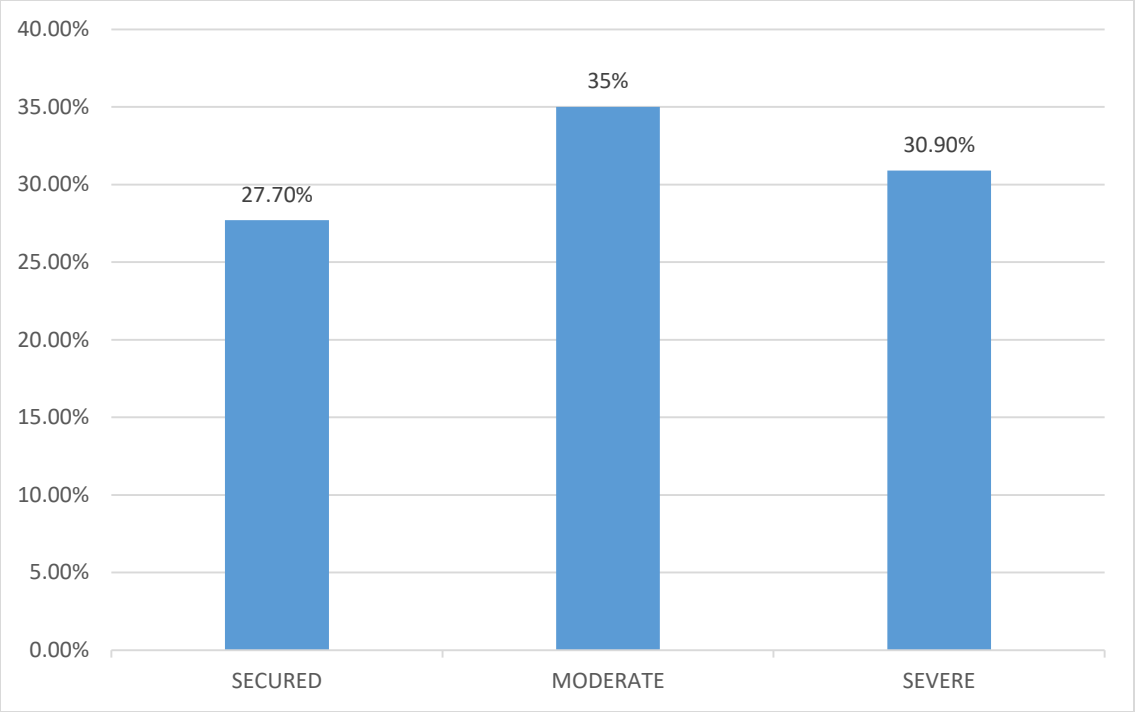


Figure 4.1 Bar chart of prevalence of individual food insecurity status.

4.2.2 Household Food Security Status of the Pupils.

This section presents the analysis of the households' responses to the food insecurity questionnaire The data showed that, for the 12 months preceding the study, 177 (80.5%) of the households were worried that, they would not have enough food to eat due to lack of food or other resources. Also, 173 (78.6%) of the households reported being unable to afford and eat healthy or nutritious foods due to lack of money or other resources. Furthermore, 201 (91.4%) of the households stated that they only ate a limited variety of foods due to lack of money or other resources. Moreover, 138 (62.7%) of the households admitted to skipping meals as a result of lack money or other resources to get food. In addition, 155 (70.5%) of the households ate less than they expected to eat because of lack of money or other resources in the 12 months preceding the study. The data showed that,

115 (52.3%) of the households did not ran out of food due to lack of money or other resources during the same period.

Exactly 103 (46.8%) of the households reported to experiencing hunger but not eating due to lack of money or other resources to get food during the 12 months preceding the study. The data also showed that 173 (78.6%) of the households never went a whole day without food as a result of lack of money or other resources as shown in Table 4.3.

Table 4.3 Responses of Households and Prevalence of Household Food Insecurity Status (HFIS)

Variable	Category	Frequency	Percentage (%)
Household worried about not having enough food to eat	No	43	19.5
	Yes	177	80.5
Household unable to eat healthy and nutritious food	No	47	21.4
	Yes	173	78.6
Household ate only a few kinds of foods	No	19	8.6
	Yes	201	91.4
Household skipped a meal	No	82	37.3
	Yes	138	62.7
Your household ate less than you thought you should	No	65	29.5
	Yes	155	70.5
Household ran out of food	No	115	52.3
	Yes	105	47.7
Household was hungry but did not eat	No	117	53.2
	Yes	103	46.8
Household went without eating for a whole day.	No	173	78.6
	Yes	47	21.4

Source: information from Households Food Insecurity Experience Scale (FIES) questionnaire

4.2.2.1 Overall Household Food Insecurity Status (HFIS)

As seen in Figure 4.2 below, the prevalence of household food insecurity status showed that 36.4% (80) of households were moderately food insecure, 75 (34.1%) were severely food insecure, and

65 (29.5%) were food secured. Also, a total of 155 (70.5%) of households reported experiencing food insecurity (not included in the figure).

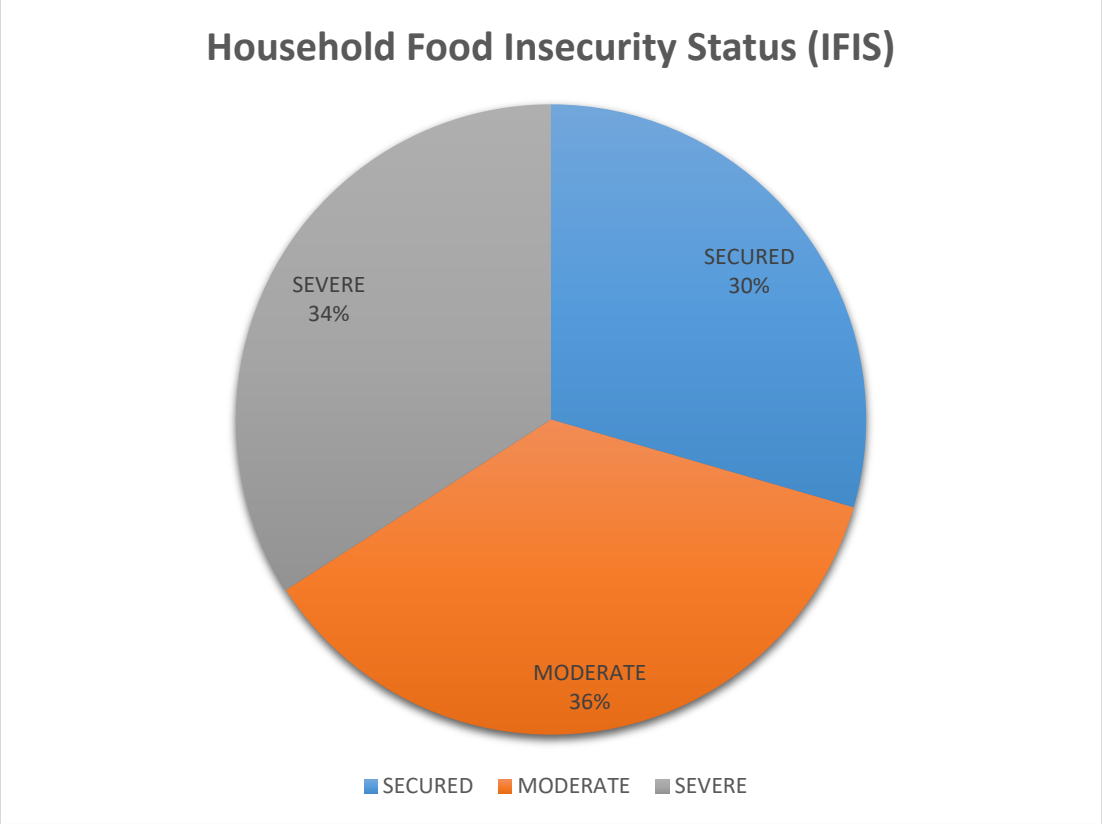


Figure 4.2 Pie chart of prevalence of Household Food Insecurity Status (HFIS)

Source: Pie chart constructed from Household food insecurity questionnaire

Further, analysis using the chi-square test of association there was a relationship between the students' individual food insecurity status (IFIS) and their household food insecurity status (HFIS).

From the Table 4.4, the P-value for the test of association was found to be P<0.001 which revealed that, the test of association was significant. This implied that, a pupil from a food secured household is likely to be food secured and a pupil from food insecure household is likely to also be food insecure. Specifically, this strong relationship implies that pupils from food secure households are more likely to experience food security whereas those from food insecure households were more likely to experience food insecurity. This strong association therefore underscores the tremendous impact of household food security or insecurity have on individual pupil food security status.

Table 4.4 Chi-square test of association between Household food insecurity status and Individual food insecurity status.

Variable		Individual Food Insecurity Status (IFIS)			P-Value
Household Food Insecurity Status (HFIS)		Secured	Moderate	Severe	
	Secured	31(50.8%)	15(24.6%)	15(24.6%)	
	Moderate	14(18.9%)	37(50%)	31(31.1%)	P<0.001
	Severe	16(22.5%)	25(35.2%)	30(42.3%)	

HFIS: Household Food Insecurity Status; IFIS: Individual Food Insecurity Status

Source: Data obtained from chi-square analysis of Household and individual food insecurity questionnaire

4.3 School Attendance of the Pupils

This section presents the results of the attendance of the pupils being measured with the socio-demographic variables and food insecurity in both adjusted and unadjusted linear regression analysis.

4.3.1 Association between socio-demographic variables and attendance of pupils.

The Table 4.5 presents both unadjusted and adjusted linear regression analysis examining the association between the socio-demographic variables, food insecurity status and school attendance of the pupils. The socio-demographic variables along-side with the food insecurity variables were compared with the attendance of the pupils. The findings revealed that, the age of the pupils was significantly associated with school attendance (β= -2.67; CI= -4.85 - -0.49; P= 0.017) in the unadjusted linear regression analysis. The age of the pupils in the unadjusted analysis had a beta-value (β) of -2.67 at a 95% Confidence Interval (CI) of -4.85 - -0.49 and a P-value of 0.017. The beta coefficient of -2.67 indicated that, as the age of the pupils increased by one year, it will averagely result in a 2.67 decrease in the number of days the pupils attended school. The age of the pupils was also significantly associated with school attendance (β= -3.13; CI= -5.41 - -0.84; P= 0.008) in the adjusted linear regression analysis. After the effects of covariates were controlled in the adjusted model, the age of the pupils had a beta coefficient (β) of -3.13, at a 95% confidence Interval of -5.41 - -0.84 and P-value of 0.008.

The adjusted analysis showed that, as the age of the pupils increased by one year, school attendance was more likely to drop by 3 days per an academic year. Moreover, the education of household head variable was also significantly associated with the school attendance of the pupils (β= -10.65;

CI= -18.8 – -2.5; P= 0.010) in the unadjusted analysis. The education of household head had an unadjusted beta coefficient (β) as -10.65 which indicates that, pupils whose household head had no formal education had on average 10.65 days decrease to attend school as compared to pupils whose household heads had formal education all other factors being held constant. The education of household heads was still significantly associated with attendance (β= -11.58; CI= -20.6 - -2.51; P= 0.013) in the multivariable analysis. This revealed that, pupils whose household heads had no formal education had almost 12 days fewer attendance compared with pupils whose household heads had formal education.

The individual food insecurity variable had three (3) categories namely; 1) IFIS Secured (reference category), 2) IFIS Moderate and 3) IFIS Severe. The Severe Individual Food Insecurity Status category (IFIS Severe) was found statistically significant (β= 10.39; CI= 1.44 – 19.34; P= 0.023) after the effects of confounding variables were controlled in the multivariable analysis. This showed that, pupils who were severely food insecure had averagely 10 days more of school attendance compared to pupils who were food secure. The other variables showed no significant association with attendance as displayed in Table 4.5.

Table 4.5 Linear regression analysis of association between socio-demographic variables and attendance

Variables	Unadjusted Analysis		Adjusted Analysis	
	β (95% CI)	P-Value	β (95% CI)	P-Value
Age of pupils	-2.67(-4.85--0.49)	0.017	-3.13(-5.41 - -0.84)	0.008
Sex of pupils Female (ref.)				
Male	-6.29(-12.9 – 0.31)	0.062	-4.41(-11.34 – 2.52)	0.211
HHH-Education Formal Education(ref.)				
No Formal Education	-10.65(-18.8 - -2.5)	0.010	-11.58(-20.6 - -2.51)	0.013
HHH-Occupation Salary Worker (ref.)				
Farming	-4.24(-13.02 – 4.54)	0.342	0.55(-9.09 – 10.20)	0.910
Household Size 1-10 (ref.)				
Household size (11-15)	-4.90(-13.49 – 3.70)	0.263	-7.54(-16.18 – 1.11)	0.087
Household size (16-20)	-1.92(-11.56 – 7.73)	0.696	-3.24(-13.14 – 6.66)	0.519
Household size (21 and above)	-5.75(-14.26 – 2.76)	0.185	7.86(-16.50 – 0.77)	0.074
Secured HFIS (ref.)				
Moderate HFIS	2.60(-5.31 – 10.52)	0.517	2.31(-6.34 – 10.97)	0.599
Severe HFIS	-4.43(-12.46 – 3.60)	0.278	-4.74(-13.40 – 3.92)	0.281
Secured IFIS (ref.)				
Moderate IFIS	-0.24(-8.13 – 7.65)	0.953	0.35(-8.12 – 8.81)	0.936
Severe IFIS	6.76(-1.32 - 14.83)	0.101	10.39(1.44 – 19.34)	0.023

HFIS: Household Food Insecurity Status; IFIS: Individual Food Insecurity Status; HH: Household Head; CI: Confidence Interval

Source: The table resulted from analysis of the data collected through the semi- structured questionnaire

4.4 Academic Performance of the pupils.

The raw scores from both subjects constituted the academic performance variable, which was compared with the socio-demographic and food insecurity variables as shown in Table 4.6. Age of the pupils was significantly associated with academic performance (β= -0.50; CI= -0.91 - -0.10; P= 0.015) in the crude analysis. This implied that, for each one-year increase in a pupil's age, academic performance was more likely to flop on the average by 0.50 in marks. In the multivariable analysis where the effects of the confounding variables were controlled, the association remained significant (β= -0.51; CI= -0.96 - -0.07; P= 0.024) with the academic performance. The results were nearly the same as the unadjusted. The direction and magnitude of the beta coefficients (β) were almost identical. This also indicated that, a pupil whose age was increased by one year had on the average 0.51 marks less than for a younger counterpart. Another variable that showed significant association (β= -1.83; CI= -3.37 - -0.30; P= 0.020) with academic performance was the educational level of the household heads in the unadjusted model. This meant that, pupils whose household heads had no formal education were likely to obtained a mark that was 1.83 less than the marks of pupils whose household heads had formal education In the adjusted analysis, the education of household head variable was still significant (β= -2.06; CI= -3.82 – 0.29; P= 0.023) with the academic performance variable. It implied that, a pupil whose household head had no formal education was likely to obtain a mark that was 2.06 less than the marks of pupils whose household heads had formal education. Majority of the other variables did not indicate any significant statistical association with the academic performance variable as seen in Table 4.6.

Table 4.6 Linear regression analysis of association between socio-demographic variables and academic performance

Variables	Unadjusted Analysis		Adjusted Analysis	
	β (95% CI)	P-Value	β (95% CI)	P-Value
Age of pupils	-0.50(-0.91 - -0.10)	0.015	-0.51(-0.96 - -0.07)	0.024
Sex of pupils				
Female (ref.)				
Male	-0.01 (-1.27 – 1.24)	0.984	-0.02(-1.37 – 1.33)	0.982
HHH-Education				
Formal Education (ref.)				
No Formal Education	-1.83(-3.37 - -0.3)	0.020	-2.06(-3.82 – 0.29)	0.023
HHH-Occupation				
Salary Worker (ref.)				
Farming	-0.24(-1.90 – 1.42)	0.776	0.78(-1.10 – 2.65)	0.417
Household Size 1-10 (ref.)				
Household size 11-15	-0.15(-1.76 – 1.47)	0.860	-0.43(-2.11 – 1.25)	0.616
Household size 16-20	-0.96(-2.77 – 0.86)	0.300	-1.27(-3.19 – 0.66)	0.197
Household size 21 and above	-1.36(-2.96 – 0.24)	0.096	-1.23(-2.91 – 0.45)	0.151
Secured HFIS (ref.)				
Moderate HFIS	-0.13(-1.63 – 1.37)	0.865	-0.42(-2.10 – 1.27)	0.628
Severe HFIS	0.05(-1.47 – 1.58)	0.944	0.04(-1.65 – 1.73)	0.963
Secured IFIS (ref.)				
Moderate IFIS	-0.05(-1.54 – 1.45)	0.953	0.37(-1.28 – 2.02)	0.660
Severe IFIS	-0.93(-2.46 - 0.60)	0.232	-0.29(-2.03 – 1.45)	0.742

HFIS: Household Food Insecurity Status; IFIS: Individual Food Insecurity Status; HH: Household Head; CI: Confidence Interval

Source: **The table resulted from analysis of the data collected through the semi- structured questionnaire**

4.5 Nutritional Status of the Pupils

The various nutritional statuses were compared with the socio-demographic variables of the study in both unadjusted and adjusted models of binary logistic regression.

4.5.1 Prevalence of Malnutrition.

The nutritional status obtained from the data showed that 190 (86.4%) had normal weight, 4 (1.8%) were severely underweight, 21 (9.5%) were moderately underweight and 5 (2.3%) were overweight. Furthermore, 9 (4.1%) of the participants were severely stunted, 30 (13.6%) were moderately stunted and over 181 (82.3%) were normal without stunting as shown in Table 4.7. The overall prevalence of underweight was 25 (11.3%) and the total prevalence of stunting among the study participants was 39 (17.7%).

Table 4.7 Nutritional status and prevalence of malnutrition among the pupils

Variable	Category	Frequency	Percentage (%)
BMI for Age Z-scores (BAZ)	Moderate Underweight	21	9.5
	Severe Underweight	4	1.8
	Overweight	5	2.3
	Normal	190	86.4
Overall prevalence of underweight		25	11.3
Height for Age Z-scores (HAZ)	Moderate Stunting	30	13.6
	Severe Stunting	9	4.1
	Normal	181	82.3
Total prevalence of stunting		39	17.7

BMI-for-age > 1 SD = Overweight, BMI-for-age > 2SD = Obese, BMI-for-age < -2 to -3 SD = Thin/underweight, BMI-for-age <

-3 SD = severely thin/severely underweight and BMI-for-age ≥-2≤1 = Normal nutritional status. Height-for-age < -2SD to -3SD = Stunted, Height-for-age < -3SD = severely stunted and Height-for-age ≥-2 = Normal nutritional status (not stunted)

4.5.2 Association between socio-demographic variables and underweight.

The associations of the various socio-demographic variables with stunting were determined using binary logistics regression analysis. The sex of the pupils was the only variable that indicated significant statistical association with underweight in both the unadjusted and adjusted models. In the unadjusted model, the sex of the pupils had Unadjusted Odds Ratio (UOR) = 5.04; Confidence

Interval (CI) = 1.46-17.40; and statistical significance (P) = 0.010. This implies that, the males were 4.04 times more likely to be underweight as compared with the females all other factors being held constant. In the adjusted model, the association of sex of the pupils remained significant (AOR= 4.67; CI= 1.29-16.9; P= 0.019) with the underweight variable. It also indicated that, the males were 3.67 times more likely to be underweight as compared to the females. In other expression, it meant that, the males had 3.67 higher odds of being underweight compared with their female counter parts after the effects of confounding variables were dealt with in the model. The other variables showed no significant association with the underweight variables as seen in Table 4.8.

Table 4.8 Binary logistic regression analysis of association between socio-demographic variables and underweight.

Variables	Category	Unadjusted		Adjusted	
		UOR (95% CI)	P-value	AOR (95% CI)	P-value
Age of Pupils		1.19(0.87 – 1.62)	0.272	0.97(0.64 – 1.47)	0.889
Sex of Pupils	Female (ref.)				
	Male	5.04(1.46 -17.40)	0.010	4.67(1.29 – 16.9)	0.019
Education of Household Head.	Formal Education (ref.)				
	No Formal Education	0.99(0.35 – 2.80)	0.980	1.10(0.31 – 3.90)	0.886
Occupation of Household Head	Salary worker/Trader (ref.)				
	Farming	1.46(0.41 – 5.18)	0.561	1.24(0.30 – 5.20)	0.770
Household Size	Size 1-10 (ref.)				
	Size 11-15	0.42(0.12 – 1.40)	0.156	0.42(0.24 – 3.10)	0.171
	Size 16-20	0.94(0.32 – 2.78)	0.907	1.01(0.28 – 3.67)	0.986
	Size 21 and above	0.51(0.17 – 1.57)	0.241	0.55(0.17 – 1.82)	0.326
Household Food Insecurity Status (HFIS)	HFIS-Secured (ref.)				
	HFIS-Moderate	1.35(0.46 – 3.94)	0.585	0.85(0.24 – 3.10)	0.810
	HFIS-Severe	1.50(0.51 – 4.41)	0.458	0.90(0.25 – 3.29)	0.876
Individual Food Insecurity Status (IFIS)	IFIS-Secured (ref.)				
	IFIS-Moderate	2.88(0.89 – 9.36)	0.078	3.31(0.88 – 12.5)	0.078
	IFIS-Severe	2.29(0.67 – 7.89)	0.189	3.16(0.80 – 12.6)	0.102

HFIS: Household Food Insecurity Status; IFIS: Individual Food Insecurity Status; CI: Confidence Interval

4.5.3 Association between socio-demographic variables and stunting

The socio-demographic variables were compared with stunting in both adjusted and unadjusted models of binary logistic regression analysis. The only variable that indicated significant association with stunting was sex of the pupils in the unadjusted model (UOR=3.90; CI=1.55-9.78; P= 0.004). All other things being equal, it showed that the likelihood of stunting was 2.90 times higher in men than in women. In the study, the odds of stunting were nearly three times higher in males than in females. After controlling for the effects of the confounding variables, the association of sex of the pupils and stunting was still strongly significant (AOR=8.69; CI=2.45-30.9; P= 0.001). It was observed that boys had a 7.69-fold higher chance of being stunted than females did. In a multivariable analysis, the risks of stunting were thus about eight times higher in boys than in females. The Household Food Insecurity Status (HFIS) variable did not show a significant statistical association with stunting. The moderate household food insecurity status category had an Adjusted Odds Ratio (AOR) = 1.25; Confidence Interval (CI) = 0.38 – 4.12 and statistical significance (P) = 0.710. This suggested that students from families experiencing moderate food insecurity had a roughly 25% higher risk of stunting when compared to students from households experiencing food security. Additionally, the category of extreme household food insecurity had a statistical significance (P) of 0.309, an Adjusted Odds Ratio (AOR) of 1.81, and a Confidence Interval (CI) of 0.58 - 5.69. According to the odds ratio, students from homes experiencing extreme food insecurity had an 81% higher risk of stunting than students from households where food was secure.

Table 4.9 Binary logistic regression analysis of association between socio-demographic variables and stunting

Variables	Category	Unadjusted		Adjusted	
		UOR (95% CI)	P-value	AOR (95% CI)	P-value
Age of Pupils		0.88(0.68 – 1.14)	0.325	0.81(0.55 – 1.18)	0.276
Sex of Pupils	Female (ref.)				
	Male	3.90(1.55 – 9.78)	0.004	8.69(2.45 – 30.9)	0.001
Education of Household Head.	Formal Education (ref.)				
	No Formal Education	2.33 (0.78 – 6.97)	0.131	2.43(0.63 – 9.38)	0.197
Occupation of Household Head	Salary worker/Trader (ref.)				
	Farming	1.39(0.50 – 3.84)	0.532	1.27(0.35 – 4.62)	0.718
Household Size	Size 1-10 (ref.)				
	Size 11-15	1.40(0.55 – 3.60)	0.484	1.82(0.62 – 5.38)	0.279
	Size 16-20	1.49(0.53 – 4.18)	0.445	2.94(0.80 – 10.8)	0.104
	Size 21 and above	1.22(0.47 – 3.18)	0.688	2.00(0.67 – 5.99)	0.215
Household Food Insecurity Status (HFIS)	HFIS-Secured (ref.)				
	HFIS-Moderate	1.18(0.47 – 2.97)	0.723	1.25(0.38 – 4.12)	0.710
	HFIS-Severe	1.82(0.75 – 4.44)	0.187	1.81(0.58 – 5.69)	0.309
Individual Food Insecurity Status (IFIS)	IFIS-Secured (ref.)				
	IFIS-Moderate	0.86(0.34 – 2.18)	0.750	0.97(0.33 – 2.88)	0.957
	IFIS-Severe	1.47(0.60 – 3.58)	0.396	2.06(0.72 – 5.93)	0.181

HFIS: Household Food Insecurity Status; IFIS: Individual Food Insecurity Status; CI: Confidence Interval

CHAPTER FIVE

5,0 DISCUSSION OF FINDINGS

5.0 Introduction.

This chapter embodied discussions about the findings or results in the previous chapter. The thematic pattern of the discussion in this chapter follows this order: socio-demographic characteristics of the pupils and their household heads, food insecurity status, school attendance of the pupils, academic performance of the pupils, nutritional status of the pupils, prevalence of malnutrition, association between underweight and socio-demographic variables and association between stunting and the socio-demographic variables.

5.1 Socio-demographic characteristics of pupils and their household heads

The socio-demographic data of the research participants are the areas covered in this section. About 220 students made up the sample size in total, whose household head's data were collected, analyzed and discussed herein. The ages of pupils in the study ranged from 12 to 21 years. This means that pupils within this age range maybe at different stages of physical, emotional, and cognitive development. The modal age of the participants was 16 which was about 30% of the sample size. The study also revealed that the average age of pupils in Junior High Schools within Tolon is 16. Most of the pupils (84.5%) were within age 15-18years category. Majority of the study participants were teenagers. Furthermore, the study unveils that, the age range of pupils in Junior High Schools within Tolon was higher than the national standard age range for Junior High Schools. The national standard age range for Junior High Schools (JHS) is 12-15 years and Senior High School is 15-18 years (National Pre-Tertiary Education Curriculum Framework, 2018). This

further shows that, pupils within the same age brackets elsewhere in Ghana will be in Senior High Schools whiles those in Tolon will still be at JHS level. This reveals lateness in the enrolment of pupils into Junior High Schools within Tolon. Other existing literature uncovers that; it is a common problem in the Northern Region for JHS pupils to be older than the usual age range. This study demonstrates that kids in JHS are not of the right age and are probably entering school later than is recommended, especially in the northern regions. The Education Sector Performance Report from 2013 emphasizes how difficult it is to retain kids in school past Primary level at the appropriate age in the northern regions. The boys were 139 (63.2%) and the girls were close to 81 (37%). These findings showed that there are more boys in school than girls. The findings of this study have confirmed the findings of the other studies that have been done in the past. Other studies within the region also submitted that, there were more boys in school than girls (Alhassan& Odame, 2015). The possible reasons that accounted for more boys being in school than girls in the Northern region could be attributed to socio-cultural factors such as cultural mindset, boy child preference, early marriage and household chores. In some communities, there prevailing cultural mindset is that female education is not valuable so they turn to prioritize the female domestic roles over their academic pursuits (Amabo & Awimi, 2017). In terms of boy child preference, some families prefer to invest in their sons' education, believing it will produce better economic profits (Alhassan E., 2010). Also, about early marriage, girls are often forced into early marriage, which can lead to school dropout and hinder their educational prospects (Alhassan E., 2010). There is a need for a campaign and advocacy for girl child education in the Northern Region to increase enrolment in schools.

Majority of the household heads were males constituting 205 (93.2%), while the female household heads were also 15 (6.8%), indicating a predominance of male household heads in Tolon. This

research discovered that, most of the families where the household heads were female were nuclear families. The few female household heads were mostly widows. The findings here agreed with the national average of household heads' sex prevalence. There are more male household heads than female household heads. Nationally it stands at 66.6% male household heads and 33.4% female household heads, (GSS Final Report, 2018). Additionally, majority 207 (94.1%) of the household heads were Muslims and 13 (5.9%) were Christians. This confirmed the final report of Ghana Statistical Service (GSS Final Report, 2018), that stated that majority of the household heads in Northern region were Muslims. The household heads were predominantly Dagombas with a prevalence of 216 (98.2%) and 4 (1.8) of the household heads belonged to other ethnic groups. According to the Ghana Statistical Service, Dagomba is the predominant ethnic group in Tolon (GSS, 2014).

Moreover, 179 (81.3%) of the household heads had no formal education whiles 41 (18.6%) had formal education. This also confirmed the findings of the Tolon District Assembly's Programme Based Budget Estimates for 2019, which stated that, there was high illiteracy rate in Tolon. It also stated that, the illiteracy rate in any language was at 73.8% within the district, according to the 2010 population and housing census report, Tolon District Assembly, (2019). This calls for concern to strengthen the educational efforts in the district with premium on adult education.

Farming was the major occupation of the household heads. The percentage of household heads who were farmers was 181 (82.3%). About 14 (6.4%) of the household heads were salaried workers, 21 (9.5%) were traders and 4 (1.8%) were unemployed. The dominant occupation in the district according to the available literature is farming. The Tolon District Assembly's Programme Based Budget Estimates for 2019 stated that, farming is the major occupation of Tolon District which constituted 74% of the total labour-force in the district. The district is basically agrarian in

nature with about 88.8% of its labour force being farmers, (Tolon District 2020 Annual Report, 2021).

Majority of the pupils 68 (30.9%) came from families whose household size ranged from 1-10 members. This household size (1-10) was used as the reference category for comparison in this researched. It was chosen as the reference category because the midpoint of that range was almost equivalent to the national average household size of 4.3. The national average household size was 4.3, (GSS Final Report, 2018). Twenty-six percent (26%) of the pupils came from families whose household size was 11-15. Over 17% of the pupils came from household size 16-20 and 26.4% came from household size 21 and above. The household size 21 and above represents the second highest in terms of percentage according to this study, which made clear the fact that, there are bigger household sizes especially in the Northern Region as compare to the national average of 4.3. These larger household sizes in the Northern region than the national average implies that increased food demand, reduced food availability, decreased purchasing power and increased vulnerability to shocks. Larger household sizes with limited resources will definitely impact food insecurity negatively. This negative impact on food insecurity will in-turn impact academic performance in the worse sense. The household food decisions were mostly made by the husbands. The question "who decides what you eat in this house in a day?" was asked the various respondents from each household and from their responses, it was gathered that, close to 85% of the households had their food decisions being made by the husband alone. Above 3% of the households had their food decisions being made by the wife. Nearly 1% of the households have their food decisions being made by both the husband and wife. Also, over 11% of the households have their food decisions being made by the children and other family members. Because the husband makes the

food decisions, it means that, most of the families feeding pattern depends on what the husband can afford and willing to provide per day.

5.2 Food Security Status

The individual food insecurity status of the pupils indicated that nearly 28% of the pupils were food secured, 35% were moderately food insecure and almost 31% of the pupils were severely food insecure. A total of 65.9% of the pupils, report experiencing food insecurity on an individual basis. A high percentage of the households (more than 36%) were moderately food insecure. Furthermore, approximately 30% of the households had food security and over 34% had severe food insecurity. The combined prevalence of moderate food insecurity and severe food insecurity at household level amounted to 70.5% while 29.5% of households were food secured. This means that majority of the families, battle with food insecurity from minor levels to severe levels. This addressed my first research question: “What is the prevalence of household and individual food insecurity among Junior High School pupils in Tolon?” It is evident that the majority of junior high school students' households in Tolon experience either mild or severe food insecurity. Also, about 66% of Junior High School pupils in Tolon are either moderately or severely food insecure. A previous study revealed that the prevalence of household food insecurity in rural areas of Northern Ghana is very high. The said study states that, the prevalence of moderate and severe household hunger was 25.9% (95% CI: 19.0, 34.3) and 6.8% (95% CI: 4.2, 10.9), respectively, (Saaka et al., 2017). Other studies also confirmed this fact that household food insecurity is very high in the Northern Region. In the Northern part of Ghana research showed that over 20% of teenage girls were categorized as being likely to be depressed and 70.3% of their households were food insecure. About 22.9% of these adolescents live in moderate food insecure households and also, 18.0% of

them live in severe food-insecure households (Doglikuu *et al.,* 2023). Additionally, there was a significant correlation found between the pupils' food insecurity status and their household food insecurity status. This indicates that students from households with food security were more likely to have food security, while students from households with food insecurity were likewise more likely to have food insecurity.

Also, unadjusted and multivariable linear regression analyses were conducted for the test of association between the food insecurity status variables and the school attendance of the pupils. This also answered the second research question: "What is the association between household and individual food insecurity status and school attendance among the pupils?" There were no significant associations between the food insecurity variables and school attendance of the pupils. Nonetheless, the beta coefficients and confidence intervals suggested that, pupils who were food insecure were less likely to attend school as compared to pupils who were food secured. This also confirmed the assertion of some studies that stated that, there is a link between food insecurity and absenteeism of pupils in school. Food insecurity in the home has a detrimental impact on young children's cognitive development as well as their social skills and normal physical growth. According to previous research, pupils' low attendance at school is significantly correlated with home food insecurity (Tamiru & Belachew, 2017). Severe food hardship was linked to worse math results and lower attendance rates in our sample of teenage Ghanaians (Chowa & Masa, 2021).

The food insecurity status of the pupils was also compared with academic performance of the pupils. This also tackled the third research question that "What is the relationship between household and individual food insecurity status and academic performance among Junior High

School pupils in Tolon?" There were no significant statistical associations between food insecurity variables and academic performance. However, the probability of being food insecure suggested a high likelihood of low academic performance compared to pupils who were food secured.

Food insecurity is negatively linked with widespread educational outcomes related to both knowledge acquisition and socio-emotional capabilities, (Chowa & Masa, 2021). Also, the beta coefficient of one of the food insecurity variables suggested that, pupils who were food insecure were 0.85 times less likely to perform well academically than pupils who were food secured. This agrees with the assertion of the existing literature which stated that food insecurity is linked with poor academic performance of pupils (Mohammed, 2023).

5.3 School attendance of the pupils

The school attendance of the pupils was very good. The average attendance of the pupils from this study was 75%. The national average of school attendance among Junior High School pupils was 76% (UNICEF, 2023). Thus, the findings of this research align with the national average. This implies that, the attendance of the pupils was normal since it was consistent with the national average. The attendance was also compared with the socio-demographic variables in both adjusted and unadjusted models of linear regression. Comparing the attendance with the socio-demographic variables, none of those variables showed any significant association with the attendance. But the confidence intervals and beta coefficients of the various socio-demographic variables indicated that, those variables have the tendency to influence the attendance of the pupils. One of the socio-demographic variables was educational level of the household head. The educational level of the household head had no significant association with attendance of the pupils. However, the beta coefficients suggested that, pupils whose household heads had no formal education had on the average 10.65 fewer days of attendance compared to pupils whose household heads had formal education. The implications of household heads without formal education in the lives of their children are numerous. Some of the implications include, lesser educational goals, inadequate support for homework and learning, reduced access to educational resources, increased risk of dropout, increased risk of child labor among others. These negative implications can be addressed if the following measures are put into consideration; adult education and literacy programs, parenting programs that focus on education and child development, access to educational resources and technology, socioeconomic support, such as food assistance or healthcare and encouraging parental involvement in education through workshops and training.

Other research also indicated that the educational level of the household heads negatively influences the attendance of pupils. Compared to girls living in households where the head had no formal education or had maximum of pre-primary education, those who have a household head with some education are less likely to not be attending school (GSS, 2022).

Also, occupation of the household heads was one of the socio-demographic variables compared with the attendance of the pupils. Again, there was no significant association between the two variables. However, the beta coefficients and confidence intervals suggested that, pupils whose household heads occupation was farming were 4.24 times less likely to attend school as compared to pupils whose household heads were salaried workers and traders. Available research data supposed that, girls with household heads that were unemployed were 39.4% more likely not to be attending school compared to those with employed household heads (GSS, 2022).

5.4 Academic performance of the pupils

The relationships between socio-demographic variables and academic performance of the pupils were evaluated. Majority of these socio-demographic variables did not show significant associations with academic performance. However, the beta values in those variables suggested that, they could have an influence on the academic performance of the pupils. In contrast, educational level of the household heads had a significant association with academic performance. The educational level of the household head had a beta value (β) = -1.83; confidence intervals (CI) = -3.37 - -0.30; and statistical significance level (P) = 0.020. This then implied that pupils whose household heads had no formal education had averagely a decrease in academic performance by 1.83 marks compared to those whose household heads had formal education. The occupation of

household head had a beta value (β) = -0.24; confidence intervals (CI) = -1.90 - 1.42 and statistical significance level (P) = 0.776. Although, the p-value was not significant, the beta suggested that, pupils whose household heads' occupation was farming were 0.24 times less likely to perform well academically as compared to pupils whose household heads were salaried workers and traders. Other studies also proposed that parents' occupation had influence on the academic achievement of their wards, indicating that good parental occupation has a positive effect on the academic achievement of students (Darko-Asumadu, 2021).

5.5 Nutritional status of the pupils.

There was malnutrition among the study participants. The underweight prevalence in all was 11.3% and the overall stunting prevalence also was 17.7%. The statistics above demonstrated that, a good number of the pupils were malnourished by either being underweight or stunted. Though, majority of the pupils were normal in terms of their nutritional statuses, nonetheless, there was still quite a good percentage that had one malnutrition case or the other. The prevalence of the malnutrition is discussed in the next section.

5.6 Prevalence of malnutrition

Malnutrition is a great burden across the world. In Ghana the prevalence of malnutrition among teenagers is very high. The prevalence of wasting is 9% and stunting accounts for 33% in the Northern Region and 19% in the whole Ghana (USAID, 2018). This section addresses the fourth research question which stated that "What is the prevalence of malnutrition (stunting, underweight, overweight and obesity) among the pupils?" In this study, 1.8% of the pupils were severely underweight. About 9.5% of the pupils were moderately underweight and the overall underweight

prevalence was 11.3%. Additionally, the percentage of pupil overweight was 2.3%. Severe stunting among the study participants was 4.1% and moderate stunting was 13.6%. The total prevalence of stunting among the study participants was 17.7%. This prevalence is similar to the statistics available in other research works that preceded this one. According to Azupogo et al. (2020), budding data from Ghana has also revealed varying and somewhat higher prevalence rates of underweight (7-19.4%), overweight/obesity (6.9–17%), and stunting (15–50.3%) among adolescent boys and girls according on the context in which the study was conducted.

The effects of the malnutrition on educational and social development of learners are profound. Grantham-McGregor, as cited in Aboagye et al. (2022) stated that, under-nutrition in the early stages of life is linked with meager bodily enlargement, cognitive, motor, and socio-emotional development, with a subsequent harmful impact on their educational productivity. According to the National Nutrition Policy for Ghana 2013–2017, (March 2013), childhood malnutrition can cause irreversible lower IQ, low economic production later in life, and an increased risk of cardiovascular disease in maturity.

5.7 Association between underweight and socio-demographic variables

The various socio-demographic variables were compared with underweight in both unadjusted and adjusted models of binary logistic regression analysis. This section and the proceeding section also addressed the fifth question of this research, which stated that “What is the association between household food insecurity status and nutritional status of the pupils?” There were no significant associations between most of the variables and underweight. However, the various odds ratios in both the adjusted and unadjusted models suggested that, those variables had an indirect influence

on the underweight variable. Some of the variables include sex of the pupil. Sex of the pupils had a significant association with the underweight variable. Sex of the pupils also had unadjusted odds ratio (UOR) = 5.04; confidence interval (CI) = 1.46 - 17.40 and statistical significance (P) = 0.010. It supposed that, the males were 4.04 times more likely to be underweight as compared to their female counterparts. This confirmed the findings of other studies which stated that, female sex is associated with a lower risk of being underweight Darling et al. (2020). The occupation of the household heads variable was also compared with the underweight variable. Furthermore, occupation of the household heads had an unadjusted odds ratio (UOR) = 1.46; confidence interval (CI) = 0.41 - 5.18 and statistical significance (P) = 0.561. The association between occupation of the household head and underweight was not statistically significant. But the confidence interval was quite wide indicating the range of values within which the true odds ratio is likely to lie. Because the confidence interval was quite wide it indicated some level of uncertainty in the estimate. Therefore, pupils from farming households were 0.46 times more likely to be underweight as compared to pupils from household heads who were salaried workers and traders. This meant that pupils from farming households had 46% higher likelihood of being underweight than the others. Food insecurity was also one of the variables that, was compared with the underweight. Yet again, the p-values in both the adjusted and unadjusted models showed no significant association, but the odds ratio indicated that, pupils with food insecurity stood a greater likelihood of being underweight than their food secured counterparts. It has answered the fifth research question exclusively. This also aligns with the other studies that holds the view that, there is a link between food insecurity and underweight. According to one of these studies, food insecurity was found in the households of 19.4%, 7.4%, and 9.1% of the adolescents who were

stunted and undernourished based on the classification of height-for-age and BMI-for-age, respectively (Dirghayu et al., 2021).

5.8 Association of stunting and socio-demographic variables.

Stunting is a major nutrition issue worldwide and also a very common problem in Ghana. The Northern Savannah Ecological Zone continues to have high rates of poverty and stunting, at 50.4 and 33 percent, respectively, despite Ghana's national efforts to reduce malnutrition (2023). Children that are stunted also have lower academic performance and a harder time studying, which further reduces economic production (National Nutrition Policy for Ghana 2013–2017, March 2013). Case in the study, the sex of the pupils had significant association with the stunting variable. Sex of pupils had unadjusted odds ratio (UOR) = 3.90; confidence interval (CI) = 1.55 - 9.78 and statistical significance (P) = 0.004. The association between sex of the pupils and stunting was significant with the P-value = 0.004. This implied that, the sex of a pupil had the tendency to influence his or her stunting status. According to the odds ratio, the likelihood of stunting was 2.90 times higher in boys than in girls. Stunting was significantly correlated with the sex of the students, according to additional research. According to Bantie et al. (2021), one of those studies found a significant correlation between stunting and the student's age and sex at a p-value of 0.05. According to a different study, males may be more likely than girls to have stunting in low-income nations (Samuel et al., 2022).

The present study revealed that students whose household heads school lacked formal education had a 1.33 times higher risk of stunting than students whose household heads had formal education. According to one study, maternal education and children's nutritional health in Northern Ghana are related (Aguree et al., 2020). The present study also revealed that that, pupils whose household

heads were farmers were 0.39 times less likely to be stunted as compared to pupils whose household heads were salaried workers and traders. In a previous research it was identified that, one of the factors influencing stunting was parents' working status (Danso & Appiah, 2023). Food security did not have a significant association with the stunting. However, the odds ratio suggested that, pupils who were food insecure stood higher odds of being stunted as compared to pupils who were food secured. This agrees with existing data that, food insecurity is linked with stunting. According to a particular study, stunting is a linear growth retardation that happens when a person consumes insufficient food over an extended length of time (Kumi-Kyereme et al., 2014). This means that when food insecurity persists, the resultant effect in the long-run will be stunting and other malnutrition indices. Thus, the various variables had the tendency to adversely influence stunting.

CHAPTER SIX

6.0 CONCLUSIONS AND RECOMMENDATIONS

6.1 Summary of Key Findings

From this study, the prevalence of moderate food insecurity was 35% for individuals and 36.4% for households. The rate of severe food insecurity was 30.9% at individual level and 34.1% at the household level. About 27.7% individuals and 29.5% households were food secured in this study. There was significant association between Individual Food Insecurity Status (IFIS) and Household Food Insecurity Status (HFIS). There was no significant association between food security status and attendance of the pupils. The average attendance of pupils in this study was 75%. Also, there was no significant association between attendance and most of the socio-demographic variables. Likewise, there was no significant association between food security and academic performance. In this study, there was no significant association between academic performance and many of the socio-demographic variables.

In this study, 1.8% of the pupils were severely underweight, 9.5% of the pupils were moderately underweight and the overall underweight prevalence was 11.3%. The percentage of pupils who were overweight was 2.3%. Severe stunting among the study participants was 4.1% and moderate stunting was 13.6%. The overall prevalence of stunting among the study participants was 17.7%. The normal nutritional status for weight was 86.4%. Meaning, the percentage of pupils who had normal weight was 86.4%. In terms of stunting, 82.3% were not stunted but had normal stature. Underweight had no significant association with any of the independent variables. However, there was a significant association between stunting and sex of the pupil.

In this study, 81.4% of the household heads had no formal education, which signifies high levels of illiteracy in the district. There were more boys in school in terms of enrolment than girls. The percentage of boys in school against girls is 63.2% and 36.8% respectively.

6.2 Conclusion

The study's findings indicate that food insecurity was quite prevalent among the students' households and individuals. Additionally, the study showed a significant relationship between students' individual food insecurity status and household food insufficiency. The findings also showed that there was an association between the students' sex and stunting. Though household food insecurity had no significant association with attendance, nutritional status and academic performance, it however showed higher odds of influencing those variables. Therefore, food insecurity should be tackled with all the needed attention and resources to curb its negative impact on children, adolescents, adults and the society at large.

6.3 Recommendations

Based on the findings of this study, the following recommendations have been suggested:

- In line with the Sustainable Development Goal 2 (SDG2) which seeks to achieve zero hunger by 2030, local stakeholders in Tolon District in collaboration with the government, should roll out a family support program to alleviate poverty, reduce household food insecurity and end hunger.
- Ghana Health Service in connection with the Ministry of Health, should intensify their efforts in the area of nutrition education of parents to drastically reduce the prevalence of malnutrition particularly among children and teenagers.

- The Ministry of Gender, Children and Social Protection in connection with the Ghana feeding programme should expand their scope to cover all or most Junior High Schools.

- Girl-Child Education unit should create incentives for girl-child education to bridge the gender disparity that exists between females and their male counterparts concerning school enrolment and attendance.

- The Ghana Education Service should implement more strategies to improve education, especially with premium on adult education to reduce the illiteracy rate.

REFERENCES

Agbadi, P., Bj, H., & Mittelmark, M. B. (2017). *Household food security and adequacy of child diet in the food insecure region north in Ghana*. 1–16.

Ahenkan, A. and Boon, E. (2008). *Enhancing food security, poverty reduction and sustainable forest management in Ghana through Non- timber Forest Products Farming: Case Study of Sefwi Wiawso District. Published online by GRIN publishing at: www.grin.com/de/preview/.htm*.

Alaimo, K., CM Olson, and EA Frongillo, Jr. (2018). *"Food Insufficiency and American School aged Children's Cognitive, Academic, and Psychosocial Development." Pediatrics 108 (2018): 44-53. PubMed.*

Rahman, M., Matsui, N., & Ikemoto, Y. (2013). *Poverty and Food Security* (pp. 101–109). Springer Japan. https://doi.org/10.1007/978-4-431-54285-8_8

Tiffin, R. (2014). *3 Food security* (pp. 257–265). Routledge. https://doi.org/10.4324/9780203528983-53

Babu, S. C., & Sanyal, P. (2009). *Chapter 1 – Introduction to food security: concepts and measurement* (pp. 5–15). https://doi.org/10.1016/B978-0-12-374712-9.00001-8

Hamad, H. J., Khashroum, A., & Aldeseit, B. (2016). Nutritional and Health Outcomes of Household Food Insecurity (HFIS). *Journal of Biology, Agriculture and Healthcare*, *6*(4), 147–157.

https://iiste.org/Journals/index.php/JBAH/article/download/29118/29884

Hendriks, S. L., & Babu, S. C. (2024). *What is food security?* (pp. 24–30). Edward Elgar Publishing. https://doi.org/10.4337/9781839105449.00008

Kröger, F., & Meier, B. (2003). *Ghana's north : research on culture, religion, and politics of societies in transition*. Peter Lang. https://ci.nii.ac.jp/ncid/BA74638940

Introduction to food security (pp. 3–26). (2022). Elsevier eBooks. https://doi.org/10.1016/b978-0-12-820477-1.00009-7

Babu, S. C., Gajanan, S. N., & Sanyal, P. (2014). *Introduction to Food Security: Concepts and Measurement* (pp. 7–28).

Gadiso, W. J., Alemu, B. A., & Shete, M. (2023). Unpacking regional variations of multidimensional food security in rural Ethiopia: insights for policy. *International Journal of Social Economics*. https://doi.org/10.1108/ijse-02-2023-0139

Ike, C. U., Jacobs, P., & Kelly, C. (2015). Towards Comprehensive Food Security Measures: Comparing Key Indicators. *Africa Insight*, *45*(3), 91–110. https://doi.org/10.4314/AI.V45I3

Malkanthi, R. L. D. K., Silva, K. D. R. R., & Jayasinghe, J. M. U. K. (2011). *Measuring household food security in subsistence paddy farming sector in Sri Lanka: development*

of household food insecurity index (HFSI). 70. https://doi.org/10.1017/S0029665111002588

Kepple, A. W., & Segall-Corrêa, A. M. (2011). Conceituando e medindo segurança alimentar e nutricional. *Ciencia & Saude Coletiva*, *16*(1), 187–199. https://doi.org/10.1590/S1413-81232011000100022

Manikas, I., Ali, B. M., & Sundarakani, B. (2023). A systematic literature review of indicators measuring food security. *Agriculture & Food Security*, *12*(1). https://doi.org/10.1186/s40066-023-00415-7

Headey, D., & Ecker, O. (2013). Rethinking the measurement of food security: from first principles to best practice. *Food Security*, *5*(3), 327–343. https://doi.org/10.1007/S12571-013-0253-0

Nguyen, G., Aucott, L., McNeill, G., & Douglas, F. (2017). *Identifying a potential tool to measure household food insecurity in the UK: a systematic review*. *76*. https://doi.org/10.1017/S0029665117003469

Malkanthi, R. L. D. K., Silva, K. D. R. R., & Jayasinghe, J. M. U. K. (2011). *Measuring household food security in subsistence paddy farming sector in Sri Lanka: development of household food insecurity index (HFSI). 70*. https://doi.org/10.1017/S0029665111002588

Wineman, A. (2014). Multidimensional Household Food Security Measurement in Rural Zambia. *Research Papers in Economics*. https://EconPapers.repec.org/RePEc:ags:aaea14:169819

Renzaho, A. M. N., & Mellor, D. (2010). *Review article Food security measurement in cultural pluralism: Missing the point or conceptual misunderstanding?*

Agyepong, G. T., Gyasi, E. A., Nabila, J. S., & Kufogbe, S. K. (1999). *Population, Land-Use and the Environment in a West African Savanna Ecosystem: An Approach to Sustainable Land-Use on Community Lands in Northern Ghana* (pp. 251–271). Palgrave Macmillan, London. https://doi.org/10.1007/978-1-349-27182-5_16

Boateng, P. K. (2017). *From arable Savannah land to barren desert? the political ecology of land cover and land use change in Northeast Ghana*. https://doi.org/10.4225/03/58B8A69F7E049

Dedzoe, C. D., Antwi, B. O., & Tetteh, F. M. (2002). *Environmental and Socio-Economic Characteristics of the Kpene Catchment in Northern Ghana: Implications for Soil and Water Conservation*. https://tucson.ars.ag.gov/isco/isco12/volumei/environmentalandsocio-economiccharacteristics.pdf

Tomomatsu, Y. (2014). Parkia biglobosa-Dominated Cultural Landscape: An Ethnohistory of the Dagomba Political Institution in Farmed Parkland of Northern Ghana. *Journal of Ethnobiology*, *34*(2), 153–174. https://doi.org/10.2993/0278-0771-34.2.153

Yidana, S. M., Abdul-Samed, A., Banoeng-Yakubo, B., & Nude, P. M. (2011). Characterization of the Hydrogeological Conditions of Some Portions of the Neoproterozoic Voltaian Supergroup in Northern Ghana. *Journal of Water Resource and Protection*, *3*(12), 861–875. https://doi.org/10.4236/JWARP.2011.312096

Ewusi, A., & Kuma, J. S. (2014). Groundwater Assessment for Current and Future Water Demand in the Daka Catchment, Northern Region, Ghana. *Natural Resources Research*, *23*(4), 355–365. https://doi.org/10.1007/S11053-014-9227-Y

Kröger, F., & Meier, B. (2003). *Ghana's north : research on culture, religion, and politics of societies in transition*. Peter Lang. https://ci.nii.ac.jp/ncid/BA74638940

Aapengnuo, C. M. (2013). *Power and Social Identity---The Crisis of Legitimacy of Traditional Rule in Northern Ghana and Ethnic Conflicts*. http://mars.gmu.edu/handle/1920/8775

Alare, R. S., Owusu, E. H., & Owusu, K. (2018). Climate Smart Agriculture Practices in Semi-arid Northern Ghana: Implications for Sustainable Livelihoods. *Journal of Sustainable Development*, *11*(5), 57. https://doi.org/10.5539/JSD.V11N5P57

Tomomatsu, Y. (2014). Parkia biglobosa-Dominated Cultural Landscape: An Ethnohistory of the Dagomba Political Institution in Farmed Parkland of Northern Ghana. *Journal of Ethnobiology*, *34*(2), 153–174. https://doi.org/10.2993/0278-0771-34.2.153

Addaney, M., Makafui Yegblemenawo, S. A., Ayaribilla Akudugu, J., & Kodua, M. A. (2022). Climate change and preservation of minority languages in the upper regions of Ghana: A systematic review. *China Adhesives*, *20*(2), 177–189. https://doi.org/10.1016/j.cjpre.2022.06.008

Dedzoe, C. D., Antwi, B. O., & Tetteh, F. M. (2002). *Environmental and Socio-Economic Characteristics of the Kpene Catchment in Northern Ghana: Implications for Soil and Water Conservation*. https://tucson.ars.ag.gov/isco/isco12/volumei/environmentalandsocio-economiccharacteristics.pdf

Marchetta, F. (2013). Migration and nonfarm activities as income diversification strategies: the case of Northern Ghana. *Canadian Journal of Development Studies*, *34*(1), 1–21. https://doi.org/10.1080/02255189.2013.755916

Seglah, P. A., Wang, Y., Wang, H., Neglo, K. A. W., Gao, C., & Bi, Y. (2022). Energy Potential and Sustainability of Straw Resources in Three Regions of Ghana. *Sustainability*, *14*(3), 1434. https://doi.org/10.3390/su14031434

Songsore, J. (1996). *Population growth and ecological degradation in Northern Ghana: myths and realities*. *12*, 51–66.

Atanga, R. A., & Tankpa, V. (2021). *Climate Change, Flood Disaster Risk and Food Security Nexus in Northern Ghana*. *5*. https://doi.org/10.3389/FSUFS.2021.706721

Mabe, F. N., Ayamga, M., & Amadu, M. (2021). Livelihood security of rural households in Northern Ghana: do forests matter? *Environment, Development and Sustainability*, *23*(6), 8542–8558. https://doi.org/10.1007/S10668-020-00981-X

Akudugu, M. A., & Alhassan, A.-R. (2013). *The Climate Change Menace, Food Security, Livelihoods and Social Safety in Northern Ghana*. *1*(3), 80–95. https://ideas.repec.org/a/pkp/ijsdwp/2012p80-95.html

Carter, M. A., Dubois, L., & Tremblay, M. S. (2014). Place and food insecurity: a critical review and synthesis of the literature. *Public health nutrition*, *17*(1), 94-112.

American Dietetic Association. (2010). *Position of the American Dietetic Association: food insecurity in the United States. J Am Diet Assoc 110, 1368–1377*.

Atuoye, K. N., Kuuire, V. Z., Kangmennaang, J., Antabe, R., & Luginaah, I. (2017). *Residential Remittances and Food Security in the Upper West Region of Ghana*. *55*(4). https://doi.org/10.1111/imig.12310

Awojobi, O. N. (2019). *A systematic review of the impact of Ghana ' s school feeding programme on educational and nutritional outcomes ++. June*. https://doi.org/10.4314/as.v18i2.8

Baiden, P., Boateng, G. O., Dako-gyeke, M., Acolatse, C. K., Peters, K. E., Baiden, P., Boateng, G. O., Dako-gyeke, M., & Acolatse, C. K. (2019). Examining the effects of household food insecurity on school absenteeism among Junior High School students : findings from the 2012 Ghana global school-based student health survey. *African Geographical Review*, *00*(00), 1–13. https://doi.org/10.1080/19376812.2019.1627667

Belsky, D. W., T. E. Moffitt, L. Arseneault, M. M. and A. C. (2010). *"Context and sequelae of food insecurity in children's development." American journal of epidemiology 172(7): 809-818.*

Boadi, R., & Kobina, S. (2017). Dietary diversity and child malnutrition in Ghana. *Heliyon*, *August 2016*, e00298. https://doi.org/10.1016/j.heliyon.2017.e00298

Bongaarts, J. (2021). *FAO, IFAD, UNICEF, WFP and WHO The State of Food Security and Nutrition in the World 2020. Transforming food systems for affordable healthy diets FAO, 2020, 320 p.*

Casey, Patrick H., Kitty L. Szeto, James M. Robbins, Janice E. Stuff, Carol Connell, Jeffery M. Gossett, and Pippa M. Simpson.Casey, Patrick H., Kitty L. Szeto, James M. Robbins, Janice E. Stuff, Carol Connell, Jeffery M. Gossett, and P. M. Simpson. (2015). *"Child Health-Related Quality of Life and Household Food Security." Arch Pediatr Adolesc Med Archives of Pediatrics & Adolescent Medicine 159.1 (2015): 51*.

Chilton, M., Chyatte, M., & Breaux, J. (2007). The negative effects of poverty & food insecurity on child development. *Indian Journal of Medical Research*, *126*(4), 262–272.

Cooke, E., & Sarahhague, andy mackay. (2016). *The Ghana poverty and inquality Report*. *1999*(December), 1–6.

Cook,J. and Jeng, K. (2009). *Child Food Insecurity: The Economic Impact on our Nation. www.feedingamerica.org*.

Creswell, J. (2007). *Research Design. Qualitative, Quantitative, and Mixed Methods Approaches. 3rd Edition. Sage Publications, California, U.S.A*.

Creswell, J. W. (2009). *"Research Design: Qualitative, Quantitative and Mixed Methods Approaches" (3rd ed.). Los Angeles: Sage.*

Creswell, J. W., & Poth, C. N. (2016). *Qualitative inquiry and research design: Choosing among five approaches. Sage publications.*

de Oliveira, K. H. D., de Almeida, G. M., Gubert, M. B., Moura, A. S., Spaniol, A. M., Hernandez, D. C., Pérez-Escamilla, R., & Buccini, G. (2020). Household food insecurity

and early childhood development: Systematic review and meta-analysis. *Maternal and Child Nutrition*, *16*(3), 1–27. https://doi.org/10.1111/mcn.12967

Elsahoryi, N., Al-sayyed, H., Odeh, M., & Mcgrattan, A. (2020). Since January 2020 Elsevier has created a COVID-19 resource centre with free information in English and Mandarin on the novel coronavirus COVID- 19 . The COVID-19 resource centre is hosted on Elsevier Connect , the company ' s public news and information. *Clinical Nutrition ESPEN*, *January*, 171–178.

FAO. (1996). *In: Rome Declaration on World Food Security. World Food Summit Rome Italy. 13-17 November 1996 [Internet]. Available from:https://www.fao.org/3/w3613e/w3613e00.htm [cited May 28, 2023]*.

FAO. (2011). *Global food losses and FW–Extent, Causes and Prevention. FAO. (2012), The State of Food Insecurity in the World*.

FAO. (2013). *Food Wastage Footprint. Impacts on Natural Resources. Rome.*

Faught, E. L., Williams, P. L., Willows, N. D., Asbridge, M., & Veugelers, P. J. (2017). *The association between food insecurity and academic achievement in Canadian school-aged children*. 1–8. https://doi.org/10.1017/S1368980017001562

Food and Agriculture Organization. (1996). *Rome Declaration on World Food Security and World Food Summit Plan of Action. Rome: Food and Agriculture Organization of the United Nations*.

Fram, M. S., L. D. Ritchie, N. R. and E. A. F. (2015). *"Child experience of food insecurity is associated with child diet and physical activity." The Journal of nutrition 145(3): 499-504.*

Gelli A, Aurino E, F. G. et al. (2019). *A school meals pro- gram Implemented at scale in Ghana increases height-for- age during midchildhood in girls and in children from poor households: a cluster randomized trial. J Nutr 149, 1434–1442*.

Ghana National Nutrition Policy. (2013). *Ghana national nutrition policy 2014–2017. Accra, Ghana. Retrieved from http://extwprlegs1.fao.org/docs/pdf/gha145267.pdf Gonzálvez,*.

Ghana Statistica Service. (2014). *Ghana demographic and health survey. In: Oklah C, Riis WA, Mensah JO, Nartey M, editors. Demographic and health survey; 2014.*

Gross, R.; Schoeneberger, H.; Pfeifer, H.; Preuss, H.-J. (2000). *The four dimensions of food and nutrition security: Definitions and concepts. SCN News 2000, 20, 20–25.*

Gundersen C & Ziliak JP. (2015). *Food insecurity and health outcomes. Health Aff(Millwood) 34, 1830–1839*.

Gyasi G.E.O., Asante, M.M.N., A. J. and A.-B. S. (2018). *Assessing food quality delivery in the school feeding programme and its impacts on enrolment: a study of some public basic schools in Bawku Municipality of Ghana. Saudi Journal of Business and Management Studies, 3, 98–106. https://doi.org/10.21276/sjbms.*

Hernandez, D. C., & Jacknowitz, A. (2009). *Transient, but not persistent, adult food insecurity influences toddler development. The Journal of Nutrition, 139(8), 1517–1524*.

Howard, L. L. (2010). *"Does Food Insecurity at Home Affect Non-cognitive Performance at School? A Longitudinal Analysis of Elementary Student Classroom Behavior." Economics of Education Review 30.1 (2010): 157-76. Web. Jyoti,*.

Howard, L. L. (2011). Economics of Education Review Does food insecurity at home affect non-cognitive performance at school ? A longitudinal analysis of elementary student classroom behavior. *Economics of Education Review*, *30*(1), 157–176. https://doi.org/10.1016/j.econedurev.2010.08.003

Huang, Y., & Potochnick, S. (2018). *Household Food Insecurity and Early Childhood Health and Cognitive Development Among Children of Immigrants*. https://doi.org/10.1177/0192513X17710772

Huang, Y., Potochnick, S., & Heflin, C. M. (2018). Household Food Insecurity and Early Childhood Health and Cognitive Development Among Children of Immigrants. *Journal of Family Issues*, *39*(6), 1465–1497. https://doi.org/10.1177/0192513X17710772

Huizar MI, Arena R, Laddu DR. Huizar MI, Arena R, L. DR. (2020). *The global food syndemic: The impact of food insecurity, Malnutrition and obesity on the healthspan amid the COVID-19 pandemic. Prog Cardiovasc Dis. 2021 Jan-Feb;64:105-107. doi: 10.1016/j.pcad.2020.07.002. Epub 2020 Jul 10. PMID: 32653438; PMCID: PMC7347*.

Johnson, A. D., & Markowitz, A. J. (2018). Associations Between Household Food Insecurity in Early Childhood and Children's Kindergarten Skills. *Child Development*, *89*(2), e1–e17. https://doi.org/10.1111/cdev.12764

Jyoti, D. F., Frongillo, E. A., Jones, S. J., & Al, J. E. T. (2005). *Community and International Nutrition Food Insecurity Affects School Children ' s Academic Performance , Weight Gain , and Social Skills 1 – 3*. *September*, 2831–2839.

Khalil, A., & Elmulthum, N. (2021). *Can Food Insecurity Affect Cognitive Performance of School Children ? 11*(3), 41–46. https://doi.org/10.5923/j.ijpbs.20211103.01

Kimbro, R. T., & Denney, J. T. (2015). Transitions into food insecurity associated with behavioral problems and worse overall health among children. *Health Affairs*, *34*(11), 1949–1955. https://doi.org/10.1377/hlthaff.2015.0626

Kuku-Shittu, O., Mathiassen, A., Wadhwa, A., Myles, L., & Ajibola, A. (2013). *Comprehensive food security and vulnerability analysis: Nigeria (Vol. 1275). Intl Food Policy Res Inst.*

Laura Kim. (2016). *THE RELATIONSHIP BETWEEN FOOD INSECURITY AND ACADEMIC ACHIEVEMENT IN THE UNITED STATES. A Thesis submitted to the Faculty of the Graduate School of Arts and Sciences of Georgetown Universityin partial fulfillment of the requirements for the degree of Mast*.

Majid, U. (2018). *Research Fundamentals: Study Design, Populaion and Sample SIze. Undergraduate Research in Natural and Clinical Science and Technology Journal, 2(1): 1-7.*

Masa Rainier & Gina Chowa. (2020). *Household food insecurity and educational outcomes in school-going adolescents in Ghana*. *16*. https://doi.org/10.1017/S1368980020001974

Masa, R., & Chowa, G. (2021). Household food insecurity and educational outcomes in school-going adolescents in Ghana. *Public Health Nutrition*, *24*(6), 1349–1361. https://doi.org/10.1017/S1368980020001974

Mohd Irwan Maarof. (2017). *TRANSLATION AND VALIDATION OF HOUSEHOLD FOOD INSECURITY ACCESS SCALE (HFIAS) AND FACTORS ASSOCIATED WITH FOOD INSECURITY AMONG HOUSEHOLDS WITH CHILDREN AGED FIVE TO SIX YEARS OLD IN TUMPAT , KELANTAN. DISERTATION SUBMITTED IN PARTIAL FULFILMENT OF REQUI*. *January*.

N'Danikou, S., Vodouhe, R. S., Bellon, M. R., Sidibé, A., & Coulibaly, H. (2017). Foraging is determinant to improve smallholders' food security in rural areas in Mali, West Africa. *Sustainability (Switzerland)*, *9*(11), 1–18. https://doi.org/10.3390/su9112074

Oduro-Ofori E. and Adwoa-Yeboah G. (2014). *The contribution of the Ghana schools feeding programme to basic school participation: a study of selected schools in the Kwaebibirim District of Ghana location. Developing Country Studies, 4 (19), 40-50*.

Olson CM. (1999). *Nutrition and health outcomes associated with food insecurity and hunger. JNutr 129, 2S Suppl., 521S–524S*.

Payne-sturges, D. C., Tjaden, A., Caldeira, K. M., Vincent, K. B., & Arria, A. M. (2019). *students and implications for academic institutions*. *32*(2), 349–354. https://doi.org/10.1177/0890117117719620.Student

Perez-Escamilla, R., Pinheiro de Toledo Vianna, R., & de Toledo Vianna, P. (2012). Informing Policy for Children at Risk Food Insecurity and the Behavioral and Intellectual Development of Children: A Review of the Evidence Recommended Citation. *Journal of Applied Research on Children: Informing Policy for Children at Risk*, *3*(1).

Previšić, V. (2007). *The influences of school environment on child social development. Napredak, 140(1), 7 – 16.*

Rose-Jacobs, R., Black, M. M., Casey, P. H., Cook, J. T., Cutts, D. B., Chilton, M., Heeren, T., Levenson, S. M., Meyers, A. F., & Frank, D. A. (2008). Household food insecurity: Associations with at-risk infant and toddler development. *Pediatrics*, *121*(1), 65–72. https://doi.org/10.1542/peds.2006-3717

Rosenberg, J. (2020). *Food for Thought : Food Insecurity and Academic Performance*.

Saha KK, Tofail F, F. E. et al. (2010). *Household food security is associated with early childhood language development: results from a longitudinal study in rural Bangladesh. Child Care Health Dev 36, 309–316*.

Sekaran, U., & Bougie, R. (2016). *Research methods for business: A skill building approach. john wiley & sons.*

Shanafelt, A., Hearst, M., & Wang, Q. (2017). *Food insecurity and rural adolescent personal health, home and academic environments*. *86*(6), 472–480. https://doi.org/10.1111/josh.12397.Food

Shankar, P., Chung, R., & Frank, D. A. (2017). Association of Food Insecurity with Children's Behavioral, Emotional, and Academic Outcomes: A Systematic Review. *Journal of Developmental and Behavioral Pediatrics*, *38*(2), 135–150. https://doi.org/10.1097/DBP.0000000000000383

Sraku-Lartey, M. (2014). Harnessing indigenous knowledge for sustainable forest management in Ghana. *International Journal on Food System Dynamics*, *5*(4), 182–189. https://doi.org/10.18461/ijfsd.v5i4.543

Stormer, Ame; & Harrison, G. G. (2013). *Does Household Food Security Affect Cognitive and Social Development of Kindergartners?. California Center for Population Research. UCLA: California Center for Population Research. Retrieved from: https://escholarship.org/uc/item/9kt5537k*.

Tagoe I. (2018). *The Ghana National School Feeding Program: Peoples' Perceptions about the Program's Impact on School Enrolment, Attendance and Completion. Bowling Green State University, United States. Retrieved from https://etd.ohiolink. edu/!etd.send_file?accession=bgs*.

Tarasuk V, Mitchell A, D. N. (2013). *Household food insecurity in Canada 2012 [Internet]. Research to identify policy options to reduce food insecurity (PROOF). 2013 [cited 2017 Mar 11]. Available from: http://proof.utoronto.ca/resources/proof- annual-reports/*.

USDA. (2012). *U.S. Household Food Security Survey Module: Six-Item Short Form Economic Research Service, USDA September 2012. Available at: https://www.ers.usda.gov/media/8282/short2012.pdf [Accessed on Jan 11, 2023]. September*.

Vozoris NT & Tarasuk VS. (2003). *Household food insuffi- ciency is associated with poorer health. J Nutr 133, 120–126.*

WAEC reports. (2021). *GENERAL RÉSUMÉ GENERAL RÉSUMÉ OF THE CHIEF EXAMINERS ' REPORTS FOR THE WEST AFRICAN SENIOR SCHOOL CERTIFICATE EXAMINATION FOR SCHOOL CANDIDATES*. *c*, 1–23.

Wagner, F. (2021). *EXPLORING THE RELATIONSHIP BETWEEN FOOD INSECURITY WITH HUNGER AND ACADEMIC PROGRESSION AT A LARGE Food insecurity among students is a growing concern in South African Higher Education*. *35*(5), 296–309.

Weaver, R. R., Vaughn, N. A., Hendricks, S. P., Mcpherson-, P. E., Jia, Q., Willis, S. L., Rescigno, K. P., Weaver, R. R., Vaughn, N. A., Hendricks, S. P., Penny, E., Jia, Q., Willis, S. L., & Rescigno, K. P. (2019). University student food insecurity and academic performance. *Journal of American College Health*, *0*(0), 1–7. https://doi.org/10.1080/07448481.2019.1600522

World Health Organization. (2020). *The state of food security and nutrition in the world 2020: transforming food systems for affordable healthy diets (Vol. 2020). Food & Agriculture Org.*.

Zhang Y, Yang K, Hou S, Zhong T, C. J. (2021). *Factors determining household-level food insecurity during COVID-19 epidemic: a case of Wuhan, China. Food Nutr Res. 2021 Mar 8;65. doi: 10.29219/fnr.v65.5501. PMID: 33776620; PMCID: PMC7955523.*

Zimon, D., Madzik, P., & Domingues, P. (2020). *Development of key processes along the supply chain by implementing the ISO 22000 standard. Sustainability, 12(15), 6176.*

Agbadi, P., Bj, H., & Mittelmark, M. B. (2017). *Household food security and adequacy of child diet in the food insecure region north in Ghana*. 1–16.

Ahenkan, A. and Boon, E. (2008). *Enhancing food security, poverty reduction and sustainable forest management in Ghana through Non- timber Forest Products Farming: Case Study of Sefwi Wiawso District. Published online by GRIN publishing at: www.grin.com/de/preview/.htm*.

Alaimo, K., CM Olson, and EA Frongillo, Jr. (2018). *"Food Insufficiency and American School aged Children's Cognitive, Academic, and Psychosocial Development." Pediatrics 108 (2018): 44-53. PubMed.*

American Dietetic Association. (2010). *Position of the American Dietetic Association: food insecurity in the United States. J Am Diet Assoc 110, 1368–1377*.

Atuoye, K. N., Kuuire, V. Z., Kangmennaang, J., Antabe, R., & Luginaah, I. (2017). *Residential Remittances and Food Security in the Upper West Region of Ghana*. *55*(4). https://doi.org/10.1111/imig.12310

Awojobi, O. N. (2019). *A systematic review of the impact of Ghana 's school feeding programme on educational and nutritional outcomes ++*. *June*. https://doi.org/10.4314/as.v18i2.8

Baiden, P., Boateng, G. O., Dako-gyeke, M., Acolatse, C. K., Peters, K. E., Baiden, P., Boateng, G. O., Dako-gyeke, M., & Acolatse, C. K. (2019). Examining the effects of household food insecurity on school absenteeism among Junior High School students : findings from the 2012 Ghana global school-based student health survey. *African Geographical Review*, *00*(00), 1–13. https://doi.org/10.1080/19376812.2019.1627667

Belsky, D. W., T. E. Moffitt, L. Arseneault, M. M. and A. C. (2010). *"Context and sequelae of food insecurity in children's development." American journal of epidemiology 172(7): 809-818.*

Boadi, R., & Kobina, S. (2017). Dietary diversity and child malnutrition in Ghana. *Heliyon*, *August 2016*, e00298. https://doi.org/10.1016/j.heliyon.2017.e00298

Bongaarts, J. (2021). *FAO, IFAD, UNICEF, WFP and WHO The State of Food Security and Nutrition in the World 2020. Transforming food systems for affordable healthy diets FAO, 2020, 320 p.*

Casey, Patrick H., Kitty L. Szeto, James M. Robbins, Janice E. Stuff, Carol Connell, Jeffery M. Gossett, and Pippa M. Simpson.Casey, Patrick H., Kitty L. Szeto, James M. Robbins, Janice E. Stuff, Carol Connell, Jeffery M. Gossett, and P. M. Simpson. (2015). *"Child Health-*

Related Quality of Life and Household Food Security." Arch Pediatr Adolesc Med Archives of Pediatrics & Adolescent Medicine 159.1 (2015): 51.

Chilton, M., Chyatte, M., & Breaux, J. (2007). The negative effects of poverty & food insecurity on child development. *Indian Journal of Medical Research*, *126*(4), 262–272.

Cooke, E., & Sarahhague, andy mackay. (2016). *The Ghana poverty and inquality Report*. *1999*(December), 1–6.

Cook,J. and Jeng, K. (2009). *Child Food Insecurity: The Economic Impact on our Nation. www.feedingamerica.org*.

Creswell, J. (2007). *Research Design. Qualitative, Quantitative, and Mixed Methods Approaches. 3rd Edition. Sage Publications, California, U.S.A*.

Creswell, J. W. (2009). *"Research Design: Qualitative, Quantitative and Mixed Methods Approaches" (3rd ed.). Los Angeles: Sage.*

Creswell, J. W., & Poth, C. N. (2016). *Qualitative inquiry and research design: Choosing among five approaches. Sage publications.*

de Oliveira, K. H. D., de Almeida, G. M., Gubert, M. B., Moura, A. S., Spaniol, A. M., Hernandez, D. C., Pérez-Escamilla, R., & Buccini, G. (2020). Household food insecurity and early childhood development: Systematic review and meta-analysis. *Maternal and Child Nutrition*, *16*(3), 1–27. https://doi.org/10.1111/mcn.12967

Elsahoryi, N., Al-sayyed, H., Odeh, M., & Mcgrattan, A. (2020). Since January 2020 Elsevier has created a COVID-19 resource centre with free information in English and Mandarin on the novel coronavirus COVID- 19 . The COVID-19 resource centre is hosted on Elsevier Connect , the company ' s public news and information. *Clinical Nutrition ESPEN*, *January*, 171–178.

FAO. (1996). *In: Rome Declaration on World Food Security. World Food Summit Rome Italy. 13-17 November 1996 [Internet]. Available from:https://www.fao.org/3/w3613e/w3613e00.htm [cited May 28, 2023]*.

FAO. (2011). *Global food losses and FW–Extent, Causes and Prevention. FAO. (2012), The State of Food Insecurity in the World*.

FAO. (2013). *Food Wastage Footprint. Impacts on Natural Resources. Rome.*

Faught, E. L., Williams, P. L., Willows, N. D., Asbridge, M., & Veugelers, P. J. (2017). *The association between food insecurity and academic achievement in Canadian school-aged children*. 1–8. https://doi.org/10.1017/S1368980017001562

Food and Agriculture Organization. (1996). *Rome Declaration on World Food Security and World Food Summit Plan of Action. Rome: Food and Agriculture Organization of the United Nations*.

Fram, M. S., L. D. Ritchie, N. R. and E. A. F. (2015). *"Child experience of food insecurity is associated with child diet and physical activity." The Journal of nutrition 145(3): 499-504.*

Gelli A, Aurino E, F. G. et al. (2019). *A school meals pro- gram Implemented at scale in Ghana increases height-for- age during midchildhood in girls and in children from poor households: a cluster randomized trial. J Nutr 149, 1434–1442*.

Ghana National Nutrition Policy. (2013). *Ghana national nutrition policy 2014–2017. Accra, Ghana. Retrieved from http://extwprlegs1.fao.org/docs/pdf/gha145267.pdf Gonzálvez,*.

Ghana Statistica Service. (2014). *Ghana demographic and health survey. In: Oklah C, Riis WA, Mensah JO, Nartey M, editors. Demographic and health survey; 2014.*

Gross, R.; Schoeneberger, H.; Pfeifer, H.; Preuss, H.-J. (2000). *The four dimensions of food and nutrition security: Definitions and concepts. SCN News 2000, 20, 20–25.*

Gundersen C & Ziliak JP. (2015). *Food insecurity and health outcomes. Health Aff(Millwood) 34, 1830–1839*.

Gyasi G.E.O., Asante, M.M.N., A. J. and A.-B. S. (2018). *Assessing food quality delivery in the school feeding programme and its impacts on enrolment: a study of some public basic schools in Bawku Municipality of Ghana. Saudi Journal of Business and Management Studies, 3, 98–106. https://doi.org/10.21276/sjbms.*

Hernandez, D. C., & Jacknowitz, A. (2009). *Transient, but not persistent, adult food insecurity influences toddler development. The Journal of Nutrition, 139(8), 1517–1524*.

Howard, L. L. (2010). *"Does Food Insecurity at Home Affect Non-cognitive Performance at School? A Longitudinal Analysis of Elementary Student Classroom Behavior." Economics of Education Review 30.1 (2010): 157-76. Web. Jyoti,*.

Howard, L. L. (2011). Economics of Education Review Does food insecurity at home affect non-cognitive performance at school ? A longitudinal analysis of elementary student classroom behavior. *Economics of Education Review*, *30*(1), 157–176. https://doi.org/10.1016/j.econedurev.2010.08.003

Huang, Y., & Potochnick, S. (2018). *Household Food Insecurity and Early Childhood Health and Cognitive Development Among Children of Immigrants*. https://doi.org/10.1177/0192513X17710772

Huang, Y., Potochnick, S., & Heflin, C. M. (2018). Household Food Insecurity and Early Childhood Health and Cognitive Development Among Children of Immigrants. *Journal of Family Issues*, *39*(6), 1465–1497. https://doi.org/10.1177/0192513X17710772

Huizar MI, Arena R, Laddu DR. Huizar MI, Arena R, L. DR. (2020). *The global food syndemic: The impact of food insecurity, Malnutrition and obesity on the healthspan amid the COVID-19 pandemic. Prog Cardiovasc Dis. 2021 Jan-Feb;64:105-107. doi: 10.1016/j.pcad.2020.07.002. Epub 2020 Jul 10. PMID: 32653438; PMCID: PMC7347*.

Johnson, A. D., & Markowitz, A. J. (2018). Associations Between Household Food Insecurity in Early Childhood and Children's Kindergarten Skills. *Child Development*, *89*(2), e1–e17. https://doi.org/10.1111/cdev.12764

Jyoti, D. F., Frongillo, E. A., Jones, S. J., & Al, J. E. T. (2005). *Community and International Nutrition Food Insecurity Affects School Children ' s Academic Performance , Weight Gain , and Social Skills 1 – 3*. *September*, 2831–2839.

Khalil, A., & Elmulthum, N. (2021). *Can Food Insecurity Affect Cognitive Performance of School Children ? 11*(3), 41–46. https://doi.org/10.5923/j.ijpbs.20211103.01

Kimbro, R. T., & Denney, J. T. (2015). Transitions into food insecurity associated with behavioral problems and worse overall health among children. *Health Affairs*, *34*(11), 1949–1955. https://doi.org/10.1377/hlthaff.2015.0626

Kuku-Shittu, O., Mathiassen, A., Wadhwa, A., Myles, L., & Ajibola, A. (2013). *Comprehensive food security and vulnerability analysis: Nigeria (Vol. 1275). Intl Food Policy Res Inst.*

Laura Kim. (2016). *THE RELATIONSHIP BETWEEN FOOD INSECURITY AND ACADEMIC ACHIEVEMENT IN THE UNITED STATES. A Thesis submitted to the Faculty of the Graduate School of Arts and Sciences of Georgetown Universityin partial fulfillment of the requirements for the degree of Mast*.

Majid, U. (2018). *Research Fundamentals: Study Design, Populaion and Sample SIze. Undergraduate Research in Natural and Clinical Science and Technology Journal, 2(1): 1-7.*

Masa Rainier & Gina Chowa. (2020). *Household food insecurity and educational outcomes in school-going adolescents in Ghana*. *16*. https://doi.org/10.1017/S1368980020001974

Masa, R., & Chowa, G. (2021). Household food insecurity and educational outcomes in school-going adolescents in Ghana. *Public Health Nutrition*, *24*(6), 1349–1361. https://doi.org/10.1017/S1368980020001974

Mohd Irwan Maarof. (2017). *TRANSLATION AND VALIDATION OF HOUSEHOLD FOOD INSECURITY ACCESS SCALE (HFIAS) AND FACTORS ASSOCIATED WITH FOOD INSECURITY AMONG HOUSEHOLDS WITH CHILDREN AGED FIVE TO SIX YEARS OLD IN TUMPAT , KELANTAN. DISERTATION SUBMITTED IN PARTIAL FULFILMENT OF REQUI*. *January*.

N'Danikou, S., Vodouhe, R. S., Bellon, M. R., Sidibé, A., & Coulibaly, H. (2017). Foraging is determinant to improve smallholders' food security in rural areas in Mali, West Africa. *Sustainability (Switzerland)*, *9*(11), 1–18. https://doi.org/10.3390/su9112074

Oduro-Ofori E. and Adwoa-Yeboah G. (2014). *The contribution of the Ghana schools feeding programme to basic school participation: a study of selected schools in the Kwaebibirim District of Ghana location. Developing Country Studies, 4 (19), 40-50.*

Olson CM. (1999). *Nutrition and health outcomes associated with food insecurity and hunger. JNutr 129, 2S Suppl., 521S–524S.*

Payne-sturges, D. C., Tjaden, A., Caldeira, K. M., Vincent, K. B., & Arria, A. M. (2019). *students and implications for academic institutions*. *32*(2), 349–354. https://doi.org/10.1177/0890117117719620.Student

Perez-Escamilla, R., Pinheiro de Toledo Vianna, R., & de Toledo Vianna, P. (2012). Informing Policy for Children at Risk Food Insecurity and the Behavioral and Intellectual Development

of Children: A Review of the Evidence Recommended Citation. *Journal of Applied Research on Children: Informing Policy for Children at Risk*, *3*(1).

Previšić, V. (2007). *The influences of school environment on child social development. Napredak, 140(1), 7 – 16.*

Rose-Jacobs, R., Black, M. M., Casey, P. H., Cook, J. T., Cutts, D. B., Chilton, M., Heeren, T., Levenson, S. M., Meyers, A. F., & Frank, D. A. (2008). Household food insecurity: Associations with at-risk infant and toddler development. *Pediatrics*, *121*(1), 65–72. https://doi.org/10.1542/peds.2006-3717

Rosenberg, J. (2020). *Food for Thought : Food Insecurity and Academic Performance*.

Saha KK, Tofail F, F. E. et al. (2010). *Household food security is associated with early childhood language development: results from a longitudinal study in rural Bangladesh. Child Care Health Dev 36, 309–316*.

Sekaran, U., & Bougie, R. (2016). *Research methods for business: A skill building approach. john wiley & sons.*

Shanafelt, A., Hearst, M., & Wang, Q. (2017). *Food insecurity and rural adolescent personal health, home and academic environments*. *86*(6), 472–480. https://doi.org/10.1111/josh.12397.Food

Shankar, P., Chung, R., & Frank, D. A. (2017). Association of Food Insecurity with Children's Behavioral, Emotional, and Academic Outcomes: A Systematic Review. *Journal of Developmental and Behavioral Pediatrics*, *38*(2), 135–150. https://doi.org/10.1097/DBP.0000000000000383

Sraku-Lartey, M. (2014). Harnessing indigenous knowledge for sustainable forest management in Ghana. *International Journal on Food System Dynamics*, *5*(4), 182–189. https://doi.org/10.18461/ijfsd.v5i4.543

Stormer, Ame; & Harrison, G. G. (2013). *Does Household Food Security Affect Cognitive and Social Development of Kindergartners?. California Center for Population Research. UCLA: California Center for Population Research. Retrieved from: https://escholarship.org/uc/item/9kt5537k*.

Tagoe I. (2018). *The Ghana National School Feeding Program: Peoples' Perceptions about the Program's Impact on School Enrolment, Attendance and Completion. Bowling Green State University, United States. Retrieved from https://etd.ohiolink. edu/!etd.send_file?accession=bgs*.

Tarasuk V, Mitchell A, D. N. (2013). *Household food insecurity in Canada 2012 [Internet]. Research to identify policy options to reduce food insecurity (PROOF). 2013 [cited 2017 Mar 11]. Available from: http://proof.utoronto.ca/resources/proof- annual-reports/*.

USDA. (2012). *U.S. Household Food Security Survey Module: Six-Item Short Form Economic Research Service, USDA September 2012. Available at: https://www.ers.usda.gov/media/8282/short2012.pdf [Accessed on Jan 11, 2023]. September*.

Vozoris NT & Tarasuk VS. (2003). *Household food insuffi- ciency is associated with poorer health. J Nutr 133, 120–126.*

WAEC reports. (2021). *GENERAL RÉSUMÉ GENERAL RÉSUMÉ OF THE CHIEF EXAMINERS ' REPORTS FOR THE WEST AFRICAN SENIOR SCHOOL CERTIFICATE EXAMINATION FOR SCHOOL CANDIDATES*. *c*, 1–23.

Wagner, F. (2021). *EXPLORING THE RELATIONSHIP BETWEEN FOOD INSECURITY WITH HUNGER AND ACADEMIC PROGRESSION AT A LARGE Food insecurity among students is a growing concern in South African Higher Education*. *35*(5), 296–309.

Weaver, R. R., Vaughn, N. A., Hendricks, S. P., Mcpherson-, P. E., Jia, Q., Willis, S. L., Rescigno, K. P., Weaver, R. R., Vaughn, N. A., Hendricks, S. P., Penny, E., Jia, Q., Willis, S. L., & Rescigno, K. P. (2019). University student food insecurity and academic performance. *Journal of American College Health*, *0*(0), 1–7. https://doi.org/10.1080/07448481.2019.1600522

World Health Organization. (2020). *The state of food security and nutrition in the world 2020: transforming food systems for affordable healthy diets (Vol. 2020). Food & Agriculture Org.*.

Zhang Y, Yang K, Hou S, Zhong T, C. J. (2021). *Factors determining household-level food insecurity during COVID-19 epidemic: a case of Wuhan, China. Food Nutr Res. 2021 Mar 8;65. doi: 10.29219/fnr.v65.5501. PMID: 33776620; PMCID: PMC7955523.*

Zimon, D., Madzik, P., & Domingues, P. (2020). *Development of key processes along the supply chain by implementing the ISO 22000 standard. Sustainability, 12(15), 6176.*

APPENDICES

APPENDIX 1: DATA COLLECTION INSTRUMENTS

UNIVERSITY FOR DEVELOPMENT STUDIES

DEPARTMENT OF NUTRITIONAL SCIENCES

Structured Questionnaire for Household Food Insecurity Experience Scale (HFIES)

Introduction and Consent Form

Hello! My name is **Emmanuel Busagri**, a final year Masters student at UDS, and I am currently conducting a survey on the "Association between Household Food Insecurity and Academic Performance of JHS Students in Tolon. The purpose of the survey is to gather data on the food access levels of households of students in order to measure their level of food insecurity, and its effect on their academic performance. The study will help understand the extent to which food insecurity is affecting the academic achievements of JHS students in the Tolon District, which may serve as useful data to the Ghana Education Service to expand and improve on its School Lunch Programme and help to raise the academic performance in the district. It will take 15 minutes of your time to respond to the questions. As part of the survey, I would first ask some questions about yourself. All of the answers you give will be confidential. There are no risks to you or your family in answering these questions. Participation in the survey is completely voluntary. If we should come to any question you don't want to answer, just let me know and I will go on to the next question, or you can stop the interview at any time. However, I hope you will participate in the survey since your views are important. If you have any questions about the study or the survey at a later date, you may contact me at **0241513543**. At this time, do you want to ask me anything about the survey? May I begin the interview now?

Do you agree to participate?	1 = Yes 2 = No	|__|	If "2" --> STOP SURVEY

Signature/ Thumb Print: ……. Date: ……

SECTION A: SOCIO-DEMOGRAPHIC CHARACTERISTICS OF RESPONDENTS

1. Age (years)…….

2. Gender A. Male [ ] B. Female [ ]

3. How many people live in your house? A. 5 or less [ ] B. 5-10 [ ] C. 10-15 D. 15-20 [ ]

E. 20 and above[ ]

4. Educational status of respondent

(A). Non-formal [ ] (B). Primary [ ] (C). J.H.S. [ ] (D). SHS/Vocational School [ ] (E). Diploma [ ] (F). Degree [ ] (G). Masters [ ] (H). PhD [ ] (I). None [ ] (J). Others [ ] Specify……..

5.Educational status of household head

(A). Non-formal [ ] (B). Primary [ ] (C). J.H.S. [ ] (D). SHS/Vocational School [ ] (E). Diploma [ ] (F). Degree [ ] (G). Masters [ ] (H). PhD [ ] (I). None [ ] (J). Others [ ] Specify……..

6.Sex of household head

A) Male [ ] B) Female [ ]

7. Occupation of respondent

A) Farming [ ] B) Teaching [ ] C) Carpentry [ ] D) Tailoring [ ] E) Others [ ] Specify……..

8. Occupation of household head

A) Farming [ ] B) Teaching [ ] C) Carpentry [ ] D) Tailoring [ ] E) Others [ ] Specify……..

9. Religion of respondent

A) Islam [ ] B) Christianity [ ] C) African Traditional Religion [ ] D) Others [ ] Specify……

10. Religion of household head

A) Islam [ ] B) Christianity [ ] C) African Traditional Religion [ ] D) Others [ ] Specify……

11.Ethnicity of respondent

A) Dagomba [ ] B) Gonja [ ] C) Others [ ] Specify……..

12 Ethnicity of household head

A) Dagomba [ ] B) Gonja [ ] C) Others [ ] Specify……..

13. Who is responsible for making food decisions in your household?

Husband [ ] Wife [ ] Both [ ] Others (specify)…….

SECTION B: HOUSEHOLD FOOD SECURITY STATUS OF PUPILS

FOOD INSECURITY EXPERIENCE SCALE SURVEY MODULE (FIES-SM)

FIES-SM Household – 12 month + 30 day

Now I would like to ask you some questions about food.		
Q1. During the last 12 months, **was there a time when you or others in your household were worried you would not have enough food to eat because of a lack of money or other resources?**	0 No 98 Don't Know 1 Yes 99 Refused	*If "Yes", ask Q1a (otherwise go to Q2)*
Q1a. Did this happen in the past 4 weeks (30 days)?	0 No 98 Don't Know 1 Yes 99 Refused	
Q2. Still thinking about the last 12 months, **was there a time when you or others in your household were unable to eat healthy and nutritious food because of a lack of money or other resources?**	0 No 98 Don't Know 1 Yes 99 Refused	*If "Yes", ask Q2a (otherwise go to Q3)*
Q2a. Did this happen in the past 4 weeks (30 days)?	0 No 98 Don't Know 1 Yes 99 Refused	
Q3. During the last 12 months, **was there a time when you or others in your household ate only a few kinds of foods because of a lack of money or other resources?**	0 No 98 Don't Know 1 Yes 99 Refused	*If "Yes", ask Q3a (otherwise go to Q4)*
Q3a. Did this happen in the past 4 weeks (30 days)?	0 No 98 Don't Know 1 Yes 99 Refused	
Q4. During the last 12 months, **was there a time when you or others in your household had to skip a meal because there was not enough money or other resources to get food?**	0 No 98 Don't Know 1 Yes 99 Refused	*If "Yes", ask Q4a (otherwise go to Q5)*

	Q4a. Did this happen in the past 4 weeks (30 days)?	0 No 98 Don't Know 1 Yes 99 Refused	
Q5. Still thinking about the last 12 months, **was there a time when you or others in your household ate less than you thought you should because of a lack of money or other resources?**		0 No 98 Don't Know 1 Yes 99 Refused	*If "Yes", ask Q5a (otherwise go to Q6)*
	Q5a. Did this happen in the past 4 weeks (30 days)?	0 No 98 Don't Know 1 Yes 99 Refused	
Q6. In the past 12 months, **was there ever no food to eat of any kind in your house because of lack of resources to get food?**		0 No 98 Don't Know 1 Yes 99 Refused	*If "Yes", ask Q6a (otherwise go to Q7)*
	Q6a. Did this happen in the past 4 weeks (30 days)?	0 No 98 Don't Know 1 Yes 99 Refused	*If "Yes", ask Q6b (otherwise go to Q7)*
	Q6b. How often did this happen in the past 4 weeks (30 days)?	1 Rarely (1 or 2 times) 2 Sometimes (3-10 times) 3 Often (more than 10 times) 98 Don't Know 99 Refused	
Q7. In the past 12 months, **did you or others in your household ever go to sleep at night hungry because there was not enough food?**		0 No 1 Yes 98 Don't Know 99 Refused	*If "Yes", ask Q7a (otherwise go to Q8)*
	Q7a. Did this happen in the past 4 weeks (30 days)?	0 No 1 Yes 98 Don't Know 99 Refused	*If "Yes", ask Q7b (otherwise go to Q8)*
	Q7b. How often did this happen in the past 4 weeks (30 days)?	1 Rarely (1 or 2 times) 2 Sometimes (3-10 times)	

		3 Often (more than 10 times) 98 Don't Know 99 Refused		
Q8. During the last 12 months, **did you or others in your household ever go a whole day and night without eating anything at all because there was not enough food?**		0 No 1 Yes	98 Don't Know 99 Refused	*If "Yes", ask Q8a (otherwise END)*
	Q8a. Did this happen in the past 4 weeks (30 days)?	0 No 1 Yes	98 Don't Know 99 Refused	*If "Yes", ask Q8b (otherwise END)*
	Q8b. How often did this happen in the past 4 weeks (30 days)?	1 Rarely (1 or 2 times) 2 Sometimes (3-10 times) 3 Often (more than 10 times) 98 Don't Know 99 Refused		

SECTION C: SOCIO-DEMOGRAPHIC CHARACTERISTICS OF PUPILS

1. **Name: ……**
2. **Date Of Birth ……(retrieve from school register if child cannot remember)**
3. **Age …….**
4. **Weight ……. (kg)**
5. **Height ……..(cm)**
6. What form are you? A. Form One [ ] B. Form Two [ ] Form Three [ ]

SECTION D: INDIVIDUAL FOOD SECURITY STATUS OF STUDENTS

FOOD INSECURITY EXPERIENCE SCALE SURVEY MODULE (FIES-SM) ***FIES-SM Individual – 12 month + 30 day***			
Now I would like to ask you some questions about food.			
Q1. During the last 12 months, **was there a time when you were worried you would not have enough food to eat because of a lack of money or other resources?**	0 No 1 Yes	98 Don't Know 99 Refused	*If "Yes", ask Q1a (otherwise go to Q2)*

	Q1a. Did this happen in the past 4 weeks (30 days)?	0 No 1 Yes 98 Don't Know 99 Refused	
Q2. Still thinking about the last 12 months, **was there a time when you were unable to eat healthy and nutritious food because of a lack of money or other resources?**		0 No 1 Yes 98 Don't Know 99 Refused	*If "Yes", ask Q2a (otherwise go to Q3)*
	Q2a. Did this happen in the past 4 weeks (30 days)?	0 No 1 Yes 98 Don't Know 99 Refused	
Q3. During the last 12 months, **was there a time when you ate only a few kinds of foods because of a lack of money or other resources?**		0 No 1 Yes 98 Don't Know 99 Refused	*If "Yes", ask Q3a (otherwise go to Q4)*
	Q3a. Did this happen in the past 4 weeks (30 days)?	0 No 1 Yes 98 Don't Know 99 Refused	
Q4. During the last 12 months, **was there a time when you had to skip a meal because there was not enough money or other resources to get food?**		0 No 1 Yes 98 Don't Know 99 Refused	*If "Yes", ask Q4a (otherwise go to Q5)*
	Q4a. Did this happen in the past 4 weeks (30 days)?	0 No 1 Yes 98 Don't Know 99 Refused	
Q5. Still thinking about the last 12 months, **was there a time when you ate less than you thought you should because of a lack of money or other resources?**		0 No 1 Yes 98 Don't Know 99 Refused	*If "Yes", ask Q5a (otherwise go to Q6)*
	Q5a. Did this happen in the past 4 weeks (30 days)?	0 No 1 Yes 98 Don't Know 99 Refused	
Q6. In the past 12 months, **was there ever no food to eat of any kind in your house because of lack of resources to get food?**		0 No 1 Yes 98 Don't Know 99 Refused	*If "Yes", ask Q6a (otherwise go to Q7)*
	Q6a. Did this happen in the past 4 weeks (30 days)?	0 No 1 Yes 98 Don't Know 99 Refused	*If "Yes", ask Q6b*

			(otherwise go to Q7)
	Q6b. How often did this happen in the past 4 weeks (30 days)?	1 Rarely (1 or 2 times) 2 Sometimes (3-10 times) 3 Often (more than 10 times) 98 Don't Know 99 Refused	
Q7. In the past 12 months, **did you ever go to sleep at night hungry because there was not enough food?**		0 No 98 Don't Know 1 Yes 99 Refused	*If "Yes", ask Q7a (otherwise go to Q8)*
	Q7a. Did this happen in the past 4 weeks (30 days)?	0 No 98 Don't Know 1 Yes 99 Refused	*If "Yes", ask Q7b (otherwise go to Q8)*
	Q7b. How often did this happen in the past 4 weeks (30 days)?	1 Rarely (1 or 2 times) 2 Sometimes (3-10 times) 3 Often (more than 10 times) 98 Don't Know 99 Refused	
Q8. During the last 12 months, **did you ever go a whole day and night without eating anything at all because there was not enough food?**		0 No 98 Don't Know 1 Yes 99 Refused	*If "Yes", ask Q8a (otherwise END)*
	Q8a. Did this happen in the past 4 weeks (30 days)?	0 No 98 Don't Know 1 Yes 99 Refused	*If "Yes", ask Q8b (otherwise END)*
	Q8b. How often did this happen in the past 4 weeks (30 days)?	1 Rarely (1 or 2 times) 2 Sometimes (3-10 times) 3 Often (more than 10 times) 98 Don't Know 99 Refused	

APPENDIX TWO

SECTION D: ACADEMIC ACHIEVEMENT TEST OF STUDENTS

PART A: ENGLISH LANGUAGE

SECTION A

*From the alternatives lettered A to D, choose the one which **most suitably completes** each sentence*

1. Unless your father reports at the police station, we.....all be whipped

a) will b) shall c) should d) would

2. Under no circumstances.....his or her parents

a) A child disobeys b) A child to disobey

c) a child must obey d) must a child obey

3. The triplets love.....very much

a) each other b) themselves c) theirselves d) one another

4. Ohemaa is leaving.....Takoradi this morning

a) for b) to c) by d) from

5. The work was.....difficult for the pupils to do

a) too b) very c) much d) such

6. Finish the work quickly and..... your exercise books

a) hand up b) hand out c) hand down d) hand over

7. It was not obvious.....he was pointing to

a) the one to which b) which one

c) one which d) as to that

8. .....frankly, I hate the idea

a) speak b) spoken c) to speak d) for speaking

9. 'Yes, ...a book', he said

a) is b) its c) it's d) it

10. Neither Sammy nor his friends, ...a play to the end

a) watch b) watches c) was watching d) were watching

11. You had better.....now

a) left b) leave c) be leaving d) to leave

12. Grace travelled to Takoradi with .....

a) us b) we c) she d) ourselves

13. I would rather you.....the teacher the truth

a) tell b) told c) will tell d) had told

14. ..... Ruth was ill, she came to school yesterday

a) even b) although c) however d) moreover

15. You didn't believe that, ...?

a) isn't you b) do you c) won't you d) don't you

SECTION B

*Choose from the alternatives lettered A to D the one which is **nearest in meaning** to the underlined word in **each** sentence.*

16. Kingsley's bushy eyebrows gave him a very *severe* look

a) bad b) deadly c) serious d) unpleasant

17. The excessive speeding made the accident *inevitable*

a) fatal b) certain c) likely d) unfortunate

18. The troops *retreated* when they were attacked

a) escaped b) scattered c) fought d) withdrew

19. The *indigenous* people provided the labor during the building of the school

a) skilled b) native c) expatriate d) urban

20. The effort of the watchman which led to the arrest of the thieves was *laudable*

a) quick b) real c) constant d) praiseworthy

SECTION C

In each of the following sentences a group of words has been underlined. Choose from the alternatives letteredA to D the one that best explains the underlined group of words.

21. Augustine rather *poured oil on the flames* with his reply to the teacher's question
    a) confused b) angry c) careful d) interested
22. I have heard *from the horses' own mouth* that he will be transferred. This means that..... that he will be transferred.
    a) people are saying b) it is rumored
    c) he himself d) it has been announced
23. Several passengers were killed in the accident, but the driver escaped by *the skin of his teeth*. This means that the driver
    a) missed death narrowly b) lost all his teeth
    c) ran into the bush d) had only a scratch on his skin
24. The form two students were asked to *toe the line* or quit the team. This means that form two students were asked to
    a) apologize b) resign c) cool d) proud
25. Benedicta is always *light – hearted* in spite of her problems. This means that in spite of her problem Benedicta is always.....
    a) careless b) cheerful c) cool d) proud

SECTION D

*From the list of words lettered A to D. Choose the one that **nearly opposite in meaning** to the underlined word in each sentence.*

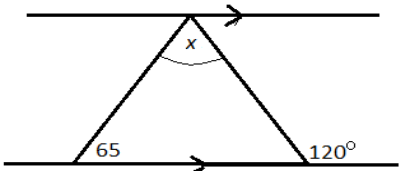
26. People in the village are *polite* to strangers
    a) cruel b) mean c) rude d) unfair
27. Fishes are *plentiful* in the pond
    a) little b) scarce c) small d) unusual
28. The price of petrol has *fallen* for no reason.
    a) aggravated b) doubled c) risen d) weakened
29. Tina worked hard to *stock* the shop
    a) decorate b) empty c) fill d) reinforce

30. There was *mayhem* as the crowd scattered

a) anger b) fear c) order d) riot

PART B: MATHEMATICS

1. The mark of eight students in a test are 10, 4, 5, 3, 14, 13, 16 and 7. Find the range
   A. 16
   B. 14
   C. 13
   D. 11
2. Find the least common multiple (L.C.M) of the numbers 6, 12 and 20.
   A. 2^2 x 3 x 5
   B. 2 x 3^2 x 5
   C. 2^2 x 3^2 x 5
   D. 2 x 2
3. Find the value of x in the diagram



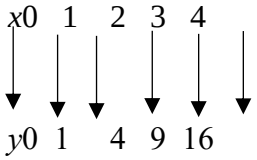
   a. 60
   b. 65
   c. 55
   d. +95
4. Find the value of ¾ ÷ 0.8
   A. $^2/_3$
   B. $^{15}/_{16}$
   C. 6
   D. $^1/_2$
5. Add 27.41 + 289.2 + 231
   A. 54.761
   B. 447.61
   C. 547.612
   D. 547.61
6. Simplify 348.94 – 189.76
   A. 149.18
   B. 259.18
   C. 159.18
   D. 158.18
7. Find the least number from these numbers 1, -1, -5, 3 and -4
   A. 1
   B. 3
   C. -1
   D. -4
8. If $a^6 \div a^4 = 64$ find a

A. 8
B. 10
C. 16
D. 24

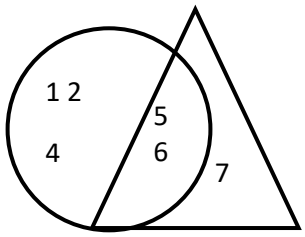
The marks obtained by 10 children in a mental drill are 0, 1, 3, 3, 5, 7, 8, 9, 9, 9. Use this information to answer questions 9 to 12.

9. What is the modal mark?
   A. 3
   B. 7
   C. 8
   D. 9
10. Find the median mark?
   A. 3
   B. 5
   C. 6
   D. 7
11. Calculate the mean mark
   A. -54
   B. 5.4
   C. 10
   D. 54
12. What is the probability that a child chosen at random scored 3 marks?
   A. 2/54
   B. 3/54
   C. 2/10
   D. 3/10

13. What is the rule for the mapping below



   A. $x \rightarrow x + 2$
   B. $x \rightarrow x + 1$
   C. $x \rightarrow x^2$
   D. $x \rightarrow \sqrt{x}$
14. Find the value of x in an equation y = 2x + 1, If *y* is 7
   A. 1
   B. 2
   C. 3
   D. 4
15. In the diagram below, P is a set of numbers in the circle and Q is the set of numbers in the triangle. What is P n Q?



A. {1, 2, 4}
B. {5, 6}
C. {7}
D. {1, 2, 4, 5, 6, 7}

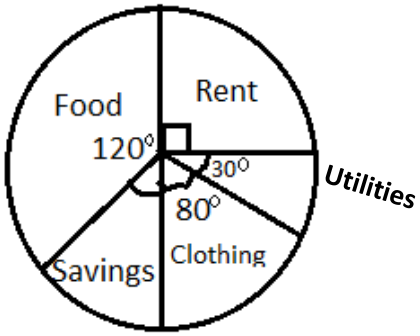
16. Given that set P = {m, n, o, p}, find the number of subsets of P.
    A. 4
    B. 8
    C. 10
    D. 16
17. Simplify -27 + 18 – (10-14) – (-2)
    A. -3
    B. -7
    C. -11
    D. -35
18. If$2^{2x} = 8$, what is the value of x ?
    A. 2/3
    B. 1
    C. 3/2
    D. 2
19. State the property used in this statement P(q + r) = pq + pr
    A. associative
    B. commutative
    C. distributive
    D. identity
20. Evaluate $\frac{0.54\ x\ 0.7}{9}$
    A. 0.0042
    B. 0.042
    C. 0.42
    D. 4.2
21. Simplify 4(x + 2) – 3(x + 1)
    A. x + 5
    B. x + 11
    C. 7x + 5
    D. 7x + 12
22. A man is 24 years old when his son was born. Now he is three times as old as his son. Find the age of the son
    A. 8 years
    B. 6 years
    C. 12 years
    D. 18 years
23. Ama is “N” years old now? How old will she be in 10 years

A. (N – 10 years)
B. (N + 10 years)
C. (10 – N years)
D. 10N years

24. Find x, if $\frac{1}{x} + \frac{1}{3} = 1$
A. $-{}^{3}/_{2}$
B. $-{}^{2}/_{3}$
C. ${}^{3}/_{2}$
D. ${}^{3}/_{4}$

25. Solve for the inequality $x - \frac{1}{3} \geq \frac{2}{3} - x$
A. $x \leq \frac{1}{2}$
B. $x \leq \frac{2}{3}$
C. $x \geq \frac{1}{2}$
D. $x \geq \frac{2}{3}$

The pie chart shows the monthly expenditure of Mrs Mensah whose monthly salary is Ghc 18, 000.00. Use the chat to answer questions 26 to 28.



26. What is the size of the angle representing savings?
A. 40
B. 60
C. 130
D. 230

27. What fraction of Mr. Mensah's income is spent on food?
A. ${}^{1}/_{6}$
B. ${}^{1}/_{4}$
C. ${}^{1}/_{3}$
D. ${}^{2}/_{5}$

28. How much does Mr. Mensah spent on rent?
A. Gh¢ 9,000.00
B. Gh¢ 4,500.00

C. Gh¢ 16,200.00
D. Gh¢ 9, 500.00

29. Simplify $\frac{1}{2}\left(3\frac{1}{3}-1\frac{1}{6}\right)$
A. 1 ½
B. 2 ½
C. 4 ½
D. 0

30. Arrange the following from highest to the lowest: 2/3, -9, 3/5 and 0
A. -9, $^{3}/_{5}$, $^{2}/_{3}$, 0
B. -9, 0, 3/5, 2/3
C. 3/5, 2/3, 0, -9
D. 2/3, 3/5, 0, -9

SECTION F: ETHICAL CLEARANCE LETTER

UNIVERSITY FOR DEVELOPMENT STUDIES

P. O. Box TL 1350
Tamale, Ghana

Tel: 03720-93382/26634/22078
Email: registrar@uds.edu.gh
Website: www.uds.edu.gh

Our Ref: UDS/IRB/021/23

Your Ref:.....

OFFICE OF THE REGISTRAR

27TH MARCH, 2023.

Date:.....

BUSAGRI EMMANUEL,
UNIVERSITY FOR DEVELOPMENT STUDIES,
TAMALE

ETHICAL APPROVAL NOTIFICATION

With reference to your request for ethical clearance on the research proposal titled **"Assessing the association between household food security status and academic performance of Junior High School students in Tolon"** I write to inform you that the University for Development Studies Institutional Review Board (UDSIRB) found your proposal including the consent forms to be satisfactory and have duly approved same. The mandatory period for the approval is six (6) months, starting from 27th March, 2023 to 27th August, 2023.

Subject to this approval, you are please required to observe the following conditions:

1. That the anonymity of the respondents shall be guaranteed as mentioned in the consent forms.
2. That you will acknowledge the source of the data collected in any publication related to this research.
3. That you will submit a field report and a copy of the research report to the UDSIRB.
4. That you may apply to the UDSIRB for any amendments relating to recruiting methods, informed consent procedures, study design and research personnel.
5. That you will strictly abide by the code of conduct of this University.

Please do not hesitate to refer any issue (s) that you may deem necessary for the attention of the Board.

Thank you

Prof. Nafiu Amidu
(Chairman, *UDS IRB)*
Cc: file

SECTION G: INTRODUCTORY LETTER

UNIVERSITY FOR DEVELOPMENT STUDIES

(School of Allied Health Sciences)

Tel:071-03720-26633/26634/93382

Our Ref: (UDS/MPHN/0009/21)

Your Ref:

P.O. Box 1883
Tamale, Ghana

11th May, 2023

Department of Nutritional Sciences

To whom it may concern

Dear Sir/Madam,

INTRODUCTORY LETTER: PUBLIC HEALTH NUTRITION STUDENT

I write to introduce Mr. Busagri Emmanuel as a final year postgraduate Student of Public Health Nutrition from School of Allied Health Sciences of University for Development Studies. He is working on the topic: **"Assessing the Association between Household Food Insecurity, Nutritional Status and Academic Performance of Junior High School Students in Tolon."** for his final year research project.

I would be most grateful if you could extend to him the necessary support to enable him conduct the study.

Thank you.

Yours Sincerely,

DEPARTMENT OF NUTRITIONAL SSIENCES UNIVERSITY FOR DEV. STUDIES TAMALE

Dr. Anthony Wemakor
(Head of Department)