

**COMPARATIVE STUDY OF THE NUTRITIONAL STATUS OF SCHOOL AGED
CHILDREN ENROLLED ON THE GHANA SCHOOL FEEDING PROGRAMME: A
CASE OF KWABRE EAST AND THE TOLON DISTRICTS OF GHANA**



BY

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DECLARATION

I, Afua Adjeibea Auguste Taricone, declare that this thesis is the result of my own work produced from research under the supervision of Prof. Matilda Steiner- Aseidu and Prof. Angelina O. Danquah. All references to other works have been duly acknowledged.

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ABSTRACT

Background: Childhood malnutrition remains a public health challenge in Africa. The original aim of the Ghana School Feeding Programme was to improve school enrolment and attendance with secondary aim to alleviate hunger and malnutrition among school aged children across every region. The aim of this study was to investigate the nutritional status of the SAC enrolled in the GSFP.

Methodology: A cross-sectional study was carried out among 300 randomly selected 6-12 year aged school children in the Kwabre East (n=150) and Tolon districts (n=150) of Ghana. A semi-structured questionnaire was employed to take information on participants and their caregivers' demographic characteristics, sanitation and morbidity. Height, weight and haemoglobin concentrations were measured. Dietary data were obtained using a 3 consecutive day 24-hour recall and food frequency questionnaire. Analyses of covariance were used to compare the differences (HAZ, BAZ, energy and nutrient intake from usual and GSFP meals) between the study children from the two districts and logistic regression used to identify predictors of malnutrition.

Results: Compared to the study children in the Kwabre East district, the prevalence of stunting and anaemia was significantly higher in Tolon district 15.3% vs. 6%; $p=0.009$ and 20.5% vs. 7.3%; $p=0.001$ respectively. The rate of thinness was significantly higher in Kwabre East than the Tolon district in the study children (21.3% vs. 10%; $p=0.026$). Having a low dietary diversity score was significantly associated with being undernourished (OR=5.1; 95%CI: 1.45-5.1) in Kwabre East and (OR=4.8; 95% CI: 1.41-16.13) in the Tolon district. It was observed that 3 out of 10 study children were undernourished in Kwabre East.

Conclusion: From the study, the prevalence of anaemia, stunting and thinness significantly differed between the study children in the two districts. The dietary diversity scores in both districts were

high among study children. The chances of being undernourished was significantly higher with the study children who had a low dietary diversity score. Meals from the GSFP contributed more than one-third of the energy, macro-nutrients and micronutrients (Vitamin A, folate, iron and zinc) that were assessed to the daily nutrient intake of the study children. Meals from GSFP did not contribute Vitamin B₁₂ to the daily nutrient intake to children in Tolon district but contributed more than half to daily Vitamin B₁₂ intake of children in Kwabre East district.

DEDICATION

This thesis is dedicated to the Almighty God who has been with me throughout and given me the strength to complete this work successfully. I also dedicate this to my wonderful children Giselle and Adrianna and my ever-supportive husband Ernest Taricone.

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LIST OF ABBREVIATIONS

ANCOVA	Analysis of Covariance
aOR	Adjusted Odds Ratio
BAZ	BMI-for-age z-score
BMI	Body Mass Index
DA	District Assembly
DDS	Dietary Diversity Score
DHS	Demographic Health Survey
EAR	Estimated Average Requirement
ECBAS	Ethical Committee of Basic and Applied Sciences
FAO	Food and Agricultural Organisation
FFE	Food for Education
GHS	Ghana Health Service
GSFP	Ghana School Feeding Programme
HAZ	Height-for-age z-score
Hb	Haemoglobin
Kg	Kilogramme
LSD	Least Significant Difference
MDG	Millennium Development Goals
MMP	Multiple Micronutrient Powder
NEPAD	New Partnership for Africa's Development
RUTF	Ready to Use Food
SAC	School-aged Children

SD	Standard Deviation
SE	Standard Error
SFP	School Feeding Programme
SPSS	Statistical Package for Social Sciences
SSHE	Sanitation and Hygiene Education
UNICEF	United Nations
WASH	Water, Sanitation and Hygiene
WES	Water, Environment and Sanitation
WFP	World Food Programme
WHO	World Health Organisation

CHAPTER ONE

1.0 INTRODUCTION

1.1 Background to the study

Adequate and balanced nutrition coupled with a healthy lifestyle is crucial for the growth and development of children globally (Popkin, Adair and Ng, 2012). In the developing world, it is estimated that about 66 million school aged children go to school daily without eating any food with approximately 23 million of these children living on the African continent (FAO, 2016, WFP, 2015). In Ghana, a recent report estimates that 14.5% of school children go to school on an empty stomach each day (Intiful and Lartey, 2014). Undernutrition and over nutrition, prevent children from reaching their intended physical growth and achieving their full cognitive development (Tzioumis and Adair, 2014). Childhood malnutrition has remained a contributing factor to more than half the deaths of children worldwide (Onis, 2000). Child under nutrition is associated with 45% of deaths in developing countries (Kramer and Allen, 2015). Aside from mortality, the morbidities that have been found to be associated with undernutrition also pose challenges to their development. In Taiwan, for instance, anaemic school children were reported to have poorer cognitive function and also recorded lower scores in mathematics and language (Sunghong *et al.*, 2002). Undernutrition consequently emerges as a global public health challenge of school-aged children, particularly in developing nations.

In recent times, intervention programmes such as school feeding programmes (SFP) have been established in the developing countries to help curb the challenges that arise from malnutrition and also as an effort to aid in addressing the ever growing burden of acute and chronic undernutrition.

School feeding programmes are now implemented in almost every country worldwide, reaching about 368 million school children. This enables one out of every five children receive a nutritious meal on school days (McGrath & Gu, 2015).

SFPs in middle-and low-income countries aim to in the short term, alleviate hunger and increase the rate of child enrolment in basic public schools and improve the school children's nutritional status, attendance and retention in schools as well as improve their cognitive development in the longer term (Jomaa *et al*, 2011 & Ghana Statistical Service *et al.*, 2015). SFPs support poor families to secure basic education for their wards and also contribute to the eagerness for a child to learn and their ability to fully partake in their individual journeys to enhance their educational process (Dheressa, 2011). It aims to promote the development of human capital by enhancing children's nutritional and health status. This in turn helps to break and discontinue the intergenerational cycle of hunger and poverty. The programme also aims to address micronutrient deficiencies that numerous studies have evidence to suggest they play a critical role in children's cognitive development (McGrath & Gu, 2015).

The government of Ghana started the SFP in 2005 as an initiative to achieve the United Nations-Millennium development goals on hunger, poverty and primary education. One basic concept of the programme is to provide pupils within the underprivileged and poorest district public primary schools throughout the country with one hot, nutritious meal every school day, with the use of foodstuffs produced by local farmers. The goal for the implementation of the programme is to reduce poverty and malnutrition among school children in Ghana (Government of Ghana, 2006). The programme currently feeds about 1,728,682 children in 4,952 beneficiary schools with the majority

of the children coming from the Ashanti (335, 293) and the Northern Region (203,679) (Ghana school feeding programme national Secretariat 4th Quarter, 2014 estimates). The introduction and implementation of SFPs are anticipated to be supported with assessments of biomarkers and development outcomes. These are generally measured at different intervals to guide programme planners on the way forward. In developing countries and resources constrained settings, however, these assessments are less regularly undertaken. In Ghana particularly, the programme has not been adequately explored in terms of the nutritional status of school aged children across the various regions.

1.2 Rationale

The occurrence of malnutrition in school children affects their health and nutritional well-being which also affects their academic performance in the long run. Children are the bedrock of a country's future development and as such their overall health, particularly in-terms of nutrition need to be critically examined for the development of appropriate intervention where necessary. The government of Ghana introduced the SFP to reduce malnutrition and improve on the nutritional status of school children. After more than 10 years of the implementation and existence of the GSFP, its impact on nutritional status has not been adequately explored, particularly within the regions where there is a greater population of children enrolled in the programme.

By conducting such an assessment, programme planners are able to identify areas of progress as well as those where additional efforts may be required to improve child health and development. The factors inhibiting the attainment of these targets where assessable could also be identified for interventions to be designed to overcome them where necessary. This study, therefore, sought to

assess the nutritional status and quality of the diet given to school children participating in the GSFP in the Kwabre East and Tolon districts where there are a greater number of participating children and also where the possibility of the types of foods grown, geographic, weather patterns and the socio-demographics of the school aged children could probably affect their nutritional status.

1.3 Research questions

The research was undertaken to answer the questions below concerning school aged children in the Kwabre East and Tolon district enrolled in the Ghana School Feeding Programme:

1. Is the SFP along the two different ecological zones helping to achieve a good nutritional status of the school aged child?
2. Are there significant differences between the children's nutritional status in the two (2) schools?
3. Has the SFP been specially tailored to compensate for the lapse in the regions with higher prevalence of poor nutritional status of the school aged child?
4. What are the contributions of the energy and nutrient intake from the meals in the GSFP to the daily intake of the study children?

1.4 Main objectives

The main objective of the study was to compare the nutritional status of school children aged 6 – 12 years enrolled on the Ghana school feeding programme in the Kwabre East and Tolon districts of Ghana.

1.4.1 Specific objectives

The specific objectives were to:

1. Investigate the prevalence of stunting, thinness and Haemoglobin (Hb) concentration of study children.
2. Determine the dietary diversity and nutrient intake from the total daily consumption of meals of the study children.
3. Find out the relationship between dietary intake and malnutrition.
4. Assess the contribution of the meals eaten in GSFP to the daily intake of study children.

1.5 Study hypothesis

Ho: There is no difference in nutritional status between the school children in the Kwabre East and Tolon districts enrolled in the GSFP

H1: There is a difference in nutritional status between the school children in the Kwabre East and Tolon districts enrolled in the GSFP.

CHAPTER TWO

2.0 LITERATURE REVIEW

2.1 Overview

As hunger, micronutrient deficiencies and malnutrition persist, the resulting effect presents adverse consequences on productivity and well-being of individuals and nations at large. Childhood under nutrition according to Jomaa *et al.*, (2011) has a long-term effect on individuals as well as the economic value of nations. An improvement in the diets of children can positively affect their academic performance and behaviours at school and consequently improve productivity in adulthood (Jomaa *et al.* 2011). Evidence from findings by Alderman, Hoddinott & Kingsley (2006), suggest that malnutrition leads to an increased rate of school aged children's delayed entry into school, less overall schooling, smaller physical physique and 14% lower earnings later in adulthood. Malnutrition that occurs at an early stage in life often affects all aspects of child development, including stunted growth, underweight, lowered immunity and mortality (Mwaniki and Makokha, 2013). A study reported on the additional effects of malnutrition that body mass index (BMI) significantly impacts productivity and wages of an individual (Broca & Stamoulis, 2003).

In an attempt to address the challenges of malnutrition, various strategies have been implemented by Governments and non-governmental organisations. One of these strategies include the Food For Education (FFE). The idea of FFE is to motivate children and their families by providing food for them (Lawson, 2012). According to Gokah (2008), FFE was utilized by the United Kingdom and United States as early as the 1930s to improve the health of children. These early interventions were in the form of school feeding programmes (SFPs), which provided a meal or snack at school. The FFE programmes have become popular among policy makers and political leaders in developing thus

in Africa, Asia and Latin America. Former presidents of Ghana and Brazil, John Agyekum Kufour and Luiz Inácio Lula da Silva respectively, were recently honoured with the 2011 World Food Prize, for successfully social programmes including school feeding. The provision of incentives to targeted families and their children, especially girls has been identified as a key motivation for implementing school feeding programmes (Jomaa *et al.*, 2011). In recent years, the use of SFPs as a means to develop the agricultural sector has been a matter of consideration. In the opinion of Sumberg and Sabates-Wheeler (2011), the use of foods produced locally in the school feeding programme is a strategy to boost the income of farmers.

2.1.1 School feeding programmes

School feeding programmes are used around the world by political leaders as a visible social safety net (Hall, 2008). In communities that benefit from these programmes, they do not only feed children but, their families are supplied with extra food (WHO/CSDH, 2008). SFPs in developing countries are not targeted at specific children at a school but instead all students attending a school get to benefit from the programme. The cost effectiveness of the programme may be compromised if not all beneficiary students belong to food insecure families or of low socio-economic status. Due to the cost-benefit ratio, it is reported that FFE programmes should be grouped as educational interventions and not nutritional interventions, so as not to undercut budgetary allocations that are apportioned for nutritional interventions (Lawson, 2012 & Shekar and Lee, 2006).

The Government of Ghana with support from the Dutch Government implemented the Ghana School feeding Programme in 2005 with the purpose of reducing hunger and enhancing food security. The

three immediate objectives were to; reduce hunger and malnutrition; increase school enrolment, attendance and retention; and to boost domestic food production (GoG, 2006).

The GSFP is visualized to be a resource tool to reduce poverty especially in poor rural populations, thus ensuring food security at the community and the household level. The provision of one hot nutritious meal made from locally-grown food crops to every school going day was meant to reduce post-harvest losses and also to provide available markets for farm produce. Thus, about 80% of the cost expended in the programme will be on the purchase of the local food produce. This was expected to impact the economy at the rural household and community levels, providing improved incomes to enable poor rural households afford the extra food intake required to achieve the full complement of nutritional needs required to address the problems of widespread short-term hunger and poor resources (GSFP, 2007; ECASARD/SNV Ghana, 2009). Adelman, Gilligan & Lehrer (2008) assert that school feeding programmes are postulated to increase enrolment and daily attendance of students by serving food at school. Consequently, school feeding programmes are thought to change schooling decisions for families who may feel reluctant to send their children to school. This change in behaviour by both parents and children manifested in an increase in outcomes such as enrolment, attendance, length of schooling and reduction in dropout rates and absenteeism (Kremer and Holla, 2009).

In the view of Buttenheim *et al.*, (2011), the goal behind the concept of targeting children via FFE programmes is to increase their educational achievement, resulting in improved earnings and productivity. The improvement in educational achievement through school feeding programmes is hypothesized to occur via three pathways (Fig 2.1). Firstly, Food for Education programmes tend to

lower the opportunity costs of attending school and in providing extra incentives to engage in formal education, thereby resulting in increased school attendance. From the diagram below, more time is spent in school thereby resulting in an increasing period of learning for the school child. FFE programmes also improve educational achievement by alleviating short term hunger, thereby improving children’s cognitive function and attention span. The last path is the provision of children with sufficient nutrients and calories in addition to their regular diet, to improve on their nutritional status. This results in better resistance to infections and illnesses, and improvement in health which otherwise would prevent children from attending school. Better nutrition therefore directly improves educational achievement by improving school attendance of children.

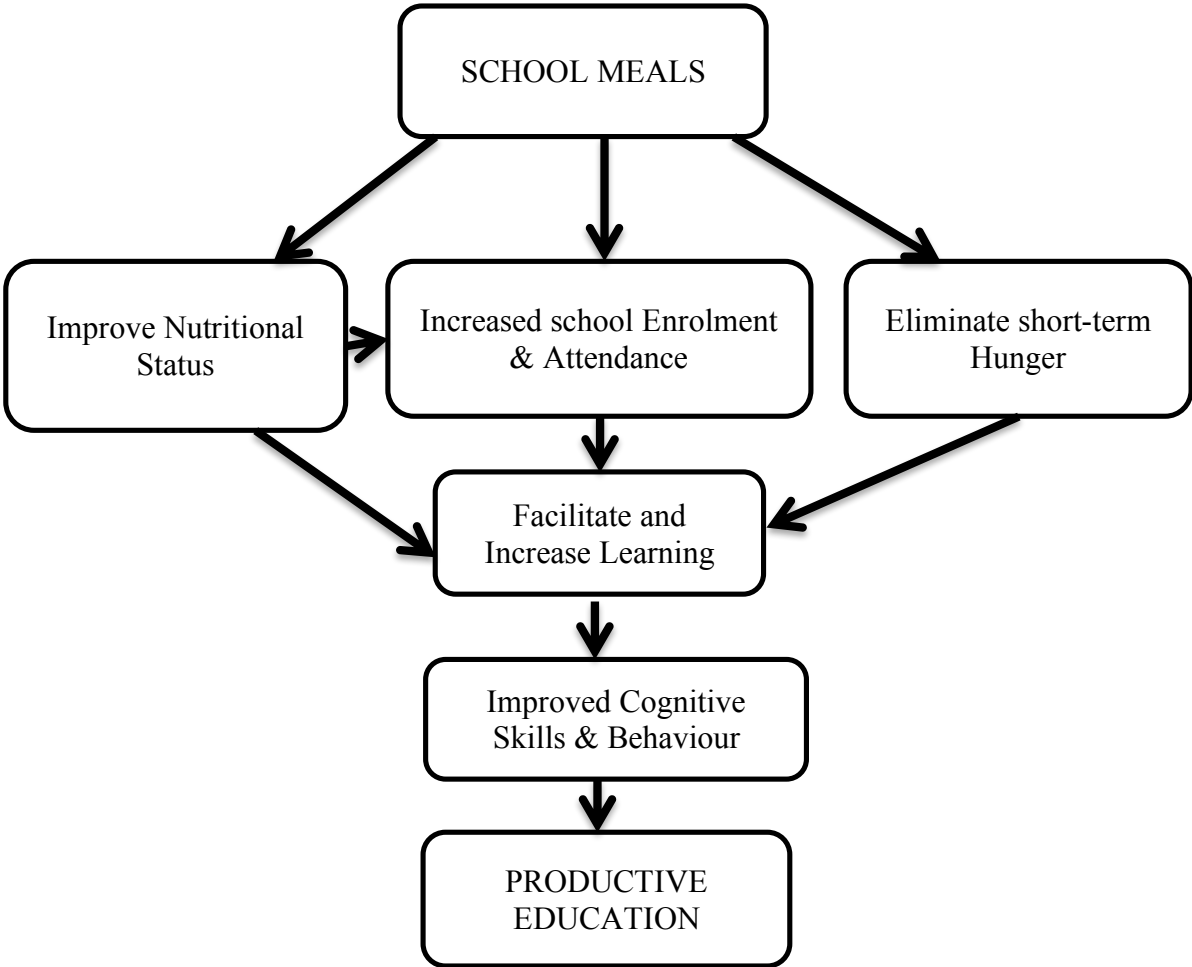


Figure 2.1: Relationship between SFP and outcomes and impact on school aged children (Adapted from Grantham-McGregor et al. (1998) & Jacoby et al. (1998).)

The government of Bangladesh together with the World Food Programme (WFP) in 2002 implemented a school feeding programme, in which fortified nutritional biscuits were provided to school children across rural and urban communities that were deemed to be chronically food insecure (Ahmed, 2004). A year after implementation, enrolment was found to have increased by 14.2%. They further stated that, in schools receiving the SFP intervention, the probability of a child dropping out of school reduced by 7.5% (Ahmed, 2004).

2.2 Nutritional status of school aged children

In developing countries, malnutrition particularly among school-aged children continues to remain a public health issue. Nutritional status is primarily determined by growth in weight and height and is affected by incidence of childhood infections and food intake (Rogol, Clark and Roemmich, 2000). In 2010, the World Health Organization (WHO) reported 7.6 million deaths, of which 64% were attributed to infectious causes including malaria, pneumonia and diarrhoea which claimed the most lives (Liu *et al.*, 2012). In children who are not able to mount an effective immune response, the severity of these infections is enormous when confounded by chronic malnutrition (Rice *et al.*, 2000 & Rayhan and Khan, 2006). In response to the health burden of both acute and chronic malnutrition in developing countries, programmes designed to partially address the problem have been implemented. For instance, Ready-to-Use Foods (RUTFs) or Multiple Micronutrient Powders (MMPs) provide a low cost and acceptable way to augment intake by the addition of vitamins, iron, proteins and fats. This has been illustrated to improve health indicators for anaemia and zinc deficiency (Jack *et al.*, 2012 & Bahwere *et al.*, 2014). Again, fortification of flour worldwide through Flour Fortification Initiative (2016) and other WHO-supported initiatives that supported flour

fortification at various national levels with iron, folic acid, zinc, and other B-vitamins such as thiamine, niacin, riboflavin and vitamin B₁₂ have shown significant improvement in health of populations.

Nutritional status of school-aged children influences their cognition, health, and consequently their educational attainment. The appropriate setting is within school environment where children are provided with health and nutrition services to children who are disadvantaged. However, school-age children are not regularly covered as part of nutrition and health surveys. From 2000 to 2009 a review of published literature on the nutritional status of school-age children between 6-12 years in developing countries and countries in transition from the continents, Africa, Latin America, Asia and Eastern Mediterranean, indicate a considerably inadequate nutritional status among this group (Ochola and Masibo, 2014). In African and South-East Asian populations, underweight and thinness were most conspicuous whereas a generally < 10% prevalence of underweight or thinness was reported in populations from Latin America. The prevalence of overweight was high (20% to 35%) in Latin American countries and generally below 15% in Asia, Africa and Eastern Mediterranean (Best *et al.*, 2010).

The School age period in the opinion of Srivastava *et al.*, (2012) is the most active growing point of one's childhood stage. Thus, children in primary school are in an active period of physical and mental development according to the International Institute of Population Sciences (2007). Available literature have attributed high absenteeism, low school enrolment and school dropout to poor nutrition among children (Best *et al.*, 2010).

2.3 Assessing school-feeding programme outcomes

Changes in weight and height (physical growth) among school-aged children have often been attributed to school feeding programmes. An enhancement in both macro and micronutrient intake of children enhances immune protection and improves growth, as well as promotes increased muscle mass and growth (Adelman, Gilligan & Lehrer, 2008). However, mixed results have been reported on the impact of SFP on the anthropometric measurements of participants. Van Stuijvenberg *et al.*, (1999) reported no changes in anthropometric indices in both treatment and control groups in their study that was to determine micronutrient status of rural primary school children aged 6-11 years. Nonetheless, the prevalence of stunting and underweight were reported to be low. Again, Arsenault *et al.* (2009) also reported mixed result from a snack supplementation in public schools in Bogotá, Colombia. After the 4-month study, it was revealed that height-for-age z-scores decreased in both the treatment and the control groups. The treatment group was however found to have deteriorated as compared to the control group while the BMI-for-age did not significantly differ between the groups studied.

There is a seeming convergence in reviewed studies suggesting that Food for Education programmes only provide modest gains in growth measurements among school aged-children. No significant gains in stunting (height-for-age) were observed in interventions where students received meals at school (Taras, 2005). In the case of interventions where snacks or beverages were provided, however, significant positive effects were reported for stunting (Jomaa *et al.*, 2011). The supplementation of snacks and beverages in schools has been shown to significantly improve height and weight among school children (Lawson, 2012). Kristjansson *et al.*, (2007) in a meta-analysis reckon that school feeding programme often produce mixed results in terms of height but small improvements in

weights. Jomaa and colleagues (2011) also reinforced that the results on the effects of SFP on impacting weight and height in children is mixed.

In 2012, Srivastava and colleagues investigated the nutritional status among school-age children (5 – 15 years) in India slums and reported that the prevalence of stunting and underweight was highest among children aged 5-6 years and 11-12 years, respectively whereas those aged 7-8 years recorded the highest levels of wasting. Underweight children were mostly dominant across all age groups. Among boys, 18.1% and 30.7% were found to be stunted and wasted respectively, whilst 16.1% of girls were stunted, an indication of high prevalence of long-term malnutrition among girls. In general, 18.5% stunting, 33.3% wasting and 46.8% normal nutritional status was observed among the children. A positive correlation was observed between age and nutritional status, with a poor nutritional status reported in younger children. The high prevalence of malnutrition among younger children makes that group a target for nutritional surveillance and interventions (Srivastava *et al.*, 2012).

A variety of studies conducted in Africa suggest consistently higher malnutrition rates among boys than girls (Wamani *et al.*, 2007). A case in point is one of the largest studies conducted by Partnership for Development on the anthropometric status among rural school children in resource limited countries including Ghana, Tanzania, Vietnam, India and Indonesia. In the aforementioned study, stunting and underweight prevalence in all five countries were found to be high. The prevalence of stunting was reported to be between 48% to 56% and 34% to 62% for underweight. In most countries, boys were more inclined to be stunted than girls, but more underweight than girls in all countries (Intiful *et al.*, 2013). The observed inconsistencies in the findings between this work and that of

Srivastava and colleagues are attributed to the differences in family set ups, study frame, gender bias and parental preferences for male children in the Indian society (Srivastava *et al.*, 2012).

Furthermore, Medhi *et al.* (2006) in a study on growth and nutritional status of school aged children (6-14 years) found a prevalence of stunting, wasting and underweight to be 47.4%, 21.2% and 51.7% respectively for children in the 6-8 years category. No significant differences were observed between boys and girls in the same category. Whereas a definite age trend was observed in the prevalence of wasting, no such trend was found in the case of stunting and underweight. In respect of children aged 9-14 years, the prevalence of stunting and thinness using BMI-for-age were 53.6% and 53.9% respectively. For both stunting and thinness, no age trends were seen. However, for both stunting and thinness, the prevalence was higher among girls (Medhi *et al.*, 2006).

In assessing the nutritional status of school aged children in a rural setting in Ghana, Danquah *et al.*, (2012) found an overall prevalence of stunting and underweight of 56.7% and 45.8% respectively. More males showed various degrees of both stunting and underweight (63.3% vrs 60%) than their female counterparts (50% vrs 31.7%) even though the results were not different statistically. However, the prevalence of overweight or obesity was significantly higher in females (13.6%) than in males (5.0%) with 15% of the total pupil population found to be overweight/obesity prevalence (Danquah *et al.*, 2012). Also, the study reported that only 5% males were found to be thin. Similarly, in a study to determine the effect of dietary patterns on the nutritional status of upper primary school children in the Tamale Metropolis in the Northern Ghana, Adamu *et al.*, (2012) found overweight and underweight prevalence to be 4% and 10% respectively. In a related study, Owusu *et al.*, (2007)

reported the prevalence of obesity among primary school children in Accra to be 26.4% and 19.3% respectively.

2.3.1 Dietary Diversity (DD) and assessments

Martens (2007) in an appraisal of the Ghana School Feeding Programme and its impact observed that the programme was successful in increasing the dietary diversity of the diet of school children aged 7-16 years in the selected schools. This, the author argues could be reflected in the nutritional status and nutrient adequacy of the primary school children, albeit no internationally accepted cut-off points were available to use as reference. The lack of a reference point makes it difficult to determine whether or not the nutrient adequacy is sufficient, the author admonishes. Dietary diversity scores (DDS) were generated for each child by first allocating the consumed foods to food groups and adding the different food groups consumed at the school lunch, foods consumed at home and a combination of the home and school consumption as recommended by the FAO (2011). The DDS for the combined home and school consumption was found to be on an average one (1) food group higher than that of the home consumption alone. Even though the contribution of the 1 food group to the combined DDS of home and school consumption cannot be entirely attributed to the GSFP due to the absence of a control group of children from a school without an SFP, it was observed from a 24hr recall that the food groups responsible for the increase in the combined DDS (eggs, beans, tubers and kontomire leaves) are food products that are not used frequently in preparing home meals. Therefore, chances are that the increase in the combined DDS relative to the DDS of the home consumption alone can be attributed to the provision of school lunches of the Ghana SFP (Danquah *et. al.*, 2013).

Again, Martens (2008) contends that an increase in DDS could lead to an increase in nutrient adequacy and/or nutritional status. This position is confirmed in studies by Torheim *et al.* (2004), Arimond and Ruel (2004), Hatløy *et al.* (2000) and Onyango *et al.* (1998). In these studies, different age groups were used, making it problematic to extrapolate the results to the primary school children in the study being considered. Nonetheless, since all studies point to an improved DDS with increasing nutrient adequacy, it may be safe to assume that the increase in DDS reported may be a reflection of an improvement in the nutrient adequacy of the diet provided to the school children. Although not much work has been done on the dietary variety of food consumption among Ghanaian primary school children, Ferguson *et al.* (1993) reported a DDS of 7.5 in Ghanaian school children aged 3-6 years using 13 food groups. In the case of Martens (2008), 14 food groups were used to assess the DDS of the children's food intake consistent with the FAO/DHS food groups.

2.4 Prevalence of anaemia and its assessment

Anaemia is a condition characterised by reduction of red blood cell volume and a decrease in the concentration of haemoglobin in the blood. Anaemia is regarded as one of the most prevalent nutritional problems in the world today with about 2 billion people estimated to have anaemia (WHO/UNICEF/UNU, 2001). In children, anaemia is associated with impaired mental and physical development as well as increased morbidity and mortality (Sachs and Malaney, 2002). Iron deficiency is the most common micronutrient deficiency globally, with anaemia often indicative of poor nutrition and poor health (GDHS, 2014). In Ghana, sub optimal nutrient intake, malaria and intestinal worm infestation are considered the most common causes of anaemia (Ghana Health Services, 2003). Over the years, several measures have been put in place to combat the high prevalence of anaemia. These include provision of insecticide-treated net to pregnant women and

children under 5 to prevent malaria, iron and folic acid supplementation. About 66% of children aged 6-59 months in Ghana are reported to have some level of anaemia. Out of this, 27%, 37% and 2% are considered to be mildly, moderately and severely anaemic respectively (GDHS, 2014). Anaemia was found to be more profound among children living in rural areas (72%) compared to their counterparts in urban areas (58%). Anaemia was also found to vary slightly across different regions, with children in the Northern region having the highest predisposition (82%) whereas those in the Ashanti region have the least predisposition (54%). The different categories of anaemia were classified using the following haemoglobin levels; any anaemia: < 11.0 g/dl, mild anaemia: 10.0 – 10.9 g/dl, moderate anaemia: 7.0 – 9.9 g/dl and severe anaemia: < 7.0 g/dl (GDHS, 2014). According to Rosado *et al.* (2010), anaemia has been identified as the most likely consequence of micronutrient deficiencies experienced by a high proportion of different population groups. Also, Bundy, Shaeffer & Jukes *et al.* (2006) alleged that more than half of the school-aged children in developing countries are considered to be anaemic (have iron deficiency anaemia)

2.5 Socio-economic status of school aged children and nutritional status

Malnutrition is considered a major public health problem in modern age and has been recognized for a long time as a consequence of poverty because a large proportion of the world's malnourished children are found in the developing nations of Africa, Asia and Latin America where those affected the most are said to come from low income families (UNICEF, 1998). Malnutrition arises from a number of interwoven factors that interact to form a network of causation and enhance each other's effect (Smith *et al.*, 2005). To a large extent it is the end-product of poverty, ignorance, insufficient education, large family size, low income, occupation and others. These are the real determinants of malnutrition in a society as they have a direct bearing on the quality of life (Babar *et al.*, 2010).

According to Kikafunda *et al.* (1998), children from households with low or very low socio-economic status were 2.5 times more likely to be underweight compared with those who came from households with middle to upper socio-economic status.

2.5.1 Education of parents/ caregivers.

Women's education and social status according to Smith and Haddad (2000) have been reported to be important underlying determinants that cause malnutrition among children either directly or indirectly. Even within the same social class, mother's education level is a crucial determinant of their children's health. A high level of maternal education they propose has the potential to lower childhood malnutrition through increased awareness of sanitation practices, healthy behaviour and a more equitable distribution of household resources to the benefit of the children. Ojiako, Manyong and Ikpi, (2009) also maintains that more education for women is linked with better care practices and behaviours, higher quality diets, higher levels of household food availability, and better nutritional outcomes. In view of this, a strong case is made for the use of capacity building and educational empowerment of women as a way of advancing food and nutritional status of children especially and household members generally.

According to Mosiur, Golam and Nasrin, (2009), a father's education status is also an essential determinant and has a demonstrated positive impact on the health and nutritional status of children. It is suggested that because the father is usually the main earner and the decision maker of the family, a higher education level plays a key role in ensuring better nutrition status for children. In addition, Babar *et al.*, (2010) observed an indirect association between paternal literacy level and child nutritional status. Fathers' education they allege is important since they play a more active role in

household income and certain health-seeking decisions in our social set up. In a study on the impact of socio-economic factors on nutritional status of primary school children aged 6-11 years, more children of illiterate fathers (50.9%) were found to be malnourished than children of literate fathers (19.5%). They also reported that children of illiterate fathers were poorer relative to those with educated fathers. (Savitri, 2014)

In Srivastava *et al.* (2012), mother's education was found to be strongly predictive of child nutritional status. Also, the data reviewed from the National Family Health Survey (NHFS) I demonstrated that even after controlling for potential confounding effects of other socio-economic and demographic factors, mother's education was found to have a strong independent effect on a child's nutritional status (Mishra & Retherford, 2000). Earlier studies by Desai & Alva (1998) and Boyle *et al.* (2006) using household-level data also found a positive association between mother's education and various measures of child health and nutritional status. In Babar *et al.* (2010), findings presented are also conclusive on the important contribution of socio-economic parameters such as mother's education to the nutritional status of children. Reports of further improvement in nutritional status with maternal education have been advanced in Bishnoi *et al.* (2004) and Shah *et al.* (2003). In Cambodia, the incidence of stunting was observed to decline with mother's education. This declining pattern was consistent with others reported in many developing countries (Mukuria *et al.*, 2005).

According to Katahoire *et al.* (2004) and Frost *et al.* (2005), it is submitted that wasting unlike stunting is influenced less by maternal characteristics and this they attribute to the fact that a mother's education has very little effect on preventing illnesses such as diarrhoea when there are extensive sources of infection. Several studies have come to the conclusion that parental education, particularly

mother's education is crucial in improving children's nutritional status (Christiaensen & Alderman, 2004).

2.5.2 Occupation of parents / caregivers

The occupation of parents, especially mothers is also believed to impact children's nutritional status. Most mothers in this modern era have become part of the labour force than previously was the case. Child feeding practices are influenced by maternal employment and thus reflect child nutritional status (Shuhaimi and Muniandy, 2012). Such work is likely to be important for family survival, particularly in developing countries. The roles of women as caregivers and as providers of family income may conflict with each other because of the time constraints they face, with potentially important ramifications for the welfare of children (Henly and Lyons, 2000). In particular, the ramifications for child nutrition have been the subject of empirical investigation and debate for the last two decades (Glick and Sahn, 1998 & Lamontagne *et al.*, 1998). Glick (2002) notes that mothers who are engaged in one form of work or the other may lack the time to sufficiently breastfeed, prepare nutritious meals for their young children or to utilize services that are fashioned to improve child nutrition.

Shah *et al.* (2003) and Gopaldas *et al.* (1998) in separate studies found that children of non-working mothers were reported to have a better nutritional status relative to children of working mothers probably because they have more time to care for children. Again, Srivastava *et al.* (2012) upholds these findings to the extent that a mother's working status was found to be one of the strongest predictors of malnutrition. This is also confirmed in the National Health Family Survey II by the International Institute for Population Sciences (2000) who observed a higher prevalence of all three

indices of malnutrition among children of working mothers. Again, Adedza (2009) in a study of the influence of socio-economic characteristics of child growth found that the level of wasting was mainly influenced by the occupation of household heads and mothers. For instance, children whose household heads were involved in mechanical or factory work were better nourished than those of household heads in a different trade. This was attributed to the fact that mechanical or factory work was a higher income generating activity than other jobs within the study area. Also, the propensity to be wasted was found to be higher in children whose mothers were farmers than those whose mothers were housewives. This observation, among other things was due to the fact that in the developing world, mothers who leave home to undertake other economic activities or to farm usually leave their young children in the care of older siblings, relatives or neighbours who often fail to provide optimal childcare. Additionally, in the same study, farming mothers were reported to rely exclusively on produce from their farms to meet household food needs, thus creating monotonous maize and cassava-based diets for the family. Another reason given for the poor nutritional status of children of farming mothers was the need to provide for the non-food requirements of the household by selling the bulk of protein and vitamin rich food crops harvested from their farms for cash (Adedza, 2009).

2.5.3 Household size and family type

Bronte-Tinkew and Dejong (2004) infers from a study with a household size ranging from 5 to 7 to be an indication that this is a home with more dependents to cater for which means there are many persons in the household to share a plate of food. This position is shared by Danquah *et al.* (2013) who contend that large family size suggests that the distribution of resources will be inadequate for

each member and this is reflected in the nutritional health of family members with children being the most affected.

Bronte-Tinkew and Dejong (2004) in their study of the influence of resource dilution characteristics and household structure on children's nutritional status in Jamaica established that living in a single-parent and cohabitating household is associated with an increase in the odds for stunting in children. They also identified that children who were stunted were from single-parent, low-income families with siblings. Cataldo *et al.* (1999) also observed that single-parent households which are largely headed by women tend to have lower mean income and less money for all expenses, including food as opposed to those households headed by men.

In the study by Srivastava *et al.* (2012) on the nutritional status of school-age children (5 – 15 years) in Indian slums, family type was found to have a significant association with all three (3) malnutrition indices; stunting, wasting and underweight. Similar reports have also been conveyed in a study by Gopaldas *et al.* (1998). The International Institute of Population Sciences (1995)'s National Family Health Survey I revealed that children living in a joint family set up were more inclined to suffer chronic malnutrition than their colleagues from nuclear families. These findings are however different from a study carried out by Singh (2003) involving children in urban slums in which over 70% of the families were nuclear. Consequently, Srivastava *et al.* (2012) urges restriction among other things, about family size as that will positively impact the nutritional status of school children. In a study by Pelto *et al.* (1991) and reported by Babar *et al.* (2010) examining the degree to which household size is related to the nutritional status of school aged children (7-9 years) in Mexico, children from large households were found to be significantly shorter and consumed poor quality

diets as assessed by intake of food from animal sources. In large families, deprivation of maternal care was reported to exist. Fewer children were said to be indicative of better maternal care, a better share of family resources and better health of family members. Furthermore, Kumari (2007) in a study exploring the variances of nutritional status in school aged children (6-11 years) and the associated factors observed that families with more number of children paid less attention to the fulfilment of nutritional requirements of the children. Families with a single child on the other hand recorded the highest percentage of normal children (44.4%). The proportion of normal children decreased significantly with an increasing family size. For instance, in a family of six children, the proportion of normal children declined to about 8.82%. Also, as the number of children in the family increased, the severity of malnutrition was said to increase, depicting the effect of family type on the nutritional status of children.

2.5.4 Religion and cultural practices

In every human society, food is consumed for both nutritional and cultural purposes (Fieldhouse, 2013). But the latter influences the former in two ways. In the first instance, culture may forbid the much needed nutritional substances from the diet by classifying them as profane, non-food, taboo, lower or higher class food, alien etc. In the second instance, culture may promote certain foods and drinks by labelling them as food, medicine, sacred or as a sign of age, gender, social, ethnic or religious identity, which are deleterious to health and nutrition (Meyer-Rochow, 2009). Therefore, in a society where the two influences co-exist persistently, there will be an increased risk of malnutrition in households where both children and mothers are in need of more nutrients due to their critical physiological status (Mengesha & Ayele, 2015). Dettwyler (1993) in a study on child malnutrition in Mali, described various interconnected factors. She reckons that only relative poverty

cannot explain completely the disparity in diet and nutritional status in a community and that there is no correlation between rising income and increase in quality and improvement in the nutritional quality of the diet. Hence, a variety of cultural, social and biological factors contribute to a child's poor growth.

In a study by Danquah *et al.* (2013) of the nutritional status of upper primary pupils in a rural setting in Ghana, BMI values showed that the pupils were generally underweight. This was attributed to the presence of certain taboos, particularly in some rural settings which forbid the intake of certain food items. The authors argued that such practices have the capacity to influence the food choices people make which affects their nutritional status in the long run. Similar sentiments are perhaps shared by Booth *et al.* (2001) and Amos *et al.* (2012) who assert that religious, social and political beliefs are factors that inform the food choices one makes. In another development, however, Babar *et al.* (2010) argues that literate mothers can impact the health of their children defying traditional beliefs and attitudes towards health, thus resulting in a greater preparedness to accept developmental and utilize modern healthcare.

2.6 Health challenges of school aged children

2.6.1 Sanitation and hygiene factors

Hygiene is very critical for living a healthy life devoid of diseases. Inadequate sanitary conditions and poor hygiene practices play key roles in the increased burden of communicable diseases in developing countries (Vivas *et al.*, 2010). A bulk of the health problems that affect school children can be prevented by promoting hygienic practices via proper health education by the teachers who

are the first point of contacts. Hygiene also plays an important role in preventing some of the familiar communicable diseases which are mainly spread via food, water, personal contact and the surrounding environment. With the practice of good hygiene, a lot of the diseases that spread from virus, protozoa and bacteria can be prevented. By teaching children the significance of good hygiene, they can imbibe habits that will improve their health in the long run (Onyango-Ouma, 2005). Initiating healthy habits at a younger age will help older children evolve into adults with routine hygienic practices. The issues of “water, sanitation and hygiene” (WASH) have been firmly established on the global agenda. The abandonment of hygiene is to blame for why water and sanitation programmes have failed to rope in the expected benefits (Motakpalli *et al.*, 2013).

Close to all under-five deaths globally are said to be due to undernutrition (Black *et al.*, 2013). Undernutrition is expressed as an outcome of inadequate food intake or nutrient absorption and recurrent infectious diseases and manifests as stunting (low height-for-age), wasting (low weight-for-height) and micronutrient deficiencies. According to UNICEF-WHO-World Bank Group (2015), 159 million and 50 million children worldwide were stunted and wasted respectively in 2014, with an estimated 2 billion people said to suffer from micronutrient deficiencies (Bailey *et al.*, 2015). It is estimated by the World Health Organization that 50% of undernutrition are linked with infections caused by unsafe water, insufficient hygiene or inadequate sanitation (WHO, 2008). The central role played by safe water, personal hygiene and sanitary disposal of human waste in health has long been recognized. Water, sanitation and hygiene (WASH) interventions, such as delivery of clean piped drinking water, promotion of hand washing with soap and improved facilities for excreta disposal are regularly implemented to improve health and reduce infectious diseases and may be related to child development outcomes (Dangour *et al.*, 2013).

School aged children make up a considerable proportion of the world's population, accounting for about 15% of the developed world (Haboubi & Shaikh, 2009) and 24% of the developing world (Sharriff, Jenny & Nan, 2000). School age according to Haboubi & Shaikh (2009) is a critical period in human development and the school environment provides a tactical point of entry for enhancing child health, self-esteem, life skills and behaviour. Several studies assessing the state of hygiene among school aged children as reported by Motakpalli *et al.* (2013) made similar observations of common unhygienic practices such as bad oral hygiene, dirty nails, dirty hair, dirty uniforms and unclean tongue and ears.

Panigrahi & Chandan Das (2014) in their study on undernutrition and its correlates among children aged 3-9 years reported two independent predictors of stunting. In this study, children resident in households without toilet facilities was found to be 1.5 times more likely to be stunted compared to children living in households with toilet facilities. It is argued by the authors that the absence of toilet facilities in households encourages open defecation which makes it easy for waterborne diseases that can adversely affect the health and nutrition of young children. The study also observed that children living in households with substandard drinking water storage practices were 2.2 times more likely to be stunted relative to children living in households with adequate drinking water storage practices. In another study, Merchant *et al.* (2003) also found that children who come from homes with water and sanitation had a 17% more chance of reversing stunting than children coming from homes without any of these facilities. Similar findings have also been attributed to Bantamen *et al.* (2014) and Demissie & Worku (2013).

According to Dewey and Adu-Afarwuah (2008), there is indication from research that insufficient dietary intake alone is not accountable for the global burden of stunting and that diet-related interventions have failed to normalize growth. A recent multiple-country study by Checkley *et al.* (2008) for example, found that poor sanitation attributable to diarrheal diseases was responsible for about 25% of stunting in children up to 2 years. Elsewhere, Lin *et al.* (2013) from an observational study found that environmental contamination as a consequence of open defecation resulted in linear growth faltering through environmental enteropathy; and that children who live in clean household environments had a 22% stunting lower than their colleagues living in dirty environments.

Available evidence is also suggestive of the fact that sanitation can prevent and reduce the levels of stunting. Esrey (1996) found improvements in sanitation to be associated with increases in height-for-age and length-for-age scores from an analysis of cross-sectional data from eight low and middle-income countries. Similarly, Christiaensen & Aldreman (2004) found comparable results from a longitudinal study in Peru, where poor water sources and storage and inadequate disposal of sewage were said to account for a 1cm height shortfall in children aged 2 years when compared to those living with better water and sanitation conditions. In the same study, however, diarrhoea was found to be responsible for 16% stunting whereas access to water and sanitation services accounted for 40%.

2.6.2 Deworming of children

It is estimated that more than one third of the world's population is infected with worms, with over 600 million school-age children with infections living mostly in Sub-Saharan Africa and East Asia (WHO, 2017). Children in the poorest countries are likely to be infected from the time breastfeeding

is terminated, and continue to be infected and re-infected for the rest of their lives (Pullan *et al.*, 2014). Worm infection is a long-term and chronic infection and can have adverse effects on all aspects of a child's development; nutrition, health, cognitive development, educational access, learning and achievement (Haddad, Alderman, Song and Yohannes, 2003).

According to Luong (2003), the highest worm burden and rate of infection in school children between the ages of 5 – 15 years was attributed to deplorable sanitation and hygiene practises. Close to 400 million children particularly of school-aged worldwide have helminth infestations. These are commonly caused by hookworm, roundworm and whipworm, and a large fraction of these children are found in the East Asia region such as China, Cambodia, Thailand and Vietnam (Khor, 2003). Malnutrition occurs as these parasites obtain nutrients from the infected children, resulting in a decrease in their usual physical development. In addition to that, damage is caused to tissues and organs of these children which often results in diarrhoea, abdominal pains, anaemia, intestinal obstruction, ulcers as well as other health problems. These consequences of worm infection in children can retard cognitive development, therefore impairing learning and leading to poor school performance (Walker, 2007). It is important to observe that stunting of children's growth as a result of worm infections may not be readily recognized because it occurs almost unnoticeably over time. Therefore, the full impact of helminthic infection is often hugely overlooked or under-reported (Sapkota, 2010).

De-worming school children through the use of anthelmintic drugs constitutes a curative approach to eliminating the worm load among children. Drug therapy alone, however represents only a short term mechanism for reducing worm infection in a target population. Re-infection is recurrent and

occurs within a short period. The adoption of control measures in schools and communities via improved hygiene and sanitation together with deworming is necessary to prevent infection and re-infection (Luong, 2003) and improve nutritional status (Fig 2.3).

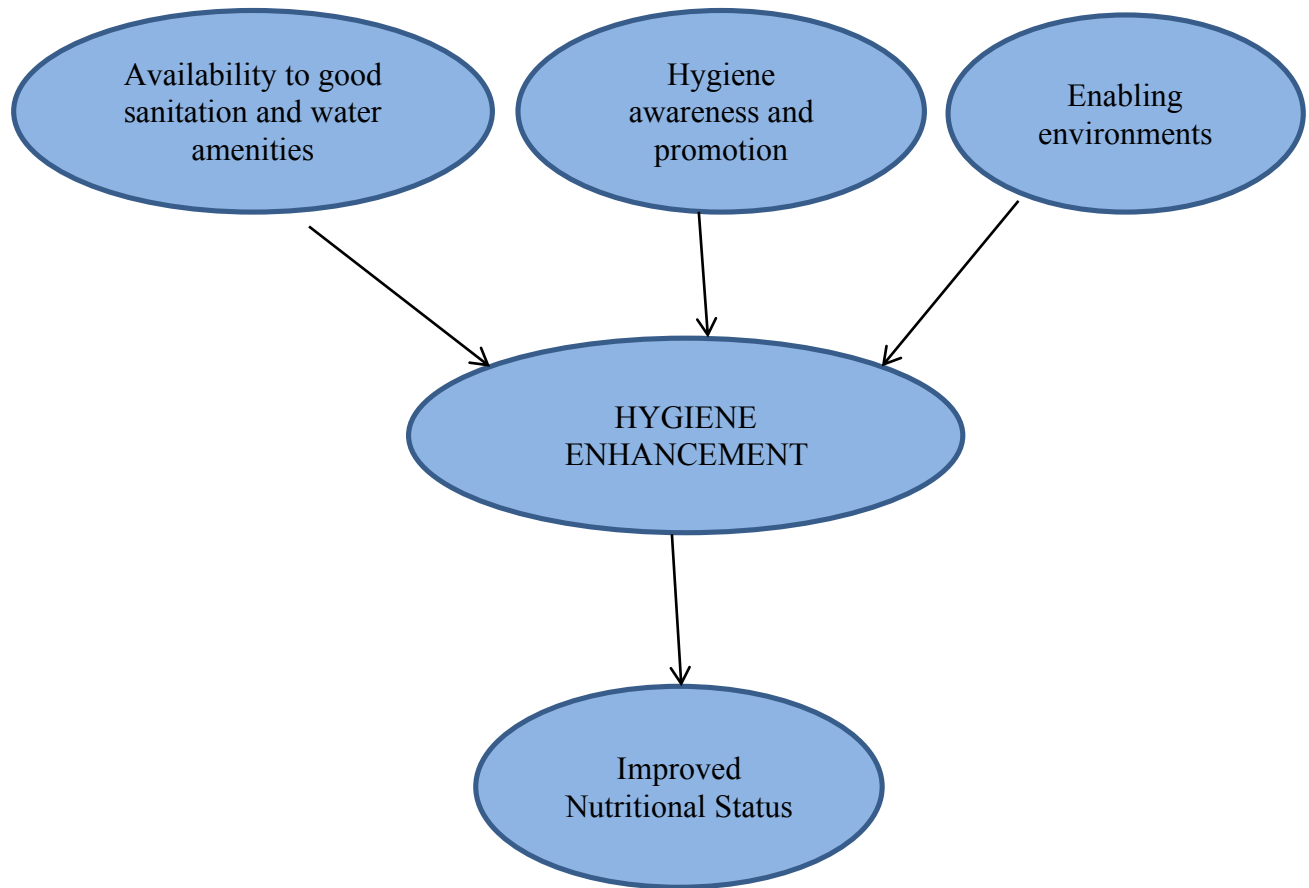


Figure 2.3: Hygiene improvement framework

For years, the United Nations Children’s Fund (UNICEF) through the Water Environment and Sanitation (WES) programme, have assisted in the facilitation of water, good hygiene education and proper sanitary facilities to schools. Presence of these segregated toilet facilities in schools, school children have been suggested to improve child’s enrolment (Luong, 2003). According to Brooker *et*

al. (2001), findings from large-scale deworming activities in Tanzania as well as Ghana revealed that through deworming, children along with parents could realize benefits such as better health and enhanced performance at school. Over 90% of the parents in the programme schools in both countries indicated a preparedness to continue to pay for treatment through the use of drugs.

Deworming programmes for children have proven not only to be an effective educational tool but also an entry point to create demand for use of safe water and enhanced hygiene behaviour change (Bundy et al., 2009. Lidonde, 2004). A case in point is a successful pilot project that was implemented in 10 villages in West Bengal, India. This project promoted a combination of practices that comprised deworming young children, building toilets for families, hygiene education and chlorination of drinking water at the household levels by housewives. Within 12 months of intervention, diarrhoea had reduced by 80% (Luong, 2003 and Luong 1987). The project demonstrated that behaviour change would not be achieved through hygiene education alone unless it is complemented by the availability of safe drinking water and facilities tailored towards the improvement of sanitation in an enabling environment (Luong, 2003 and Luong 1987). Regular deworming as contended by World Bank (2003) improves children's health and subsequently leads to increased enrolment and attendance, a reduction in class repetition and improved educational attainment. Children who are disadvantaged the most such as girls and the poor tend to suffer most from ill-health and malnutrition and derive the most benefits from deworming.

Results from a randomized evaluation of school-based mass deworming exercise for intestinal worms and schistosomiasis in Kenya achieved a one-quarter reduction in absenteeism (Miguel and Kremer, 2002). Deworming has been reported to be a cost effective approach to improve participation of

school children in a variety of interventions (Lidonde, 2004). For instance, an additional year of primary school was acquired by investing US\$ 4 in deworming, as opposed to US\$ 38 –US\$ 99 for other interventions (Miguel & Kremer, 2002). In Southern USA, the Rockefeller hookworm control programme in the early part of the 20th century achieved a similar reduction (23%) in absenteeism. Long-term effect of the benefits of a hookworm-free childhood on labour income is suggested to be around 45% of adult wages (Bleakley, 2002). Deworming provides a high return for education and labour income and therefore is an efficient investment in human capital (World Bank, 2003). The uses of albendazole and mebendazole have been described as inexpensive way for the treatment of worm infestation (World Bank, 2003). These are known to be safe and present minimal side effects. The WHO recommends annual deworming of all children once and twice in areas where prevalence of worm infestation is over 20% and 50% respectively (Croke, 2014).

2.7 Benefits of breakfast

According to Lockheed (1991), the numbers of children enrolled in school in developing countries have increased especially in the past decade. However, their achievement levels have often been unsatisfactory. It has been proposed that poor health and nutrition may thwart the ability of these children to learn and one of the conditions that have been implicated is hunger in schools (Smith and Ashiabi, 2007). Several studies have reported that missing breakfast adversely affects children's cognition, creativity, hand-eye coordination and physical activity (Edefonti *et al.*, 2014; Eisenberg *et al.*, 2004). In a recent study by Chang and others however, it was observed that providing breakfast was beneficial to children's classroom behaviour only if they were in well-organized and well-equipped schools. On the contrary, the behaviour of children in overcrowded and poorly organized schools actually worsened (Chang *et al.*, 1996).

Breakfast consumption has been identified to be associated with better cognitive ability and academic performance as well as long-term school-based studies (Taras, 2005 and Rampersaud *et al.*, 2005). There have been reports on the positive effects of breakfast on memory as documented by Wesnes *et al.* (2003). Other studies have shown that breakfast consumption is associated with increased attention or concentration (Wesnes *et al.*, 2003; Benton & Jarvis, 2007), creativity or idea generation (Wyon *et al.*, 1997), reasoning (Lopez-Sobaler *et al.*, 2003), vocabulary (Jacoby *et al.*, 1996) and problem solving/addition/math (Wyon *et al.*, 1997). Breakfast when consumed may also have positive effects on students' psychosocial function (Kleinman *et al.*, 2002). According to Utter *et al.* (2007), breakfast consumption in children reflects better food choices high-fibre/low fat foods, more fruits and vegetables and dairy products and may be less likely to consume unhealthy snacks or high fat foods.

Furthermore, Grantham-McGregor (2005) argues that even though children may be in school, their attention to a learning task may be compromised by hunger. Given that the quality of teaching and child's aptitude is held constant, the real duration of time spent concentrating during a task is perhaps the most crucial aspect of the learning process. Provision of breakfast to relieve hunger, may enhance a pupil's capacity to concentrate, thereby facilitating the learning process. Providing breakfast may also develop children's memory so they are more likely to learn. In a study conducted in Jamaica, the provision of breakfast was found to improve attendance and arithmetic scores compared with their control counterparts. The increase in arithmetic was found to remain after taking into account increased attendance. No effect on weight or spelling was reported. The mechanism of the arithmetic improvement, the authors suggest was due to the reduction of short term hunger (Mahoney *et al.*, 2005).

2.8 Food security in Ghana

Food security may be defined in many ways to highlight different components. The Ministry of Food and Agriculture defines food security as “good quality nutritious food hygienically packaged, attractively presented, available in sufficient quantities all year round and located at the right place at affordable prices” (Nyanteng and Asuming-Brempong, 2003). According to FAO (1996), food security epitomizes a situation in which “all people at all times, have physical and economic access to sufficient, safe and nutritious food which meets their dietary needs and food preferences for an active and healthy life”. Food security is composed of four main elements; the availability of food, access to food, utilization of food and stability (Gregory *et al.*, 2005). Availability of food examines the degree to which sufficient food is physically present in an area in both quality and quantity. This comprises food produced on home gardens or local farms, food found in the market as well as food provided as gifts or food aid. Access to food comes to play when communities, households and individuals have adequate resources to obtain sufficient food for a nutritious diet. This is usually achieved via a combination of home production, purchase, stocks, gifts, barter, food aid or borrowing. Utilization of food looks at an individual’s ability to obtain nutrients and energy from food for a healthy life (McMichael *et al.*, 2007). The achievement of adequate food utilization takes account of essential components such as adequate sanitation, proper child care practices, safe drinking water, a diet with sufficient energy and nutritional value and knowledge of food processing and storage. Stability refers to both availability and access to food (Hjelm & Dasori, 2012 and FAO, 1996).

FAO (2008) advances that food security is directly linked to factors such as poverty, absence of employment, increase in food prices, lack of education, poor access to markets and climate and

environmental conditions. Climate change may not be considered as the single most important cause of food insecurity, but a significant driver of food system performance at the farm end of production-related income. Food security according to Yaro & Hesselberg (2010) more depends on the socio-economic conditions as opposed to agro-climatic ones, and also on food accessibility rather than production. Food insecurity has been a long-standing developmental challenge for the African continent which has become further convoluted due to its interconnectedness with social, economic, political, technological and environmental systems (Garrity *et al.*, 2010). As the undeniable effects of climate change grow, the call for all levels of responses (global, national, regional right down to household) is becoming an increasing imperative. The changing climate is thereby fundamentally connected with global food security, taking into account the mechanisms of food systems (Burton *et al.*, 1993).

In Ghana, food security continues to be at risk, among other things by the seasonal and unstable domestic production, low household incomes, high food prices and inflation, and persistent high unemployment levels (Godfray *et al.*, 2010). Attempts to effectively address the many causes of food security in the country have been elusive. Nevertheless, the role of agriculture to supply sufficient food for the rapidly growing population continues to remain high on the agenda of successive governments. Food security at the household level has become an important issue because of the pervasive poverty in the country (Nyateng & Asuming-Brempong, 2003). The problem of food security exists across all of the agro-ecological zones, in both rural and urban areas although poverty is more evident in the rural areas. It is suggested that many households do not eat three meals a day, talk less the nutritional adequacy and safety of what they eat (Nyateng & Asuming-Brempong, 2003).

Agriculture has been identified to contribute both through direct and indirect ways to the availability and accessibility of food. It contributes directly by providing majority of the food commodities consumed yearly (Quaye, 2008). Another contribution is in the provision of foreign exchange through earnings from exportation, which allows the country the ability to import the deficit in the local production of food crops. Indirectly also, the sector provides employment to those who are economically active, thus allowing them to earn incomes. Major food commodities produced include roots and tubers (yam, cassava, and cocoyam), cereals (maize, millet, rice and sorghum), vegetables (tomato, pepper, onions, garden eggs etc.), plantain, fruits (pawpaw, banana, orange etc.), livestock (sheep, goats, cattle, pigs, poultry etc.) and fish. The per capita food production is characterized by annual fluctuations, besides being seasonal. The shortfall in domestic food production is filled with imports such as cereals (maize and rice), edible oils, canned tomato puree, onions, frozen and canned fish, fresh and canned red meat etc. (Nyateng & Asuming-Brempong, 2003).

Ghana is self-supporting in the production of tubers, plantain, staple roots and cereals, with the exception of rice that large volumes are imported yearly. The country is however capable of attaining self-sufficiency in the production of rice in the medium term (Nyateng & Asuming-Brempong, 2003). A product such as wheat is not produced in the country and therefore its requirements are met through imports annually. Ghana is also deficient in the production of all types of meat, dairy products, fish, onions and edible oils. However, the level of self-sufficiency in these commodities can be raised in the country in the medium term except dairy products that has a long term potential (Nyateng & Asuming-Brempong, 2003).

CHAPTER THREE

3.0 METHODOLOGY

3.1 Research design

This study engaged a comparative cross-sectional study design, carried out in the Kwabre East district in the Ashanti Region and Tolon district in the Northern Region of Ghana of school aged children enrolled in the Ghana School Feeding Programme.

3.2 Research site

This research was carried out in both the Ashanti region and the Northern region of Ghana due to the fact that there are a great number of school aged children enrolled in the GSFP from these regions. These two regions also vary in terms of ecological and geographical characteristics. Out of the twenty seven (27) and twenty six (26) districts in the Ashanti and Northern Region of Ghana respectively, Kwabre East and Tolon districts were purposely selected because they were among the first districts where the GSFP was initially implemented and the programme has been in existence for 10 years.

3.2.1 Kwabre East district

The Kwabre East District is one of the 27 administrative districts in the Ashanti Region with its capital Mampong. It is located approximately 14.5 kilometres from Kumasi and covers an area of 123 square kilometres (km²) in total. According to the Population and Housing Census, 2010 (GSS, 2013 a) the district has a population of 115,556 in total. The vegetation there is predominately semi-

deciduous forests with two planting seasons due to the District's double rainfall pattern: April to June marks the first rainy season and the second rainy season is usually from September to October. The dry season normally lasts from November to February (Chao, 1999). Wadie-Adumakase is one of the major towns in the district with a population of about 602 children (GSS, 2012). The Wadie-Adumakase (W-A) Methodist Primary and Wadie-Adumakase (W-A) District Assembly (DA) Primary School are the two main schools in the town benefitting from the Ghana School feeding programme.

3.2.2 Tolon district

The Tolon district in the Northern region of Ghana was formally part of the Tolon/Kumbungu District. It is one of the 26 districts with its capital town being Tolon. It is located in the outskirts of Tamale. The population in 2010, during the Population and Housing Census of the District, was 72,990 which represents approximately 2.9 percent of the Northern region's total population (GSS, 2013b).

The main vegetation is grassland, interspersed with guinea savannah woodland. The district has a single rainy season from late April to October or early November and is characterised by very little rainfall. The dry season which is often very severe starts in November and ends usually in March. Temperatures may range from 33°C to 39°C during the day. The major crops grown are therefore mostly drought-resistant such as shea nut trees (*Vitellaria paradoxa*), the baobab (*Adansonia digitata* Linn), the African Locust bean tree usually known as dawadawa, and the neem (*Azadirachta indica*). There is only one tarred road linking Tolon the district capital through Nyankpala to Tamale although there are many feeder roads. Nyankpala, one of the four town council was selected as a study area.

The main settlement there is linear and there are two main schools benefiting from the Ghana School Feeding Programme there. The Wuribo-Kukuo (W-K) T.I Ahmadiya School, a predominantly Muslim school with a total of 281 pupils and the Amy Memorial Ebenezer (AME) Kpalsogu Primary mostly Christians with a total of 274 pupils.

3.3 Study population and enrolment

The study involved school children aged between 6 to 12 years who were benefiting from the GSFP in the selected/participating schools. The inclusion criteria included the following:

1. The child should be aged 6-12 years.
2. School children should have started GSFP for at least one year prior to the study data collection point.
3. The willingness of the child to participate in the study.

Children whose parents did not give consent to be in the study and had conditions that interfere with dietary intake and other chronic conditions known to affect nutritional status were excluded in this study.

3.4 Sample size and sampling

In both regions, the study was carried out in two selected public basic schools. The names of all the twenty four (24) and twenty three (23) schools on the GSFP in the Kwabre East and Tolon districts respectively were obtained from the district assemblies. Simple random sampling technique was used to select the two schools for the study. The sample size was calculated using the formula:

$n = Z^2_{1-\alpha/2}[p^1(1-p^1)+ p^2(1-p^2)]/d^2$ (Lwanga,1991), where p was the anticipated population proportion of anaemia prevalence in each region assumed to be 50%, d = absolute precision of 5% and Z= the statistical certainty chosen to be 1.96 at a confidence level of 95%. A total of 150 school aged children was calculated per region. Proportional distribution was used to obtain the number of study participants from the selected schools based on the number of students enrolled. Simple random sampling technique was used to select the study children who meet the criteria for inclusion in the study.

3.5 Recruitment and training of field assistants

The study employed four field enumerators used predominantly for data collection. These field enumerators were trained by the researcher on how to administer the questionnaire and how to take the anthropometric measurements. Inconsistencies encountered during the training section were identified and addressed before data collection began.

3.6 Ethical considerations

Ethical clearance was obtained from the Ethics committee of the College of Basic and Applied Sciences (ECBAS) at the University of Ghana. Permission to carry out the study was also sought from both District Education Offices in the Tolon and Kwabre East districts. In addition to that, the head teachers of the various schools were requested to inform the parents of the study children to facilitate the processes of obtaining their consent for both they and their wards to be involved in the study. Pupils whose parents gave consent were then recruited into the study. The parents were assured of confidentiality in the management of the information that they would provide. The questionnaire

did not include the names of both the children and the parents. Additionally, verbal assent was sought from all pupils who meet the criteria before the study began.

3.7 Data collection procedures

Data collection took place between September 2016 and March 2017. Pretested questionnaire was employed to collect data on socio-demographics (background characteristics), anthropometric measurements, sanitation and morbidity, dietary assessment using 24-hour recall and a seven (7) day food frequency questionnaire and haemoglobin measurements.

3.7.1 Background information

This included the age, gender, class, ethnicity, religion, the occupation and educational level of parents or caregivers.

3.7.2 Anthropometric measurement

Anthropometry is a rapid process and a good tool to measure the nutritional status of a given population. It is quite objective and the technology for its application is simple (Duggan, 2010). The anthropometric indicators commonly applicable to child growth monitoring and development from 5 to 19 years are usually height-for-age, and BMI-for-age (WHO, 2006).

3.7.2.1 Weight measurement

The weight of each pupil was determined using a digital scale (Seca, 874). The child stood alone on the calibrated scale placed on a hard floor. The children were weighed in minimal clothing where possible and were barefooted. The scale was reset to zero before the child stood on. The child was placed in the centre section of the scale, with feet a little slightly apart. The child was still, but relaxed. The weight was taken twice and both measurements were recorded to the nearest 0.1 kg. The average of the two was then used for data interpretation (WHO, 2008).

3.7.2.2 Height measurement

A stadiometer with a sliding height rod was used to measure the heights of the children. The stadiometer was placed on the hard floor and the children were asked to take off shoes and other heavy outfit. The children stood on the baseboard with feet a little slightly apart with the back of the head, buttocks and legs all touching the upright rod. The child's head looked straight forward so that the chin was parallel to the baseboard (Gibson, 2005). To keep the child in this position a hand was placed under the chin and the other hand was used to lower the height rod to be placed on top of the head of the child, compressing the hair. Measurements were read out and recorded in centimetres (cm) to the nearest 0.1 cm. Measurements were recorded after being taken twice and the average of the two was used for data interpretation (WHO, 2008).

3.7.3 Dietary assessment

Dietary information was taken using the repeated 24-hour recall, a seven (7) day food frequency and the weighed food method.

3.7.3.1 Repeated 24-hour recall

With the aid of food models, participant's dietary intake was assessed using a three consecutive day 24-hour dietary recall. Participants were asked to recall all the food, including snacks and drinks they had consumed a day prior to the interview on each of the days. The children were asked to indicate where they had consumed and received the food: indicate whether the food was bought, prepared at home or in the school. This was scheduled and conducted on two school days and another on the weekend. With the food from the school feeding programme, details of all methods of preparation and the ingredients used were asked from the head Cooks at the various schools and recorded.

3.7.3.2 Food frequency questionnaire

A pretested food frequency questionnaire was used to collect the information about all the types of food the children had consumed within the last 7 days, according to FAO, (2011) nine food groupings: starchy staples, meat and fish, legumes, nuts and seeds, eggs, milk and milk products, Vitamin A rich fruits and vegetables, other fruits and vegetables, dark green leafy vegetables and organ meat. The number of times they had consumed a particular food in the food group in the last seven (7) days was indicated.

3.7.3.3 Weighed food intake

Randomly selected foods fed to 20 children by the school feeding programmes from each school for two consecutive days were weighed to estimate the average amount of food that children were fed with within the course of the week. Portions of food were weighed onto a plate and the description of the food was recorded. Brand names used in the preparation and detailed description of the method

of preparation of each meal were asked and recorded. Any leftovers from the children's bowls was also recorded so as to get the precise weight of the meals consumed by the school children.

3.7.4 Haemoglobin concentration assessment

Haemoglobin concentrations were measured using the URIT-12 haemoglobin meter. This analysis was done following the standardised procedures stated by the URIT-12 haemoglobin meter operation manual. For the haemoglobin analysis; the code card was inserted into the code slot of the URIT-12 haemoglobin meter for the haemoglobin meter to read the code. The code card was then removed from the code slot and meter turned off. The haemoglobin meter was turned on again to verify if the displayed code on the screen of the haemoglobin meter matched with the code printed on the label of the URIT-12 haemoglobin text strips container. Then each participant was asked to sit comfortably in front of the researcher and his/her middle finger was first massaged to stimulate blood flow. The sample area of the participant's middle finger was cleaned thoroughly with an alcohol pad to sterilise and wiped dry with a cotton wool. When the haemoglobin meter prompted, the haemoglobin test strip was inserted into the strip holder of the URIT-12 haemoglobin meter with the hole facing upwards and the notched end in, while ensuring that the test spot of the strip was not damaged during the process. The cleaned sample area of the participant's middle finger was pricked with a new sterile lancet needle and a gentle pressure applied after the finger prick to obtain a blood drop. The drop of blood was then immediately applied to the test strip. The study children's haemoglobin level results were then read and recorded to the nearest 0.1 g/l.

3.8 Data analyses

The data were cleaned and analysis was conducted using the Statistical Package for Social Sciences (SPSS/PC, version 22). Anthropometric measures (height and weight) were converted to age- and sex- standardized z-scores (weight-for-age and BMI-for-age) using the WHO Anthroplus version 10.4 (WHO, 2006). The data from the 24-hour recall were converted to energy and macro and micro nutrient using both the Ghana Food composition table (Eyeson and Ankrah, 1975) and the one compiled during the RIING project and used by Owusu *et. al*, (2017). The average of the energy and nutrients calculated from the foods eaten both at home and during school (in the school feeding programme) was compared to the Estimated Average Requirements (EAR) using the Institute of Medicine (Alessi and Butler, 2015) to find the cut-offs for protein, vitamin A, folate, vitamin B₁₂, zinc and iron. Five percent (5%) and ten percent (10%) adjustments were made to the actual dietary intake values calculated for each child for iron and zinc, respectively, to reflect the low bioavailability and the inhibitory nature of major cereal-based diet of the school aged children (WHO/FAO, 2004). Estimated Average Requirement of protein for each child was calculated by multiplying body weight (kg) with the dietary reference value of 0.76g/kg/day for children 6-12 years (Alessi and Butler, 2015). The value calculated for each child represented the EAR for that particular child. Thus, protein consumed by each child from the 24-hour recall was compared to his or her calculated EAR and percentage adequacy was obtained. The estimated energy requirement for each child was calculated individually by multiplying age- and sex-specific values from FAO/WHO/UNU (2004) to the body weight (kg) of each child assuming that each child had a moderate level of physical activity. The value obtained for each child represented the EAR for that particular child. To evaluate the number of children who obtained adequate intake, the proportion of children who met or exceeded the EAR were calculated. To assess the energy and nutrients eaten from the Ghana School Feeding Programme

(GSFP) meal, weigh food record for two consecutive school days was recorded for each child. These values were used in the final analyses.

Descriptive statistics were used to summarize continuous and categorical variables. Means, standard deviation (SD) or standard errors (SE) were used in reporting continuous variables, and frequencies and proportions for categorical variables. Chi-square tests were used to assess the association between categorical variables. The children from the two different regions were compared using Analysis of covariance (ANCOVA) for continuous outcome variables (Height-for-age Z-score, BMI-for-age Z-score, haemoglobin levels, dietary diversity, and energy and nutrient intakes) for objectives 1, 2, 4 and part of objective 3 with LSD adjustment for comparisons. Independent variables were background characteristics of the studied children. Only covariates significantly associated with an outcome variable at 10% level of significance in a bivariate analysis were included in the final adjusted analyses. The results were reported as adjusted means and SE. Chi-Square tests with Pearson correlation was used to compare the categorical variables (stunting, thinness and anaemia) and the proportion of children who met the EAR of energy and other nutrients between the two regions. Logistic regression analysis was used for analysis objective 3. Dependent variable used in the logistic regression analysis was undernourished (nutritional deficit in one of the following or all the following; stunting, thinness and anaemia). Independent variables were energy and nutrient intake as well as dietary diversity of the study children.

3.9 Quality assurance

To ensure the validity of the information gathered, the following measures were adhered to;

1. Pretesting of the questionnaire was done to ensure a good representation of the needed information, clarity and consistency of the questionnaires.
2. The instruments used were calibrated daily before use during the data collection period
3. For each child, each measure was taken twice to ensure there was no errors
4. The standard procedures were used to take all the measurements.

CHAPTER FOUR

4.0 RESULTS

4.1 Background characteristics of study children

A total of 300 school children (6-12 years) were enrolled into the study, 150 children each from the selected schools in Kwabre East and Tolon districts of Ghana. The socio-demographic status of the school children in the study are shown in Table 4.1.1. The mean ages of the children were 10.1 ± 1.6 and 9.6 ± 1.8 in the Kwabre East and Tolon districts respectively, with a total mean age of 9.9 ± 1.7 . Children in the two study districts significantly differed by class, ethnicity and religion ($p < 0.01$). By ethnicity, children from the Tolon district were predominantly Northerners (100%) while 80% of the study children in the Kwabre East district were Akans. By religion, 96% of children in the Kwabre East were Christians and 96% of the children in the Tolon district were Muslims. No significant differences were observed by sex ($p < 0.49$) and age of child ($p < 0.06$) in both districts

Among the 300 caregivers interviewed (Table 4.1.2), 73% of the caregivers of the studied children in the Kwabre East district were their biological mothers while that of the children in the Tolon districts were their biological fathers (53%). About 76% of caregivers were married. Also, 58.7% and 47.3% of the mothers and fathers respectively, had no formal education with significantly more mothers and fathers from the Tolon district having no formal education ($p = 0.01$). Almost half (49%) of the mothers in the Kwabre East district were traders while 44% of the mothers in the Tolon district were farmers. Fathers from the two regions significantly differed by occupation ($p = 0.01$), with 81% of the farmers in the Tolon district being farmers and diverse variation of occupations among the

fathers in the Kwabre East district. No significant differences were observed by age of care givers (p<0.26).

Table 4.1.1. Socio-demographic status of school aged children in the Kwabre East and Tolon districts

Variables	Kwabre East District n (%)	Tolon District n (%)	Total n (%)	p- value
Age of child	10.1±1.6*	9.6±1.8	9.9±1.7	0.01
6-9 years	53 (35.3)**	69 (46.0)	122 (40.7)	
10-12 years	97 (64.7)	81 (54.0)	178 (59.3)	0.06
Sex				
Male	72 (48.0)	78 (52.0)	150 (50.0)	
Female	78 (52.0)	72 (48.0)	150 (50.0)	0.49
Class of Child				
Lower primary	63 (42.0)	86 (57.3)	149 (49.7)	0.01
Upper primary	87 (58.0)	64 (42.7)	151 (50.3)	
Ethnicity				
Northern	22 (14.7)	150 (100.0)	172 (57.3)	<0.01
Akan	120 (80.0)	0 (0.0)	120 (40.0)	
Ewe	8 (5.3)	0 (0.0)	8 (2.7)	
Religion				
Christian	144 (96.0)	6 (4.0)	150 (50.0)	<0.01
Muslim	5 (3.3)	144 (96.0)	149 (49.7)	
Other ¹	1 (0.7)	0 (0.0)	1 (0.7)	

* Mean ± standard deviation; **n (%); ¹Significance based on independent T-test for continuous variables and chi-square for categorical variables; ¹ represent traditionalist.

Table 4.1.2 Socio-economic status of caregivers of the school aged children in the Kwabre East and Tolon districts

Variables	Kwabre East (n=150) n (%)	Tolon district (n=150) n (%)	Total (N=300) n (%)	p value
Age of Caregiver	38.6±11.5*	39.9±12.3	39.3±11.9	0.34
19-29 years	31 (20.7)**	24 (16.0)	55 (18.3)	
Over 30 years	119 (79.3)	126 (84.0)	245 (81.7)	0.26
Relation to child				
Biological mother	110 (73.3)	45 (30.0)	155 (51.7)	
Biological father	17 (11.3)	80 (53.3)	97 (32.3)	<0.01
Others relatives ¹	23 (15.4)	25 (16.7)	48 (16.0)	
Marital status of caregivers				
Single	37 (24.7)	10 (6.7)	47 (15.7)	
Married	95 (63.3)	133 (88.7)	228 (76.0)	<0.01
Others ²	18 (12.0)	7 (4.7)	25 (8.3)	
Level of education (mothers)				
None	37 (24.7)	139 (92.7)	176 (58.7)	
Primary	32 (21.3)	7 (4.7)	39 (13.0)	<0.01
Middle/JSS/JHS	79 (52.7)	2 (1.3)	81 (27.0)	
Secondary/Vocational/Technical	2 (1.3)	2 (1.3)	4 (1.3)	
Level of education (fathers)				
None	30 (20.0)	112 (74.7)	142 (47.3)	
Primary	29 (19.3)	20 (13.4)	49 (16.3)	
Middle/JSS/JHS	75 (50.0)	5 (3.3)	80 (26.7)	<0.01
Secondary /Vocational/Technical	12 (8.0)	11 (7.3)	23 (7.7)	
Others ³	4 (2.7)	2 (1.3)	6 (2.0)	
Occupation of mother				
Not working	44 (29.3)	58 (38.7)	102 (34.0)	
Farmer	15 (10.0)	66 (44.0)	81 (27.0)	<0.01
Trader	73 (48.7)	23 (15.3)	96 (32.0)	
Artisans	18 (12.0)	3 (2.0)	21 (7.0)	
Occupation of father				
Not working	8 (5.3)	25 (16.7)	33 (11.0)	
Farmer	43 (28.7)	121 (80.7)	164 (54.7)	
Trader	44 (29.4)	1 (0.7)	45 (15.0)	<0.01
Artisan	29 (19.3)	2 (1.3)	31 (10.3)	
Other ⁴	26 (17.3)	1 (0.7)	27 (9.0)	

* Mean ± standard deviation; **n (%); ¹ Significance based on independent T-test for continuous variables and chi-square for categorical variables; ¹ represent uncles, aunties & grandparents; ² includes divorcees & widows/widowers; ³ represents Tertiary; ⁴ includes drivers & public servants.

4.2 Biochemical and anthropometric indices of the study children

The mean HAZ of children from the Kwabre East and Tolon districts were -0.24 ± 0.24 and -0.41 ± 0.24 , respectively (Table 4.2). The HAZ as well as BAZ were not significantly different from each other ($p > 0.05$). Even though the mean haemoglobin concentration of children from Kwabre East district (13.4 ± 0.28 g/dl) was slightly higher than children from the Tolon district (12.7 ± 0.28 g/dl) there was no significant difference between the groups ($p = 0.10$). The number of children who were stunted in the Tolon district (15.3%) were significantly higher than children in the Kwabre East (6.0%). The prevalence of thinness in the two districts differed significantly from each other ($p = 0.026$) (Figure 4.2). More anaemic children were recorded in the Tolon district, Northern region (20.5%) as compared to their colleagues in the Kwabre East district in the Ashanti region (7.3%) (Figure 4.2).

Table 4.2 Anthropometric indices and anaemia profile of the study children

Indicator	Kwabre East (N=150)		Tolon District (N=150)		p-value
HAZ , mean and SE	-0.24	0.24	-0.41	0.24	0.70
BAZ , mean and SE	-1.06	0.17	-0.80	0.17	0.43
Hb , mean and SE	13.4	0.28	12.7	0.28	0.10

Significance based on ANCOVA for continuous variables; significant at $p < 0.05$. Continuous variables presented as adjusted means and SE and categorical variables as n (%). N, total number for each group. n, number of people observed in a group; Covariates controlled for includes; **HAZ**: Child's age, caregivers religion. **BAZ**: Child's age, child's sex, household size, caregiver's religion, mothers and fathers educational levels, mother's occupation. **Hb**: class of child, household size, and caregiver's religion, mother's education. Hb values were adjusted for ethnicity by plus 1 (Sullivan *et al*, 2008 and UNICEF, UNU, WHO, (2001)

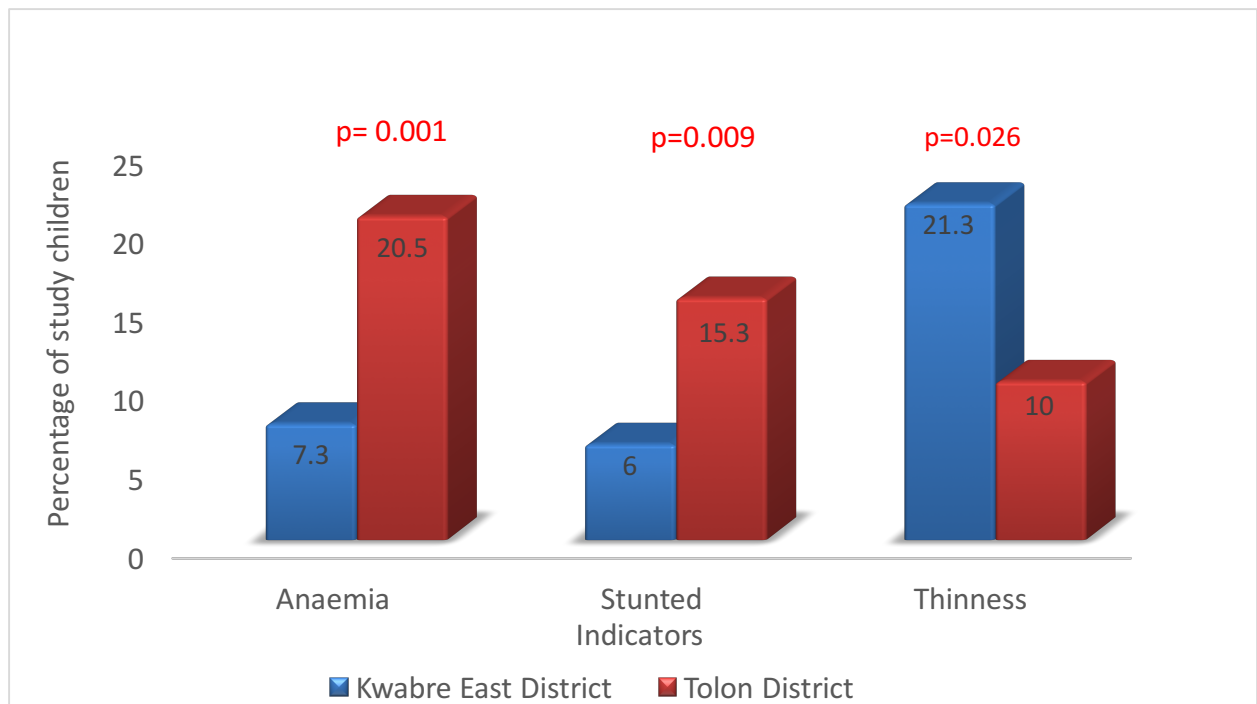


Figure 4.2 Prevalence of stunting, thinness and anaemia among the study participants

4.3 Consumption based on food groups

Food consumption from the food groups based on the 3-day repeated 24hr dietary recall showed that all the children (100%) from both regions consumed foods from the starchy food group. Children from the Kwabre East district consumed more foods from meat and fish, vitamin A rich food, eggs, other fruits and vegetables and organ meat than children from the Tolon district. On the other hand, children from Tolon district consumed more food from legumes, nuts and seeds, dark green vegetables and milk and milk products.

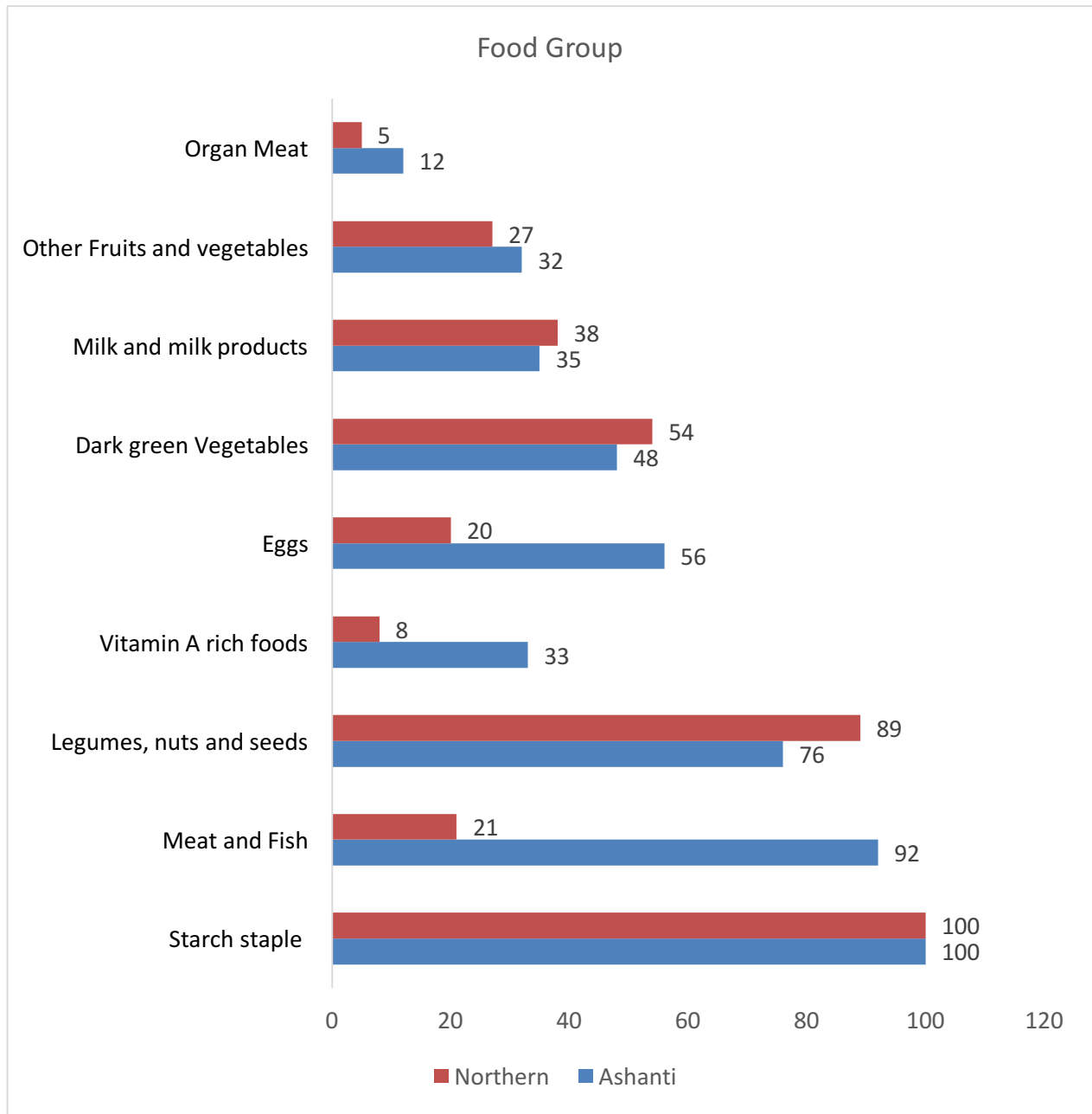


Figure 4.3 Food groups consumed by study children from the Asante region (Kwabre East district) and the Northern region (Tolon district).

4.4 Dietary diversity of the study children

The dietary diversity score was calculated from 3-day repeated 24-hour dietary recall using nine food groups (FAO, 2011). The dietary diversity score was classified as 'low', 'medium' and 'high' when a child consumed three or less, four to five and six or more food groups respectively. The dietary diversity category was significantly different between the two groups (Figure 4.4).

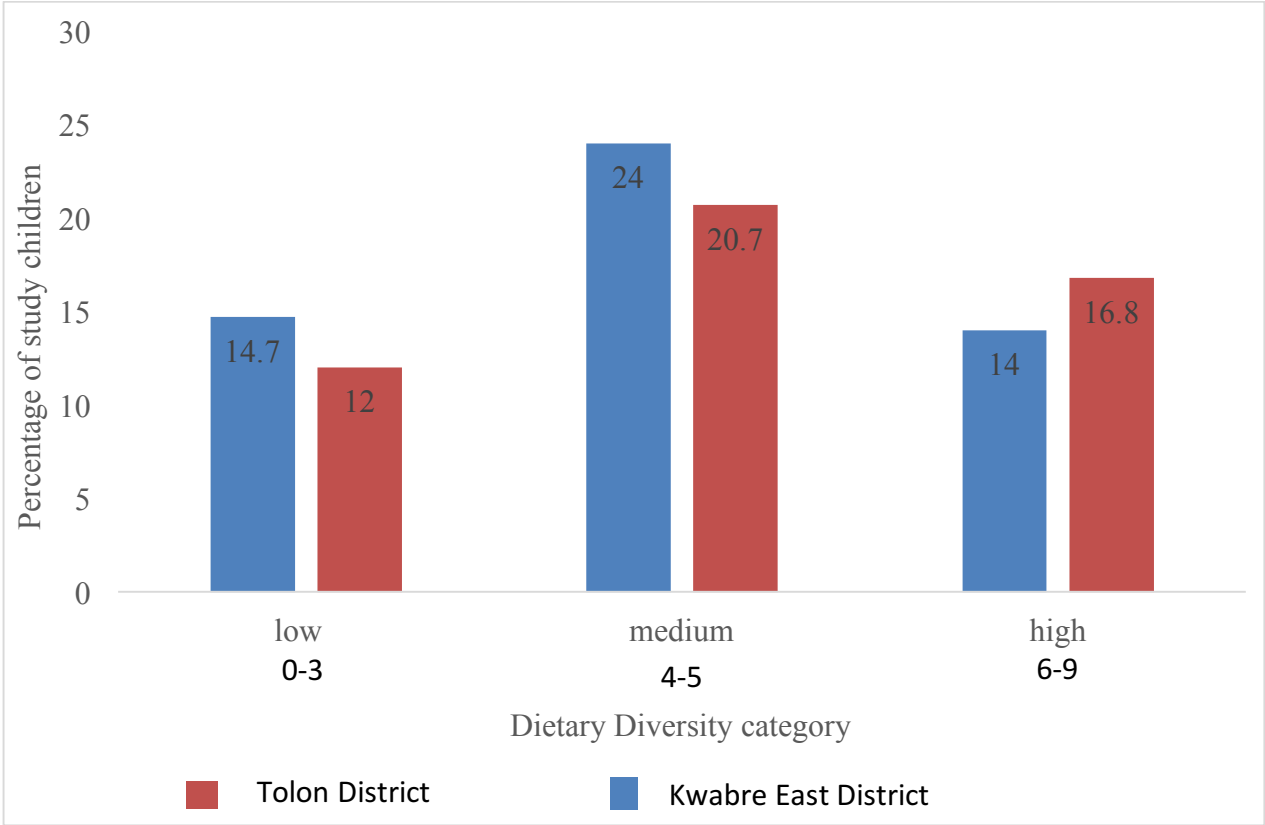


Figure 4.4 Dietary diversity scores of the study children from the Kwabre East district and the Tolon district.

4.5 Energy and macronutrients intake of the study children

The energy and macronutrients intake of the study children were obtained from a 3-day dietary recall. The mean intakes were calculated and compared among the study groups. The mean energy

(2116.4±76.4 Kcal), protein (62.3±4.3 g) and carbohydrate (422.9±13.9 g) intake of children from the Kwabre East district were significantly higher than the energy 1637.5±76.4 g), protein (39.4±4.3 g) and carbohydrate (317.6±13.9 g) intake of children from the Tolon district (Table 4.2). Fat intake of the children was not significantly different between the two groups (p=0.86).

Table 4.3 Comparison of energy and macronutrients intake of the study children

Nutrients/day	Kwabre East district (N=150)		Tolon district (N= 150)		p-value
	Mean	SE	Mean	SE	
Energy (<i>cal</i>)	2116.4	76.4	1637.5	76.4	0.001
Protein (<i>g</i>)	62.3	4.3	39.4	4.3	0.006
Carbohydrate (<i>g</i>)	422.9	13.9	317.6	13.9	<0.001
Fat (<i>g</i>)	49.1	3.5	50.3	3.5	0.860

Significance based on ANCOVA at p<0.05. Values are presented as Means and SE. Covariates that were controlled for includes: **Energy:** household size, caregiver's religion, educational level of mothers and fathers, father's occupation. **Protein:** household size, caregiver's religion, caregiver's age educational level of mothers and fathers, father's occupation. **Carbohydrate:** household size, caregiver's religion, caregiver's age educational level of mothers and fathers. **Fat:** Location of the schools, household size, caregiver's religion, educational level of mothers.

4.6 Micronutrients intake of the study children

Among the selected micronutrients, the intake of vitamin A, iron and zinc were not significantly different between the two groups (Table 4.4). On the other hand, the intake of vitamin B₁₂ and folate were significantly different between the study groups (p<0.05). The participants from the Kwabre East district had a significantly higher mean intake of vitamin B₁₂ (1.32 ±0.12, µg) than children from the Tolon district (0.43±0.12, µg).

Table 4.4 Comparison of selected micronutrients intakes of the study children

Nutrients/day	Kwabre East (N=150)		Tolon District (N= 150)		p-value
	Mean	SE	Mean	SE	
Vitamin A (μ g)	364.3	125.9	307.1	125.9	0.810
Vitamin B ₁₂ (μ g)	1.32	0.12	0.43	0.12	0.003
Folate (μ g)	32.4	3.4	56.6	3.4	<0.001
Iron (mg)	15.66	1.97	13.75	1.97	0.610
Zinc (mg)	3.29	0.22	3.92	0.22	0.220

Significance based on ANCOVA at $p < 0.05$. values are presented as Means and SE. Covariates that were controlled for includes: **Vitamin A**: caregiver's religion and age, educational level fathers. **Vitamin B₁₂**: Location of the schools, child's age. **Folate**: household size, caregiver's religion, child's age and sex, educational level of mothers and fathers, father's occupation. **Iron**: child's age and sex. **Zinc**: household size, caregiver's religion, educational level of mothers and fathers.

4.7 Proportion of children who met the selected nutrients requirement

The energy and selected nutrient intakes of the study children were compared with institute of medicine (IOM) age and sex dietary recommendations. The proportion of children who met their daily intake were calculated and the results presented in Table 4.5. More than half of the study children (53.3%) from the Kwabre East district met the requirements of energy and almost all the children (99.3%) from this region met their protein requirement. All the study children from the two regions met carbohydrate requirements. Less than half of the study children met their requirement of vitamin A (20.3%), folate (5%), zinc (9.3%) and vitamin B₁₂ (22.3%). Approximately, 98% of the study children met their daily iron intake.

Table 4.5. Proportion of study children who met the Estimated Average Requirement of the selected nutrients

Nutrients <i>n/ (%)</i>	Total (N=300)	Kwabre (n=150)	Tolon (n=150)	p-value
Energy	118 (39.3)	80 (53.3)	38 (25.3)	<0.001
Carbohydrate	300 (100)	150 (100)	150 (100.0)	-
Protein	291 (97)	147 (98.0)	144 (96.0)	0.31
Vitamin A	61(20.3)	49 (32.7)	12 (8.0)	<0.001
Vitamin B ₁₂	67 (22.3)	51 (34.0)	16 (10.7)	<0.001
Folate	15 (5)	3 (2.0)	12 (8.0)	0.031
Iron	293 (97.7)	149 (99.3)	144(96.0)	0.06
Zinc	28 (9.3)	9 (6)	19 (12.7)	0.047

Institute of Medicine (IOM) nutrient adequacy (Alessi and Butler, 2015) for all the nutrients and energy adequacy from Food and Agriculture Organization (FAO/WHO/UNU, 2004) EAR values were used in the comparison. Significance based on Chi-square test at $p<0.05$. Variables are reported as frequency (n) and percentages (%). On the same row values with different superscripts are significantly different.

4.8 Odds of being undernourished among SAC

Table 4.6 shows the relationship between children who met EAR of energy and selected nutrients as well as low or high dietary diversity as a function of undernutrition status after adjusting for other nutrient intakes. Comparably, children who had low DDS were 5.1 times more likely to be undernourished to those with high DDS and this was statistically significant (95% CI: 12.3-248.24: $p<0.001$) among the children in the Kwabre East district. Likewise in Tolon district, children who had low DDS were 4.75 times more likely to be undernourished than their colleagues who had a high DDS (95% CI: 1.41-16.13: $p<0.001$). The odds of all the other variables were not significant.

Table 4.6. Odds of being undernourished among SAC in Kwabre East and Tolon districts

VARIABLES	Kwabre East District				Tolon District			
	p-value	OR	95% CI for exp(b)		p-value	OR	95% CI for exp(b)	
			Lower	Upper			Lower	Upper
Energy								
Met EAR		1				1		
Did not meet EAR	0.72	1.2	0.45	3.19	0.72	0.79	0.21	2.99
Protein								
Met EAR		1				1		
Did not meet EAR	0.59	2.0	0.16	25.08	0.87	1.27	0.06	24.92
Vitamin A								
Meet EAR		1				1		
Did not meet EAR	0.23	0.40	0.90	1.76	0.08	3.8	0.83	17.3
Vitamin B₁₂								
Met EAR		1				1		
Did not meet EAR	0.56	0.68	0.19	2.50	0.06	4.37	0.92	20.75
Zinc								
Met EAR		1				1		
Did not meet EAR	0.67	1.56	0.21	11.87	0.52	0.49	0.06	4.33
DDS								
High		1				1		
Low	<0.001	5.1	1.45	5.1	<0.001	4.75	1.41	16.13

Significance based on logistic regression at p<0.05. Logistic regression analysis of nutritional status (undernourished) as a function of dietary diversity and energy and selected nutrients.

4.9. Meals eaten in school

Energy and nutrients differ significantly between the two districts. Children from Kwabre East district significantly had higher intake of Energy, protein, carbohydrate, vitamin A, vitamin B₁₂, folate and iron than children from the Tolon district (p<0.01) as shown in Table 4.7. The mean intake of fat and zinc from the GSFP meals was significantly higher in the Tolon district compared to the mean intake from the Kwabre East district.

Table 4.7 Calculated mean energy and selected nutrients intakes from GSFP meals.

Nutrients/day	Kwabre East (N=150)		Tolon district (N= 150)		p-value
	Mean	SE	Mean	SE	
Energy (Kcal)	745.5	0.7	684.6	0.7	<0.01
Protein (g)	19.3	0.04	16.2	0.04	<0.01
Carbohydrate (g)	165.6	0.6	113.9	0.6	<0.01
Fat (g)	18.1	0.4	20.0	0.4	<0.01
Vitamin A (µg)	122.5	1.3	54.5	1.3	<0.01
Vitamin B ₁₂ (µg)	0.4	0.04	0.00	0.00	<0.01
Folate (µg)	67.1	0.2	56.7	0.2	<0.01
Iron (mg)	7.5	0.03	5.2	0.03	<0.01
Zinc (mg)	1.2	0.01	1.7	0.01	<0.01

Significance based on ANCOVA at p<0.05. Variables are reported as Means and SE. Covariates that were significant at 10% and controlled for in the model for energy and the various nutrients includes: Community effect, child's class, child's age, household size, caregiver's religion. Energy was controlled for all the nutrients

4.9.1 Description of meals eaten in GSFP in study areas

The meals served to the study participants during lunch times in both study areas are highlighted in Table 4.8. Although the meals differed between the two districts of the study areas, within the

districts, however, the meals were very similar but eaten on different days throughout the school week.

In both study locations, a make-shift cooking area had been constructed where meals were prepared using coal pots as a means to cook the food. There were no washing facilities for utensil and feeding bowls observed in either of the study schools. All meals served were equally measured for each child in all schools observed regardless of the age or the class of the child. The study showed that in the Tolon district, there was very little animal source of protein served and indeed when asked about the ingredients used to prepare the meals, the “fish powder” the cook had referred to was fish flavoured bouillon cube. Also, the tomatoe stew made for 274 pupils in the Tolon district (school 1), was made with a teaspoon of pureed tomatoe paste and a One (1) litre bottle of vegetable oil, One (1) onion, some pepper and some fish flavoured bouillon cube. In the Kwabre East district, it was observed that both schools had more diverse meals which included protein from animal sources.

Table 4.8 Menu served in the GSFP in the two study areas

	Kwabre East district		Tolon district	
	School 1	School 2	School 1	School 2
Monday	Waakye & Tomatoe sauce	Rice & beans stew	Tubani & pepper sauce	Rice (Dagomba) & tomatoe stew
Tuesday	Banku & Okro stew	Waakye, fish stew & shito	Beans, maize & flavoured vegetable oil	Beans, gari & palm oil
Wednesday	Rice & beans stew	Rice balls & Palm nut soup	Rice & Tomatoe stew	Tubani, ground pepper sauce & vegetable oil
Thursday	Rice balls & Palm nut soup	Rice & beans stew	Beans & Maize	Beans & Maize
Friday	Jollof with fish stew	Jollof with fish stew	Gari & beans with palm oil	Rice, beans & tomatoe sauce

4.9.2 Contribution of GSFP to the daily energy and nutrient intakes of school aged children

The energy and selected nutrients obtained from the meals of GSFP were expressed as percentage contribution to the total daily energy and nutrient intake. These were presented as adjusted means and standard errors as shown in Table 4.9. The mean percentage contribution of protein, carbohydrate, vitamin A and Vitamin B₁₂ to daily nutrient intake were significantly higher among the SAC in Kwabre East district compared to their colleagues in the Tolon district ($p < 0.01$; $p < 0.01$; $p \leq 0.003$; $p < 0.01$, respectively). The average percentage contribution of fat was significantly higher in the Tolon district than the Kwabre East district; $p \leq 0.002$. There were no significant difference observed between the groups for the mean percentage contribution of energy [Kwabre East district ($41.2\% \pm 2.0$); Tolon district ($40.3\% \pm 2.0$); $p = 0.81$], folate [Kwabre East district ($42.8\% \pm 0.96$); Tolon district ($43.9\% \pm 0.96$); $p = 0.53$], iron [Kwabre East district ($50.7\% \pm 3.4$); Tolon district ($49.5\% \pm 3.4$); $p = 0.85$] and zinc [Kwabre East District ($41.4\% \pm 2.3$); Tolon District ($46.9\% \pm 2.3$); $p = 0.2$]. The mean percentage contribution of protein, carbohydrate to the total daily protein and carbohydrate intake in the Tolon district were below one third of the total daily intake. The mean percentage contribution of vitamin B₁₂ in the Tolon district was zero. Nevertheless, the mean contribution of energy and all the other selected nutrients were more than one third of the total daily intake of energy and these selected nutrients.

Table 4.9 Percentage contribution of GSFP to daily energy and selected nutrient intake

Nutrients/day	Kwabre East (N=150)		Tolon District (N= 150)		p-value
	Mean	SE	Mean	SE	
Energy (%)	41.2	2.0	40.3	2.0	0.810
Protein (%)	55.3	2.8	28.2	2.8	<0.010
Carbohydrate (%)	52.2	1.2	26.5	1.2	<0.010
Fat (%)	37.4	3.1	51.3	3.1	<0.010
Vitamin A (%)	73.4	3.0	44.8	1.3	0.003
Vitamin B ₁₂ (%)	59.9	3.0	0.00	0.00	<0.010
Folate (%)	42.8	0.96	43.9	0.96	0.530
Iron (%)	50.7	3.4	49.5	3.4	0.850
Zinc (%)	41.4	2.3	46.9	2.3	0.200

Significance based on ANCOVA at $p < 0.05$. values are presented as percentage Means and SE. Covariates that were controlled for includes: **Energy**: community effect, educational level of mothers and fathers, caregiver's religion. **Protein**: Energy contribution from GSFP meals, community effect, child's age, household size, educational level of mothers and fathers, caregiver's religion. **Carbohydrate**: Energy contribution from GSFP meals, community effect, child's age, class of child, household size, educational level of mothers and fathers, caregiver's religion. **Fat**: Energy contribution from GSFP meals, community effect, child's age, household size, educational level of mothers and fathers, caregiver's religion. **Vitamin A**: Energy contribution from GSFP meals, community effect, household size, caregiver's religion, educational level of mothers and fathers. **Vitamin B₁₂**: Energy contribution from GSFP meals, community effect, child's age and sex, household size, educational level of mothers and fathers, caregiver's religion. **Folate**: Energy contribution from GSFP meals, community effect, household size, educational level of mothers and fathers, caregiver's religion. **Iron**: Energy contribution from GSFP meals, community effect, household size, educational level of mothers and fathers, caregiver's religion. **Zinc**: Energy contribution from GSFP meals, community effect child's age and sex, class of a child, caregiver's religion, educational level of mothers and fathers

CHAPTER FIVE

5.0 DISCUSSION

5.1 Background characteristics

This study set out to compare the nutritional status of the 300 school aged children in the Kwabre East and Tolon districts enrolled on the GSFP. The results of this study indicated that 73.3% of all caregivers were their biological mothers in the Kwabre East district, while 53.3% of caregivers of the study children in the Tolon district were the biological fathers of the study children. The current study found out that approximately 3 out of every 4 of the fathers in the Tolon district had no formal education which may have contributed to the higher rate of malnutrition reported in this study as compared to their counterparts in the Kwabre East where illiteracy was lower with only 1 out of every 4 of the fathers studied having no formal education.

A strong relationship between father's education and nutritional status of school aged children has been reported in prior studies. Mosiur, Golam and Nasrin, (2009) reported that fathers with higher education had a positive impact on the nutritional status of the study children. Also, Babar *et al.*, (2010) reported from their study that illiterate fathers had 50.9% of malnourished as compared the literate fathers who had 19.5% of malnourished children. The results of this study also indicate a high rate (92.67%) of illiteracy among mothers of the Tolon district as compared to 25% illiteracy among mothers in the Kwabre East district. The findings are consistent with those of Smith and Haddad, (2000), who found a direct link between mother's education and identified it as a determinant for malnutrition among school aged children.

5.2 Prevalence of stunting, thinness and anaemia of SAC.

Infections and recurrent exposure to poor sanitation which occurs in the presence of harsh economic conditions or challenges may result in linear growth retardation which is referred to as stunting (UNSCN, 2010). The prevalence of stunting among the children in the current study was observed more in the Tolon district (15.3%) than in the Kwabre East district (6%). Compared to the prevalence of thinness and anaemia among the study children, stunting was the least nutritional deficit recorded. The prevalence of stunting recorded in this study was lower than the prevalence of stunting (45.8%) found among school-aged children in School Feeding Programmes in the peri-urban areas in the Greater Accra region of Ghana by Owusu *et al.* (2017). These were also lower than the prevalence of stunting recorded in the Kwabre East district (52.2%) in Ghana by Danquah *et al.* (2012) among children between (9-17 years) participating in GSFP and non-participants in rural areas.

Other studies in other countries of the African continent have also reported higher prevalence of stunting than this current study. In Nigeria, Hassan *et al.* (2012) reported stunting among children between 7- 11 years of age as 43% while in the North western part of Ethiopia, (Mekonnen, Tadesse, & Kisi, 2013) also reported stunting as 30.7% among school-age children. Another study in Kenya Nairobi, (Chesire, Orago, Oteba, & Echoka, 2008) also reported the prevalence of stunting as 30.2%. The difference detected between the Owusu *et al.* (2017) and that of this current may be ascribed to locational differences. The later study was conducted in the peri-urban areas of the city of Accra where food commodities are considered more expensive compared to the location of the current study in the Kwabre East and Tolon districts where foodstuffs are relatively cheaper. Again the difference observed between Danquah *et al.* (2012) and this study may perhaps be attributed to the age differences between the two studies (6-12years verse 9-17years). Owusu *et al.* also reported in

their study that the differences in the ages of the study children may have accounted for stunting. This can be further explained as Ghana is in its nutrition transition state, of which nutrition is tyro in the country. This means that the study children in this current study may be benefiting from these nutrition programmes.

Furthermore, the difference observed between the findings in the present study and that of other studies reported elsewhere in the continent may come as a result of regional differences. It has been observed that nutritional deficit (stunting) becomes difficult to reverse if it occurred within the first 1000 days of a child's life (Levinson and Bassett, 2007). The lower stunted rate recorded in the present study may have occurred as a result of the efforts to scale up nutrition in Ghana through the numerous nutrition interventions some of which target the pre-schoolers (Dewey and Adu-Afarwuah, 2008) and may have therefore had a spill-over effect on the school aged children observed in the study.

Low BMI-for-age (thinness) occurs as a result of starvation or severe disease manifestation or a combination of both and represent acute malnutrition (UNSCN, 2010). The prevalence of thinness recorded in this present study was 21.3 % and 10% in the Kwabre East and Tolon districts respectively. Although thinness was the most nutritional deficit observed in this study, the findings differ from the rates of thinness prevalence reported by Owusu *et al.* (2017) as 34.6% among school-aged children and Danquah *et al.* (2012) as 47%. These differences between Owusu *et al.* (2017) and this current study may be explained by the sample sized used (182 vs. 300) as well as the setting of the study.

Additionally, in the study by Owusu *et al.*, (2017), their study was sited in peri-urban areas of the capital city of Ghana, where it was recorded that the monthly income for most of the caregiver's of the study children was low. The differences that are observed between the present study and Danquah *et al.* (2012) may be attributed to sample size (300 vrs.234) as well as the differences between the age group (6-12 years vrs. 9-17 years). In the study by Danquah *et al.* (2012) there were more adolescent enrolled as study participants. In contrast, the prevalence rate of thinness recorded in the current study was relatively higher than the findings observed among SAC in peri-urban settings in Kenya by (Chesire *et al.*, 2008) who reported 4.5% and another study in Iran who found the prevalence of thinness to be 3.6% (Malekzadeh *et al.*, 2003).

In contrast to earlier findings of 71% national prevalence of anaemia among school aged children (Agble, Bader, Solal Céligny, Palma, & Dop, 2009), the prevalence of anaemia observed in the study children were 20.5% and 7.3 in the Tolon and Kwabre East district respectively. These were lower than the national prevalence of anaemia reported by in 1995 as 71%. Again it was lower than the anaemia prevalent estimated by WHO (2008) as 25.8% globally among school-age-children. The low rate of anaemia may be moderately due to various malaria interventions that has been implemented in the country recently by various Non-governmental organizations. Again, GSFP has a deworming component of which participating children mostly benefit from it. This can also be linked to the resent deworming exercises that are being undertaken periodically by the Ghana Health Services in primary schools which in the long run improves the haemoglobin levels of the study children due to the absence of helminth infestations.

The prevalence of anaemia in this study were also observed to be relatively lower than other studies which have been conducted by different researchers in Ghana. In these other studies, one conducted in the rural areas in the Volta region by Egbi *et al.* (2014) reported an anaemia prevalence of 30.8% among school children aged 6-12 years while in Eastern region Fentiman *et al.* (2001) also reported 70% anaemia prevalence among school going children (6-11 years). Furthermore, Owusu *et al.* (2017) also reported a prevalence of 28.3% for anaemia among the study children.

Three out of ten school-age-children in this study were malnourished; having at least one nutritional deficit (stunted, thinness or anaemic). This is lower than what was reported by Owusu *et al.* 2017 as 7 out of 10 children studied were malnourished and in close agreement with what was reported in Pakistan by (Mian, Ali, Ferroni, & Underwood, 2002) as 4 out of 10 school aged children were undernourished out of the nutritional status indicator that were measured. Disparately, Owusu and colleagues measured stunted, thinness, underweight and anaemia whilst this present study assessed only three nutritional deficits namely; stunted, thinness and anaemia. This may have accounted for low nutritional deficit observed in this present study.

5.3 Dietary diversity, energy and nutrients intake of the children

All the school children interviewed in this present study were reported to have eaten food groups in the starchy staples category (grains, roots and tubers). The findings from this present study was a reflection of the usual and typical African diet (Oniang'o, Mutuku, & Malaba, 2003). The food groups categories that were least represented and therefore the least consumed by the study children included eggs, organ meat, vitamin A rich foods and milk and milk product. Parallel observations were seen and reported by Owusu *et al.* (2017) among 182 school children (6-12 years) participating in school

feeding programme in the Greater Accra region. Elsewhere in Nigeria, Olumakaiye (2013) also reported analogous result amid 600 school children from South Western Nigerian that the study children ate less food groups of milk and milk product, organ meat, vitamin A rich foods and eggs. However, more than half of the study children in this present study consumed meat and fish as well as dark green leafy vegetables. In contrast, Owusu *et al.* (2017) reported that their study participants consumed less dark green leafy vegetables. The difference between this present study and that of Owusu *et al.*, 2017 was that this current study was conducted in areas where green leafy vegetables are predominantly consumed as source of stews and soups. Again, the data for this current study was obtained during the terminal end of the rainy season of which vegetable cultivation was predominant. This may have accounted for the good intake by children of this current study. Some of these dark green vegetables consumed that were enumerated by the school children include; cocoyam leafs locally called kontomire, bitter leaves, “ayoyo”, cassava leaves. Less than one third (29%) of the study children consumed fruits and vegetables which agrees with what Lock, Pomerleau, Causer, & McKee (2005) have documented. They stated that children are less probable to consumed vegetables as part of their diet. Some of the fruits that were mentioned as consumed included, pea, bananas, shea butter fruit, dawadawa fruit. However, this was higher than what was reported in rural Nigeria by Ene-Obong & Ekweagwu (2013) as 2% of their study participants consumed fruits and vegetables. It is important to note that Ene-Obong & Ekweagwu (2013) study employed 48 hours food recall whilst this current study employed 72 hours food recall. Approximately, 82% of the study children consumed meat and fish.

Dietary diversity score (DDS) was obtained form 72-hour food recall. This was categorised as low, medium and high based on 9 food groups using FAO guidelines (Kennedy *et al.*, 2007). The DDS of

the study participants was 5.7 ± 1.3 for children in Kwabre East district and 5.6 ± 1.3 for children in Tolon district. This finding corroborates with other findings reported elsewhere in Ghana by Owusu *et al.* (2017) during their assessment of nutrition intakes and nutritional status of 182 school aged children in Ghana practicing GSFP as 5.46 ± 1.00 and NGO sponsor-SFP as 5.51 ± 1.15 . Foods served to children in GSFP included legumes (beans) and okra. This clearly indicate that school children in Ghana participating school feeding programmes will at least add one food group to their usual intake. This potentially alludes to the fact that, the locations where the GSFPs were implemented may have exhibited some form of homogeneity. As Sulemana *et al.* (2013) put forward, GSFP schools are mostly located in rural settings and those settings have similar socio-demographic characteristics. The present study DDS is higher than what has been reported elsewhere in Tobago by Sealey-Potts and Potts (2014) among 423 preschoolers as 4.19 ± 0.83 using a food groups ranges from 1 to 6. It is worth noting that Sealey-Potts and Potts (2014) study employed only 24 hour recall while this present study used 72 hour recall which would provide more information over a longer period of observation or assessment. Again, the previous study employed pre-schoolers while the current study employed school-aged children.

The mean energy intake of this present study was recorded as 1874.2 kcals and the proportion of children who met EAR was 39.3%. Flores *et al.* (2009) also reported mean energy intake of 1501kcals amid school children in Mexico aged 5-11 years but observed that most of the children met their percentage adequately. Unlike this present study, less than half of the study children met their percentage adequacy. Comparing the mean energy intake and the proportion of children who met their energy requirement; it is clear that some children contributed to the higher mean energy intake and this would have be resulted into positive energy balance. Per this assertion, our expectation

was that more overweight children should have been recorded in this present study. This expectation however was not met because no overweight child was observed. This observation may be explicated by Abizari *et al.* (2014) who elaborated that, most children require more energy to perform their physical activities, therefore the moderate physical activity levels extrapolated during the calculation of the children's respective EAR may have been underestimated. This difference could have been as a result of the 72 hour recall method used. Most of the caregivers could have underestimated or overestimated the food given to their children thereby affecting the findings. Nonetheless, the number of children who met their adequacy was higher in this present study than the observations made by Mwaniki and Makokha (2013) among school children (4-11 years) as 17.3% in peri-urban areas in Kenya.

The mean energy intake and number of children who met their EAR of energy in this present study, was significantly higher in participants from Kwabre East than Tolon district. This observation was not surprising as the information on the macronutrients (protein and carbohydrates) that contribute immensely to energy was significantly higher in Kwabre East district than Tolon district. Again, this difference could be attributed to the age difference between the study children as children in Kwabre East district are older than children in Tolon district (10.13 ± 1.60 vs. 9.59 ± 1.78 ; $p=0.01$). Even though, majority of the study participants met their protein adequacy (97%), these food sources that provided them with the protein were from plant sources which may immensely affect the protein quality and biological value as well. These food sources included legumes and nuts. This observation was recounted by Abizari and colleagues (Abizari *et al.*, 2014) during their study on school feeding contribution to micronutrient adequacy of Ghana School children.

Approximately less than half of the study children met their adequacy of vitamin A (20.3%), folate (5%), zinc (9.3%) and vitamin B₁₂ (22.3%). Again, these observations were not astonishing as data on the food groups obtained from the study participants suggested that less than half of the study participants consumed foods that generally provide these nutrients. Thus vitamin A rich foods (20.5%), fruits and vegetables (29%), organic meat (8.5%), eggs (33%) and dairy product (36.5%) and these were consumed in smaller quantities.

5.4 Factors associated with malnutrition

The data showed that 3 out of 10 children that were assessed have at least one nutritional deficit. Children who met and did not meet their respective EAR of energy and nutrients intake (protein, vitamin A, Vitamin B₁₂, zinc) as well as dietary diversity category (low and high) were used as predictors for the nutritional status for the two regions (Ashanti and Northern). With the exception of dietary diversity category, none of these variables were significantly associated with nutritional status of the study children.

The findings indicate that children from Kwabre East who had low dietary diversity score (ate from not more than four food groups) were 5 times more likely to be undernourished than their colleagues who had high dietary diversity (ate from at least six food groups). Again, children from Tolon district who had low dietary diversity were 4.8 times more likely to be undernourished than their colleagues who had high dietary diversity. In 2011, Food and Agricultural Organization (FAO, 2011) stated that significant aspect of dietary intake that reflect mostly in the nutrient quality of individual diet is dietary diversity and it is positively correlated with nutritional status of children. In this study, the children also exhibited these similar observations. Other researchers have also found positive

associations between dietary diversity and nutritional status. Elsewhere in Iran and Indian a study conducted by Hooshmand and Udipi (2013) amid 4570 urban primary children of aged 6 to 9 years observed that an increase in dietary diversity scores (DDS) were correlated with height status of the children (India - $F=10.759$, $p<0.001$ and Iran- $F=5.825$, $p=0.001$). Again, the same study also found positive correlation as increasing dietary diversity scores (DDS) were connected with higher BMI of children (India- $F=32.197$, $p<0.001$) and the same trend was also observed in Iran ($F=9.345$, $p=0.000$). Furthermore, Olumakaiye (2013), also reported that low dietary diversity scores were significantly associated with lower height for age and as well as weight for height ($p=0.024$).

5.5 Energy and nutrients from GSFP

In 2004, WHO/FAO (2004) recommended that the least SFP meals should contribute one-third of the total amount of energy a child eats in a day. Again, Ghana SFP Secretariat in 2005-2007 also framed that SFP meals should contribute (30-45% of RDA) for energy. Even though this present study compared the amount of energy the children ate to EAR, the mean energy intake of the meals that were served from the GSFP to the study participants was 715 ± 0.7 kcal/day. This contributed 41% of the total daily energy intake of the study children and 38% of the EAR of the study participants. These recommendations were met by the study participants in this present study. The amount of energy that the children in this current study received from GSFP were higher than what other researchers have reported elsewhere in Ghana as 460.4 kcal/day by Danquah *et al.* (2012) in Kwabre East district and 295 kcal/day by Owusu *et al.* (2017) in Greater Accra region.

It is worth noting that both Owusu *et al.* (2017) and Danquah *et al.* (2012) used 24 hour food recall to assess the food served to their study children from the school meal while this current study

employed weighed food record. Again, the high content of energy that was observed in this current study could also be attributed to the season in which the current study was conducted. Noticeably, Danquah *et al.* (2012) and Owusu *et al.* (2017) conducted their study in dry season while this current study was conducted at the terminal of rainy season. Food items are abundant in Ghana during raining season and prices of foods are cheaper and this will ultimately increase the purchasing power of the caterers. Most caregivers or mothers could have overestimated the food intake of the person due to the presence of the researchers even though we employed all possible means to reduce overestimation.

In this present study, the contribution of protein from GSFP meals to daily intake of the study children was 42%. This is lower than what Ghana SFP Secretariat in 2005-2007 formulated as meals from GSFP should contribute to protein (60-70% of RDA). The sources of protein that was observed from this current study were from legumes, nuts and seeds as well as cereals. It was observed that GSFP meals that were served to children in Northern region do not have any source of animal protein and this led to zero contribution of Vitamin B₁₂ in the meals served to the study children. This was reported by Abizari *et al.* (2014) during his assessment of contribution of school feeding to micronutrient in the Northern region of Ghana.

The data from this present study showed that contribution of GSFP meals to the daily nutrient intakes of carbohydrates, fats, folate, vitamin A, iron and zinc met one-third of the total daily intake of these nutrients consumed by the study children. Walker (1997) stated that meals from school feeding should come to the participating children as supplement but this assertion cannot be likened to this present study. In this present study, meals from the GSFP came to the study children as complement

as the data indicated that most of the study children did not met their respective EAR for energy and other micronutrients.

CHAPTER SIX

6.0 CONCLUSION, RECOMMENDATIONS AND LIMITATIONS

6.1 Conclusion

The prevalence of stunting and anaemia were higher in the Tolon district (15.3%) than in the Kwabre East district (6%). The prevalence of thinness was significantly higher in Kwabre East 21.3 % than the Tolon district (10%).

The study children in both districts had a high dietary diversity score (approximately 6 out of 9 food groups). Almost all the study children met their EAR for the usual intake of carbohydrates, protein and iron. Only a small percentage of study children meet their EAR for folate (5%), vitamin A (20.3%), zinc (9.3%) and vitamin B₁₂ (22.3%). Approximately half (53.3%) of the study children in the Kwabre East met their EAR for energy, however, in the Tolon district about a quarter of (25.3%) the children meet their energy.

The chances of being malnourished was significantly higher with the study children who had a low dietary diversity score ($p=0.001$) compared to those with high dietary diversity. There were no significant differences between the children who met and did not meet the other nutrient and energy requirements. The contribution of GSFP meals to the daily nutrient intakes of carbohydrates, fats, folate, vitamin A, iron, zinc and also energy met one-third of the total daily intake of these nutrients consumed by the study children.

6.2 Recommendations

The following recommendations are made for further studies:

1. The study could be repeated with more schools participating from other districts, to enable a more complete representation of the entire regions for assessment.
2. In order to obtain the full impact of the Ghana School Feeding Programme on the nutritional status of the SAC, the Monitoring and Evaluation unit of the GSFP should collect baseline data prior to the enrollment of new schools into the programme in order to make a more robust comparison.

Additionally, observations from the study has some policy implications that need attention.

3. Despite nutritional disparities in the Kwabre East and Tolon districts, the quality of the foods served in both districts should be improved. A standard for all meals throughout the regions should be established. This could be complemented by constant monitoring and evaluation of the programme to maintain standards.
4. Further interventions should be done to decrease the rate of nutritional status deficits among school aged children.

6.3 Limitations

The following limitations were observed from the study;

1. The design of the study which was cross-sectional design may have prone to non-response bias if the sample participants who took part in the study vary from those who did not and this may not represent the population
2. The presence of the researchers could have affected the 24-hour recall as caregivers may overestimated or underestimated the foods given to their children.

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APPENDIX

Appendix I: Parent and child consent form

UNIVERSITY OF GHANA



COLLEGE OF BASIC AND APPLIED SCIENCES

Ethics Committee for Basic and Applied Sciences (ECBAS)

Official Use only

Protocol number

PROTOCOL CONSENT FORM

Section A- BACKGROUND INFORMATION

Title of Study:	COMPARATIVE STUDY OF THE NUTRITIONAL STATUS OF SCHOOL AGED CHILDREN ENROLLED ON THE GHANA SCHOOL FEEDING PROGRAMME: A CASE OF KWABRE EAST AND THE TOLON DISTRICT OF GHANA
Principal Investigator:	AFUA ADJEIBEA AUGUSTE TARICONE
Certified Protocol Number	

Section B- CONSENT TO PARTICIPATE IN RESEARCH

General Information about Research

We are carrying out a research study which we are inviting you to participate in together with your child who is between the ages of 6 and 12 years and is currently attending a school in the Kwabre East and Tolon district. Your ward is currently enrolled on the Ghana School Feeding Programme. The purpose of the study is to compare the nutritional status of school aged children (6-12 years) enrolled in the GSFP in the two districts. We are also interested in finding out the nutrient intake from the total daily intake of the study children and also to find if there is any relationship between dietary intake and malnutrition. We will also assess the contribution of the meals eaten in GSFP to the daily intake of study children. The study will begin in November, 2016 and end in June, 2017.

The height and weight of children will be taken in the school. The children will be asked to recall the foods they ate the previous day on three occasions. Other information about the children will be taken from the parents at home.

Benefits/Risk of the study

This study will not expose you to any risks. The children may experience a slight discomfort when being assessed for anaemia. There will be no immediate benefit to you for participating in the study. However the information obtained will also serve as a guide for government and health authorities to draft policies and interventions to improve the meals in the school feeding programme and child health.

Confidentiality

All information that will be obtained about you would be kept confidential and used purposely for this study. The principal investigator and supervisor will have access to your information.

Compensation

An exercise book and a pen will be shared to all the participating children at the end of the study. Each parent/caregiver will be given a bar of soap as a token of appreciation.

Withdrawal from Study

Participation is purely voluntary. You may refuse to participate or decide to withdraw from the study at any point in time. There is absolutely no penalty against you if you decide not to participate or withdraw at any time.

Contact for Additional Information

If you have any questions at any time concerning the study, please feel free and contact Afua A. Taricone (by phone number **0244631011**).

If you have any issues on your rights as a participant you can contact the address below:

Administrator, Ethics Committee for Basic and Applied Sciences
College of Basic and Applied Sciences
University of Ghana
P. O. Box LG 68
Legon – Accra
Tel: +233244692728
Email: saddo@staff.ug.edu.gh / saddo@ug.edu.gh

Section C- VOLUNTEER AGREEMENT

"I have read or have had someone read all of the above, asked questions, received answers regarding participation in this study, and am willing to give consent for me, my child/ward to participate in this study. I will not have waived any of my rights by signing this consent form. Upon signing this consent form, I will receive a copy for my personal records."

Name of volunteer

Signature or mark of volunteer

Date

If volunteers cannot read the form themselves, a witness must sign here:

I was present while the benefits, risks and procedures were read to the volunteer. All questions were answered and the volunteer has agreed to take part in the research.

Name of witness

Signature of witness

Date

I certify that the nature and purpose, the potential benefits, and possible risks associated with participating in this research have been explained to the above individual.

Name of Person who obtained consent

Signature of Person who obtained consent

Date

SECTION B: PARENTS/GUARDIANS SOCIO-ECONOMIC STATUS

Date of interview

ID NO:

14. What is your marital status?

- 1.Single [] 2.Married [] 3.Divorced[] 4.Widowed []

15. Mother’s educational status

- 1.Primary school [] 2.Middle school []
3.Secondary [] 4.Vocational [] 5.Tertiary [] 6.None []

16. Father’s educational status

- 1.Primary school [] 2.Middle school []
3.Secondary [] 4.Vocational [] 5.Tertiary [] 6.None []

17. Mother’s occupation

- 1.Not employed 2. Employed 3.Retired but working 4.Retired and not working

18. If you are employed/working, please specify what you do.....

19. Father’s occupation

1. Not employed 2. Employed 3.Retired but working 4.Retired and not working

20. If you are employed/working, please specify what you do.....

21. SECTION C: ANTHROPOMETRIC ASSESSMENT (FOR CHILD)

	1 ST READING	2 ND READING
Weight (kg)		
Height (cm)		
MUAC (cm)		

SECTION D: BIOCHEMICAL

22. Haemoglobin Concentration (g/dl):

PARTICIPANT I.D NO:

DATE:

23. SECTION E: CLINICAL ASSESSMENT (FOR CHILD)

Condition	Observation: 0=Absent 1=Present	Condition	Observation: 0=Absent 1=Present
EYES		FEET	
Bitot spots		Cracked sole	
Keratomalacia		Flat foot	
EYELIDS		NAILS	
Pale		Hard	
Swollen		Pale	
		Brittle	
LIPS		Concave	
Angular stomatitis		HANDS	
Cheilosis		Rash	
		Pale palm	
HAIR			
Sparse			
Silky			
Discoloration			
SKIN			
Dry/Scaly			
Greasy			
Peeling			
Rash			

PARTICIPANT I.D NO:

DATE:

SECTION F: DIETARY HABITS

WEEK DAY (1)

24. Do you eat at home before going to school? 1. Yes [] 2. No [] 3. Sometimes []

If no or sometimes, why?

Breakfast

Time	Food	Estimated quantity of food

Mid-morning snack

Time	Food	Estimated quantity of food

25. Do you usually eat lunch? 1. Yes [] 2. No [] 3. Sometimes []

Lunch

Time	Food	Estimated quantity of food

Mid-afternoon snack

Time	Food	Estimated quantity of food

26. Do you usually eat dinner? 1. Yes [] 2. [] 3. Sometimes []

Dinner

Time	Food	Estimated quantity of food

Bedtime snack

Time	Food	Estimated quantity of food

PARTICIPANT I.D NO:

DATE:

SECTION F: DIETARY HABITS

WEEK DAY (2)

27. Do you eat at home before going to school? 1. Yes [] 2. No [] 3. Sometimes []

If no or sometimes, why?

Breakfast

Time	Food	Estimated quantity of food

Mid-morning snack

Time	Food	Estimated quantity of food

28. Do you usually eat lunch? 1. Yes [] 2. No [] 3. Sometimes []

Lunch

Time	Food	Estimated quantity of food

Mid-afternoon snack

Time	Food	Estimated quantity of food

29. Do you usually eat dinner? 1. Yes [] 2. [] 3. Sometimes []

Dinner

Time	Food	Estimated quantity of food

Bedtime snack

Time	Food	Estimated quantity of food

PARTICIPANT I.D NO:

DATE:

WEEKEND

30. Do you usually eat breakfast on weekends? 1. Yes [] 2. No [] 3. Sometimes []

Breakfast

Time	Food	Estimated quantity of food

Mid-morning snack

Time	Food	Estimated quantity of food

31. Do you usually eat lunch? 1. Yes [] 2. No [] 3. Sometimes []

Time	Food	Estimated quantity of food

Mid-afternoon snack

Time	Food	Estimated quantity of food

32. Do you usually eat dinner? 1. Yes [] 2. [] 3. Sometimes []

Time	Food	Estimated quantity of food

Bedtime snack

Time	Food	Estimated quantity of food

PARTICIPANT I.D NO:

DATE:

FOOD GROUP	(33) Have you eaten this in the last 24 hours		(34) Have you eaten this in the last seven days?		(35) How many days in the last 7-day did you eat these?
	Yes	No	Yes	No	Number of days
STARCHY STAPLES (cassava, yam, bread, porridge, corn/maize, rice, wheat, sorghum, millet, potatoes)					
DARK GREEN LEAFY VEGETABLES AND RED PALM OIL (<i>kontonmire</i> , <i>ayoyo</i> , cassava leaves)					
VITAMIN A RICH FRUITS AND VEGETABLES (carrot, ripe mango, ripe papaya)					
OTHER FRUITS AND VEGETABLES (Garden eggs, tomato, onion, other fruits, including wild fruits and 100% fruit juice made from these)					
ORGAN MEAT (liver, kidney, heart or other organ meats or blood-based foods)					
MEAT AND FISH (beef, pork, lamb, goat, rabbit, game, chicken, duck, other birds, fresh or dried fish or shellfish)					
EGGS (Eggs from chicken, duck, guinea fowl or any other egg)					
LEGUMES, NUTS AND SEEDS dried beans, dried peas, groundnut, seeds or foods made from these (eg. peanut butter)					
MILK AND MILK PRODUCTS (Milk, cheese, yogurt or other milk Products)					

PARTICIPANT I.D NO:

DATE:

SECTION G: SANITATION AND MORBIDITY QUESTIONNAIRE

36. Do you have a toilet facility at home and/or school? 1. Yes [] 2. No []
37. What kind of toilet facility do you use at home and/or school?
1. Flush toilet [] 2. KVIP/Pit [] 3. Bush/Field/Plastic bags 4. Others (specify).....
38. Does your household/school have to pay for using the toilet?
1. Yes [] 2. No [] 3. Sometimes []
39. If yes, to the above question, how much do you pay?
GHc.....per call (use) GHc /month
40. What do you often use for your personal hygiene after toilet use?
1. Tissue paper [] 2. Newspaper [] 3. Leaves [] 4. Hands [] 5. Nothing []
41. Is the toilet(s) on the plot equipped with a hand washing facility? 1. Yes [] 2. No []
42. Is water available? 1. Yes [] 2. No []
43. What water source is used for the hand washing stand?
1. Pipe [] 2. Water brought to a barrel 3. Other (Specify).....
44. Is soap/ash/mud available? 1. Yes [] 2. No []
45. Is this hand washing facility currently in use? 1. Yes [] 2. No []
46. Is there at the moment a piece of soap at the toilet/hand washing facility? 1. Yes [] 2. No []
47. Do you always wash your hands with soap after using the toilet? 1. Yes [] 2. No []
48. If yes, even after a short-call? 1. Yes [] 2. No []
49. What is done with collected garbage at your house?
1. Burned [] 2. Dumped at a communal site [] 3. Dumped in a water body []

50. What is the source of water for drinking?

1. Pipe [] 2. Well [] 3. Bore hole [] 4. River/lake [] 5. Rainwater [] 6. Other (Specify).....

51. Have you taken any dewormer drug in the past 3 months? 1 Yes [] 2 No []

52. Have you experienced any illness in the past 2 months? 1 Yes [] 2 No []

53. If yes, what illness/sickness did you suffer from?

1. Malaria 2. Diarrhoea/dysentery 3. Excessive bleeding 4. Anemia 5. Others (Specify).....

Appendix III: Ethical Approval (ECBAS) for both study sites in the Northern and Ashanti Region
were already obtained.



UNIVERSITY OF GHANA
ETHICS COMMITTEE FOR BASIC AND APPLIED SCIENCES (ECBAS)
P. O. Box LG 1195, Legon, Accra, Ghana

My Ref. No: ECBAS 002/15-16 11th November, 2015

Ms. Agnes Josylyn Komey
Department of Nutritional and Food Science
P.O.Box LG, 134
University of Ghana
Legon - Accra

Dear Ms. Agnes Josylyn Komey,

ECBAS 002/15-16: THE EFFECT OF CONSUMING FORTIFIED GROUNDNUT BASED SNACK ON THE NUTRITIONAL STATUS OF SCHOOL CHILDREN IN THE ASHANTI REGION
This is to inform you that the above reference study has been presented to the Ethics Committee for Basic and Applied Sciences for a full board review and the following actions taken subject to the conditions and explanation provided below:

Expiry Date:	30/06/16
On Agenda for:	Initial Submission
Date of Submission:	13/08/15
ECBAS Action:	Approved
Reporting:	Quarterly

Please accept my congratulations.

Yours sincerely,


Professor Daniel Bruce Sarpong
ECBAS Chairperson

Tel: +233-244692728 Email: saddo@staff.ug.edu.gh / ecbas@ug.edu.gh



UNIVERSITY OF GHANA
ETHICS COMMITTEE FOR BASIC AND APPLIED SCIENCES (ECBAS)

P. O. Box LG 1195, Legon, Accra, Ghana

My Ref. No: ECBAS 004/15-16

11th November, 2015

Mr. Kwaku Anane
Department of Nutrition and Food Science
University of Ghana
P.O.Box LG, 134
Legon - Accra

Dear Mr. Kwaku Anane,

**ECBAS 004/15-16: THE EFFECT OF CONSUMING HIGHLY FORTIFIED GROUNDNUT
BASED SNACK ON THE NUTRITIONAL STATUS OF SCHOOL CHILDREN IN THE
NORTHERN REGION**

This is to inform you that the above reference study has been presented to the Ethics Committee for Basic and Applied Sciences for a full board review and the following actions taken subject to the conditions and explanation provided below:

Expiry Date: 30/06/16
On Agenda for: Initial Submission
Date of Submission: 13/08/2015
ECBAS Action: Approved
Reporting: Quarterly

Please accept my congratulations.

Yours sincerely,

Professor Daniel Bruce Sarpong
ECBAS Chairperson

Tel: +233-244692728

Email: saddo@staff.ug.edu.gh / ecbas@ug.edu.gh