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DETERMINANTS OF MALNUTRITION AMONG CHILDREN UNDER THE AGE OF FIVE IN THE THREE NORTHERN REGIONS OF GHANA

BY

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JULY 2015

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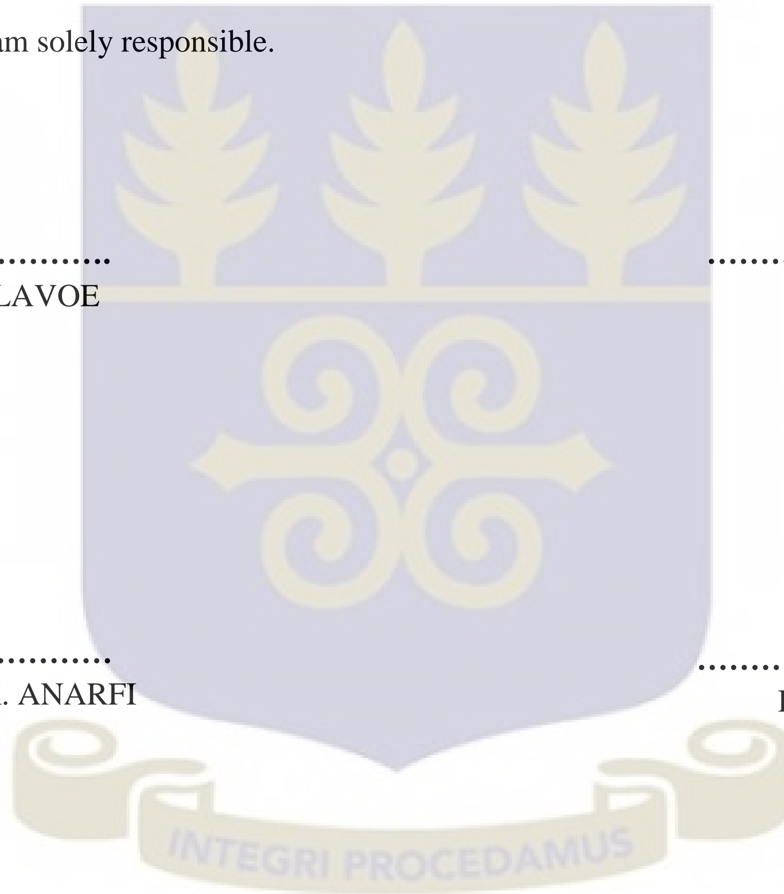
DECLARATION

I, **Francis Lavoe**, officially state that apart from references to other works, which have been duly acknowledged, this dissertation is the result of my own research work carried out under the supervision of **Prof. John K. Anarfi**.

No section of this paper has been reproduced or represented for the award of an academic certificate. I, therefore, declare that in the event of any shortcomings that may be found in this research work, I am solely responsible.



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ABSTRACT

In Ghana, the main barriers to scaling up nutrition interventions have been identified at the national level yet there is a knowledge gap regarding the determinants of malnutrition at the regional, district and sub-district levels where nutrition interventions are directly carried out. In the three northern regions, malnutrition is an underlying cause of high morbidity and mortality among children under the age of five. This study, therefore, used the 2008 GDHS and binary logistic regression analysis to assess the determinants of malnutrition among children under the age of five in the three northern regions of Ghana so as to fill the gap in the literature when it comes to the possible explanatory factors behind the high proportion of malnourished children in northern Ghana. The study was designed to answer the following research questions: (1) Does the wealth index of households in the three northern regions influence stunting among children under the age of five? (2) What is the relationship between the educational level of mothers and stunting among children under the age of five in the three northern regions? (3) Is there any relationship between place of residence and stunting among children in northern Ghana? Drawing on the review of the literature on children's nutritional status by Wondimagegn (2014), it has been hypothesized in this study that maternal education, household wealth and urban residence lead to a reduction in childhood malnutrition.

The results from the bivariate analysis revealed that age of child and ~~succeeding~~ birth interval had a significant association with stunting among children. Moreover, regression results revealed age of child, size of child at birth, wealth index and place of residence as the key determinants of malnutrition among children in the study area. Based on the findings of this study, it is recommended that more research be undertaken to investigate district and sub-district level impacts of malnutrition among children.

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DEDICATION

This study is dedicated to God for His grace and blessings, and to my family for the love, prayers and financial investments in my education.

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Finally, I want to say a big thank you to my family, Mr. Worlanyo Ocloo (Executive Director of United Way Ghana) and Mrs. Yvonne Tamakloe (Chief Executive Officer of Top Dog Africa) for their supports and prayers throughout my academic endeavours.

INTEGRI PROCEDAMUS

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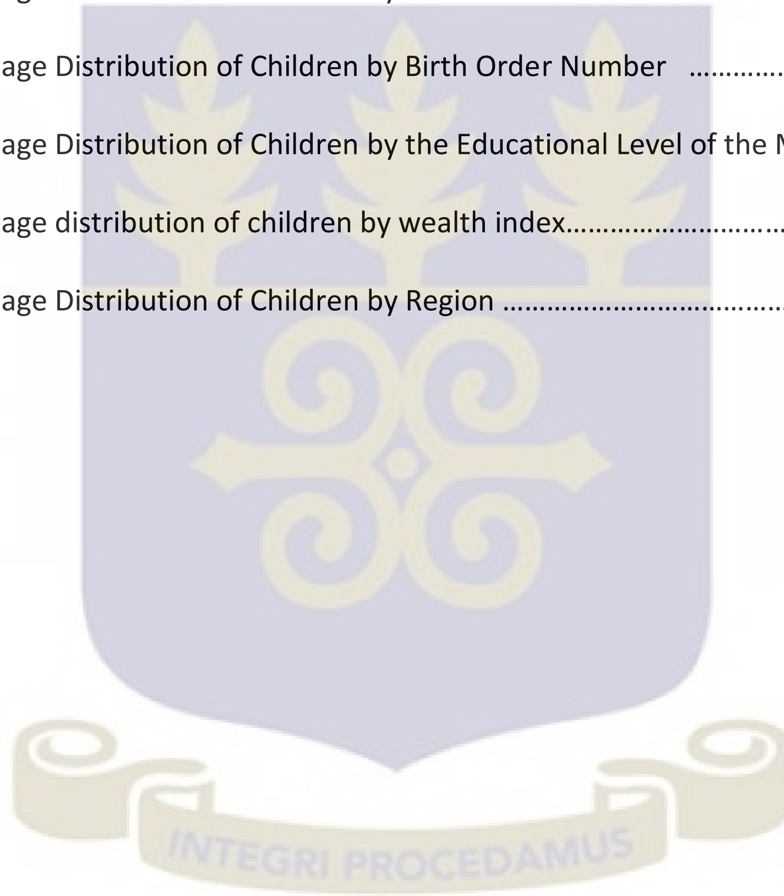

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LIST OF ABBREVIATIONS AND ACRONYMS

CMR	Child Mortality Rate
DHS	Demographic and Health Survey
GDP	Gross Domestic Product
GSS	Ghana Statistical Service
HAZ	Height-for-Age Z-Score
OR	Odds Ratio
SPSS	Statistical Package for the Social Sciences
UNICEF	United Nation's Children Fund
WHO	World Health Organization
NCHS	National Center for Health Statistics
PEM	Protein Energy Malnutrition
SUN	Scaling-Up Nutrition

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DEFINITION OF TERMS

Infant	A baby under one year of age (0-11 months)
Birth Interval	Duration of succeeding birth interval
Birth Order	The nth birth of a child to a woman; n = 1, 2, 3, ……….
Northern Ghana	Upper East Region, Upper West Region and Northern Region

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CHAPTER ONE

INTRODUCTION

1.1 Background of the study

Malnutrition among children remains a major public health problem in many regions of the world, despite global-level progress in improving children's nutritional status during the past two decades (Amugsi et al, 2013). Among the indicators of measuring malnutrition among children which include wasting and underweight, stunting has the advantage of providing information on the historical nutritional status of children (Darteh et al, 2014). Unlike the other indicators, stunting is the most difficult to tackle and it also has the greatest adverse impact on the physical growth of the child (UNICEF, 2009; Müller and Krawinkel, 2005; Williams, 2005). Globally, stunting among children under the age of five was 39.7% in 1990 but declined to 26.7% in 2010 (de Onis et al, 2011). In developing countries, stunting was observed to decline from 44.4% in 1990 to 29.2% in 2010 (de Onis et al, 2011). The decline in stunting among children in Africa has not been noteworthy and has stagnated around 40% between 1990 and 2010 (de Onis et al, 2011). This current rate of decline will not be enough to meet the WHO requirement for 2025 which is to reduce stunting among children under the age of five up to 40% in developing countries.

Within the context of Ghana, the supply of food and health services have been inadequate to cater for the growing population, especially in the northern parts of the country, and this leaves significant proportion of children as the most vulnerable to health risks of malnutrition (UNICEF, 2013). Trend analysis of the nutritional status of children under the age of five from 1993 to 2008 in Ghana revealed that stunting has only decreased marginally among Ghanaian children under the age of five from 34% in 1993 to 26% by 2008 (Amugsi et al, 2013). Ghana

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was classified among the global set of thirty-six countries which account for 90% of all stunting among children under five in 2008 as a result of this slow progress (Gongwer & Aryeetey, 2014). Malnutrition affects children's immunity, health, including physical growth, cognitive development, and exposes children to morbidity and mortality (Pelletier & Frongillo, 2003). It takes time for a malnourished child to recover from respiratory and diarrheal diseases and, therefore, the risk of morbidity and mortality is higher in malnourished children compared to their nourished counterparts. Repeated illness contributes to ill health of children and this compromises their nutritional status (Black et al, 2013).

A major evidence of malnutrition among children is Protein Energy Malnutrition (PEM), which basically results from imbalanced availability of protein and glucose (WFP, 2012). Infections play a major role in the etiology of PEM because they result in increased needs of protein and a high energy expenditure, lower appetite, nutrient losses due to vomiting, diarrhea, poor digestion, mal-absorption and the disruption of metabolic functions of children. Also, a deficiency in micronutrients such as Vitamin A, Iodine, Zinc and Iron account for close to 60% of the burden of malnutrition among children in Ghana. Additionally, more than 70% of children under the age of five in Ghana are anemic (Gongwer & Aryeetey, 2014).

With regards to the three northern regions of Ghana, recent studies (WFP, 2012; Miah, 2014) have revealed that the nutritional status of children under five in northern part of the country is poorer in relation to the national average. For instance, while on average, 28% of children are stunted in Ghana, the stunting rate in northern Ghana averages over 60% in 2013 (Akosa, 2013).

Within the three northern regions of Ghana, evidence of abject poverty exists, with these three regions having the largest proportion of Ghanaians who are below the poverty line (WFP, 2012).

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Food security is a major problem, with about more than half of northern Ghana's population extremely vulnerable to food insecurity (WFP, 2012).

While most of the nutrition interventions are implemented at the local levels through the regional and district health administration, limited evidence exists on the factors that are significantly related to the nutritional status of children at the regional levels as these interventions have been largely based on national level factors (Amugsi et al, 2013; Miah, 2014). Due to this reason, it is necessary to investigate if the poor socioeconomic profiles of the three northern regions have any influence on the nutritional status of children in that part of the country.

1.2 Statement of the Problem

There is the need to understand the possible determinants of malnutrition among children under the age of five at the regional and local levels. This is because despite the regional variations in malnutrition prevalence that have been reported in the literature, there is a knowledge gap with regards to the determinants of malnutrition among children at the regional levels of the country (Amugsi et al, 2013). According to the Ghana Statistical Service in 2008, while on average, about 24% of children under the age of five are stunted in southern Ghana, the prevalence is highest in the northern parts of the country (35%) (GSS, 2008). Also, a comparative analysis of the nutritional status of children in Ghana revealed that malnutrition in the three northern regions has been on the increase in relation to other regions of the country. In 2013, while as low as 13.7% of children under the age of five in the Greater Accra Region were stunted, 81.5% of children were reported to be stunted in the Upper West Region, followed by 77.5% in the Upper East Region and 37.4% in the Northern Region (Akosa, 2013).

Moreover, a study conducted by Miah (2014) to assess undernutrition among children under the age of five in Ghana also revealed that while 22.7% of children in Ghana are stunted, the

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prevalence was highest in northern Ghana with over 36% of children stunted in the three northern regions. Despite these national level nutritional studies that have revealed that the children in northern Ghana are the worst hit when it comes to the burden of malnutrition, there is a gap in knowledge as to what factors significantly relate to the prevalence of malnutrition in the three northern regions (Amugsi et al, 2013).

According to GSS (2004), while Child Mortality Rate (CMR) in Ghana is about 50 children per 1000 live births, the average CMR in the three northern regions is around 84 children per 1000 live births. Interestingly, Gongwer & Aryeetey (2014) noted that about 45% of these CMR in Ghana is due to Protein Energy Malnutrition (PEM) and deficiencies in one or more micronutrients. This makes malnutrition the single most important cause of childhood mortality in the three northern regions of Ghana, and calls for a critical look at the issue in these three regions.

In terms of Ghana's policy environment, the government has implemented Community Based Growth Monitoring and Promotion, the Supplementary Feeding, Health and Nutrition Education Programmes, and have also subscribed to the Scaling-Up Nutrition (SUN) program in 2010. While these policy interventions have contributed, in part, to the improvements in the national prevalence of malnutrition, the three northern regions have not shown any sign of improvement in light of these interventions (Miah, 2014).

According to the World Food Programme (2012), the possible reason why these nutrition interventions have not improved the nutritional status of children in the three northern regions is the paucity of information on the risk factors of malnutrition that are peculiar to the three northern regions. A further study is, therefore, needed to investigate the possible factors that

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determine the nutritional status of children under the age of five in the three northern regions of Ghana. This is the basis for undertaking the current study.

1.3 Research Questions

Following the background to this study and the problem statement, the following research questions are posed:

- Does the wealth index of households in the three northern regions influence stunting among children under the age of five?
- What is the relationship between maternal educational level and stunting among children under the age of five in the three northern regions?
- Is there any relationship between place of residence and stunting among children in the three northern regions?

1.4 Objectives of the Studies

1.4.1 Main Objective

The main objective of this study is to explore the determinants of malnutrition among children under the age of five in the three northern regions of Ghana so as to inform the design and implementation of nutrition interventions.

1.4.2 Specific Objectives

- To analyse the influence of wealth index of households on stunting among children under the age of five in the three northern regions of Ghana
- To assess the relationship between the maternal educational level and stunting among children under the age of five in the three northern regions of Ghana

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- To assess the relationship between place of residence and stunting among children in the three northern regions of Ghana.

1.5 Rationale of the Study

This study is important and timely for a number of reasons. Firstly, the study is very timely because the Government of Ghana is currently in the process of developing a new national nutrition policy to help speed up the improvement in the nutritional status of the population in general. An understanding of the nutritional status of children under the age of five in the three northern regions will guide the implementation of the policy in these three regions. Also, the result of this study would help in planning and execution of interventions to reduce the high Child Mortality Rates in northern Ghana.

Secondly, the results of this study will help bridge the gap between the northern and the southern parts of the country in terms of malnutrition among children. This is because the study will guide the development and implementation of targeted interventions aimed at reducing children malnutrition in northern Ghana. According to the World Food Programme in 2012, for nutrition enhancement interventions to be successful in northern Ghana, nutritional studies should be shifted from the national level to the three northern regions.

Moreover, the results of this study will not only be beneficial to the three northern regions but to the country as a whole. Apart from the development of northern Ghana that this study seeks to contribute to, the country will also reap the rewards from an economic and financial stance. According to the World Bank (2006), Ghana could save between 2% to 3% of national income by identifying and tackling the possible determinants of malnutrition among children. This implies that caring and providing for the medical and other health needs of malnourished children could be costing the country huge financial outlays. The results of this study can,

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therefore, be a step towards helping the country to tackle malnutrition head on, and then invest some of these 2% to 3% of national income in financially viable sectors like manufacturing, agricultural and technology sectors.

In research and academia, the study will contribute to existing knowledge on the risk factors for malnutrition among children under the age of five in general, and most especially with respect to children in the three northern regions. Also very important about this study is that it can lay the foundation for future research into the determinants of health and nutritional status of the population at regional, district and sub-district levels of the country.

1.6 Organisation of the Study

This study is organized into seven chapters. The first chapter is divided into the background of the study, the statement of the problem, research questions for the study, objectives for the study (general and specific objectives), rationale of the study and the organisation of the study. Chapter two consists of three different sections – literature review, the specification of the analytical frameworks for the study and the list of the proposed hypotheses to be tested. The methodology of the study is detailed in chapter three. This chapter is divided into the description of the source of data, with the limitations of the dataset for the study clearly stated, as well as, the methods of data analysis employed in the study. Chapter four is dedicated to analyzing the distribution of children by the selected variables for this study so as to provide a context for the study area. Chapters five and six are dedicated to bivariate analysis and multivariate analysis respectively. Finally, chapter seven focuses on the summary of major findings, conclusions and the relevant recommendations based on the findings from this study.

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CHAPTER TWO

LITERATURE REVIEW

2.1 Introduction

Malnutrition is defined as insufficient, excessive or an imbalanced intake of dietary energy and nutrients, which manifests as under nutrition, over nutrition and micronutrients malnutrition. Malnutrition among children is a major concern in public health because malnourished children tend to have increased risk of morbidity and mortality and often suffer delayed mental development, poor school performances and reduced intellectual achievement (Smith and Haddad, 1999).

Developing countries have had challenges with reducing childhood malnutrition over the years, mainly because the factors influencing the nutritional status of children are multifaceted (Rayman et al, 2006). It has been estimated that close to 230 million children under the age of five in developing countries are chronically malnourished (Van de Poel et al, 2007). In Sub-Saharan Africa for instance, about 54% of child mortality have been attributed to poor nutritional status (FAO, 2008).

In Africa and the rest of the developing world, economic challenges affect the earnings of most households and food production, food supply and food availability is generally low. This leads to more prevalence of undernutrition relative to overnutrition (de Onis et al, 2011). According to a UNICEF report on tracking children's nutritional status in 2009 and Parks & Naomi (2012), developing countries looking to address the health needs of their children and improve their nutritional status must tackle undernutrition at the early stages of children's development. A poor nutritional status of children manifests into either Protein Energy Malnutrition (PEM) or deficiencies in micronutrients.

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The PEM, which is also referred to as protein–calorie malnutrition, is a form of malnutrition due to inadequate calorie or protein intake whiles micronutrients deficiency is mainly due to lack of key vitamins and minerals such as vitamin A, iron, zinc and iodine. In many cases in Sub-Saharan Africa, children have been reported to be suffering from PEM while also exhibiting deficiencies in micronutrients (WHO, 1997, 2007).

This literature review, therefore, covers the causes of malnutrition among children, studies from Africa and other parts of the world, studies pertaining to Ghana and the three northern regions. The gap in the literature regarding the issue is also reiterated in this section. The theoretical framework, conceptual framework and the hypotheses to be tested are derived from the literature review, and are subsequently included in this chapter.

2.2 Types of Protein Energy Malnutrition (PEM)

2.2.1 Primary Protein Energy Malnutrition

This is the PEM that arises as a result of insufficient dietary intake or intake of protein of poor quality that fails to produce the necessary nutrients to support the body's metabolism (Mason, 2007). The presence of primary PEM in children manifests into a variety of pathological conditions like kwashiorkor and marasmus. Most of the determinants and clinical features of the two severe forms of primary PEM may be similar, but the inherent features of kwashiorkor are oedema, irritability, growth faltering and discoloured hair (Oyelami & Ogunlesi, 2007).

Children with primary PEM can have different symptoms depending on what caused the malnutrition (Gallager, 2008). According to Torún (2006), "severe PEM includes deficiencies of protein, energy or both, resulting in kwashiorkor, marasmus and marasmic kwashiorkor, with marasmic kwashiorkor developing because of a combination of chronic energy deficiency and chronic or acute protein deficiency" (p.881).

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2.2.2 Secondary Protein Energy Malnutrition

Secondary PEM arises when illness or other diseases already affecting the human body impair the uptake or utilization of nutrients, thus resulting in the body's inability to meet protein or energy requirements, or increase metabolic losses beyond nutrient availability. This is more common in the developed countries, where it usually occurs as a complication of cancer, chronic kidney failure, inflammatory bowel disease, and other illnesses that impair the body's ability to absorb or use nutrients or to compensate for nutrient losses (Mason, 2007). Secondary PEM symptoms range from mild to severe, and can alter the form or function of almost every organ in the body. The type of symptoms and their severity depend on the patient's prior nutritional status and on the nature of the underlying disease, as well as, the speed at which it is progressing (Mason, 2007).

2.3 Micronutrient Deficiencies

According to UNICEF (2013), it was approximated that more than 2 billion people worldwide suffer from deficiencies in micronutrients and micronutrients related health problems. The occurrence of illnesses and reduced nutrient intake that influence marasmus and kwashiorkor are mainly due to deficiencies in iron, iodine, vitamin A and zinc, usually termed as hidden hunger. Also, Williams (2005) concluded that a deficiency of micronutrients in children manifests in several ways such as mineral deficiencies, vitamins deficiencies and deficiencies in some specific water soluble vitamins. The peculiar problem with a deficiency in micronutrients is basically the difficulty in detecting them at early ages of life. Micronutrient deficiencies are still seen as a major public health problem, even though deficiencies in Vitamins B, C and D have dropped over the last decades, especially in developing countries (Müller and Krawinkel, 2005).

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2.3.1 Types of Micronutrient Deficiency

2.3.1.1 Vitamin A Deficiency

In 2006, Strobel and Ferguson conducted a study on immune functions, food allergies and food intolerance, and found out that Vitamin A deficiency ranks as the second most serious micronutrient deficiency in the world. The prevalence of Vitamin A deficiency is highest in Asia and Africa, with the two continents accounting for about 40% of the global burden of vitamin A deficiency (UNICEF, 2009). According to Williams (2005, p 410), the major risk factors for Vitamin A deficiency range from low intake of fat and fat-soluble vitamins, not practicing exclusive breastfeeding, economic factors and increased losses through acute infections, such as measles and diarrhea. Moreover, it has been clear from the literature on food and nutrition that vitamin A supplementation facilitates the functioning of the eye by improving the functions of the retina, as well as, boosting the immune systems (Müller and Krawinkel, 2005; Turnham, 2005).

2.3.1.2 Iodine Deficiency

Iodine deficiency is prevalent in both developed and developing countries, where 42% of Africa's population is iodine deficient, with a significant proportion of these deficient people being children (UNICEF, 2009, p.23). In a study conducted by Müller and Krawinkel (2005) on malnutrition and health in developing countries, it was concluded that the immune system of a child who is iodine deficient retards the production of thyroid hormones and increases the production of thyroid-stimulating hormone. Iodine deficiency can be treated with iodated salt. Iodine is also noted to be very important for brain development of the child. As a result of this, it is important to fortify food with iodine for pregnant women because brain development starts long before the baby is born (Wittenberg, 2004; Williams, 2005).

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2.3.1.3 Zinc Deficiency

Zinc is one of the important minerals that facilitate the development of children and plays essential roles in the formation of organ systems. The presence of zinc in children helps in the development of the skin, gastrointestinal tract, central nervous system, immune, skeletal, and reproductive systems. Globally, deficiency in zinc, especially for children, is one of many causes of diarrhea, pneumonia and malaria (Williams, 2005).

Also, a deficiency in zinc interferes with various biological functions, such as gene expression, appetite and immunity. Zinc is fundamental for the production and functioning of natural killer cells. It is, therefore, a very essential part of enzymes and it is very fundamental to the development of them (enzymes) (Müller and Krawinkel, 2005).

2.3.1.4 Iron Deficiency

According to the definition from WHO, iron deficiency is a serum value of less than 110 g/L hemoglobin concentration. Causes of iron deficiency are myriad and range from such factors as low birth weight, early introduction of whole cow milk, vegetarian weaning, high tea intake and low socioeconomic status (Williams, 2005). In children, a deficiency in iron occurs usually during the first years of life; where milk, which is low in iron, is the main source of food (Wittenberg, 2004).

Anaemia in children is mainly caused by a deficiency in essential minerals like iron, and according to the 2009 edition of the UNICEF's work on tracking child and maternal nutrition, about 20% to 50% of children worldwide are reportedly stunted because they are anemic and are iron deficient. Anemic children, as with underweight children, are often numb, solemn, isolate themselves, are unresponsive to pleasure, are wary and tire easily in free-play situations. Children with anemic conditions have poor social skills and find it difficult to pay attention to

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details. The duration of the anaemia in a child has also been linked to the level of development of that child (Baker-Henningham and Grantham-McGregor, 2004).

2.4 Assessment of Malnutrition among children

2.4.1 Stunting

Stunting, a low height for age, is a greater problem than underweight and wasting, and it is an indicator of nutritional deficiencies or status and illness that occurred during times of growth and development, usually in infants and children younger than five years (UNICEF, 2009). Stunting is an indication of the height of the child compared to the height of a normal child of the same age. Children appear normal, but when the age becomes apparent, it is obvious that the child is below the standard height for his or her age. This is basically because stunting is difficult to diagnose in children at the early stages of life (Golden and Golden, 2000). Stunting is particularly a long-term malnutrition status because it takes time to develop and to recover (Baker-Henningham and Grantham-McGregor, 2004). Stunting can also be called growth faltering, which refers to slow weight gain or inadequate growth in the infant and young child. It is an indication of chronic malnutrition and long-term insufficient diet because of a chronic energy deficiency (Müller and Krawinkel, 2005; Williams, 2005).

According to UNICEF statistics on the prevalence of malnutrition in the developing world, the trend has clearly shown that stunting has declined from 40% in 1990 to 29% in 2008. The decline in stunting in Africa, though, has been the slowest with 38% in 1990 declining to only 34% in 2008. Moreover, due to population growth, the absolute number of African children under 5 years who are stunted has increased, from an estimated 43 million in 1990 to 52 million in 2008 (UNICEF, 2009).

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2.4.2 Wasting

Wasting, indicated as a low weight for height, is used as an indicator for identifying acute malnutrition among children under the age of five (UNICEF, 2009). Inadequate food intake leads to weight loss and growth retardation and when prolonged, leads to emaciation of the body (Torún and Chew, 1994; Torún, 2006). When the growth of a child is acutely affected, the child's growth falls behind the one who is well-nourished and is actively growing (Golden and Golden, 2000). Children who suffer from wasting face a markedly increased risk of death. According to the latest available data, 13% of children under 5 years old in the developing world are wasted, and 5% are severely wasted (representing an estimated 26 million children). A number of African and Asian countries have wasting rates that exceed 15%, including Bangladesh (17%), India (20%) and Sudan (16%). The country with the highest prevalence of wasting in the world is Timor-Leste, where 25% of children under the age of five are wasted (UNICEF, 2009).

2.4.3 Underweight

Underweight is a condition where the child is below the average weight considered normal for his age. It is considered a composite measure of stunting and wasting in the same child (UNICEF, 2007). When children are continually fed diets that are insufficient in protein or energy or both, their growth rate is slowed down, they fail to gain adequate weight and their chances of losing weight is increased (Wittenberg, 2004). According to UNICEF's data on tracking child and maternal nutrition (2009), "an estimated 129 million children under 5 years old in the developing world are underweight, representing an approximately one out of every four children". It has been shown that the proportion of children severely underweight in developing countries is 10%, with underweight children significantly more in Asia (27%) than

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Africa (21%) (UNICEF, 2009). This could be due to the increased and persistent immunization of children within the African countries as compared to Asia.

2.4.4 Anthropometric Growth Standards

The two most globally used child growth standards for classifying children as stunted, wasted and underweight are the United State's National Center for Health Statistics (NCHS) and the new WHO standards. The new WHO growth standards, which have been introduced in 2006, have many advantages over the NCHS standard. First of all, the new WHO's growth standards were developed based on growth standards of six countries (Brazil, Ghana, Norway, India, Oman and USA) whereas the NCHS standards were only based on the standards of one country. Further, in the new WHO standards, growth charts are available for boys and girls, infants to one year and children to five years, as well as, the BMI of infants to five years of age. Thus the new WHO standards also look at the milestones that children should reach at specific ages while milestones were not part of the NCHS standards. Finally, the main idea of the new WHO standards is to see how children should be growing for the best health outcome, rather than just showing how the average child is growing (WHO, 2006).

2.5 Determinants of malnutrition among children under the age of five

2.5.1 Studies pertaining to Africa and developing countries

The nutrition and health of a child is a worldwide indicator of the quality of life of people in a particular country. Adequate or optimum nutrition and healthy living among children is essential to the development of the children, the communities they live in, as well as, the country as a whole. The various factors that are associated with the nutritional status of children have been examined by some nutrition scholars across the world. The reviews provided, herein, look at the

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determinants of malnutrition among children under the age of five in developing countries, including Africa.

According to UNICEF (1998), even though the political and socio-economic environments of Africa are general predictors of malnutrition among children, specific factors like the prevalence of disease and inadequacy of diet are the immediate causes. In the deprived areas of Africa, factors like household food insecurity, lack of maternal education and knowledge on child care practices, an unhealthy environment in the household and inadequate health services also go a long way to influence the nutritional status of the child.

Most of these factors are confirmed by the systematic review of relevant literatures on malnutrition among children under the age of five carried out by Wondimagegn (2014) in his work on the magnitude and determinants of stunting among children in Africa. The objective of this study was to review all the relevant researches on children's nutritional status and to establish the most common factors that are prevalent within the African region. At the analysis stage, a total of 21 out 55 publications on determinants of children's nutritional status were thoroughly reviewed. Analyses of the selected materials showed that the researchers were unanimous on such factors as inappropriate complementary feeding practice, maternal under nutrition, household food insecurity, economic growth and maternal education as the principal determinants of stunting among children in Africa. The analyses also confirmed the significant relationship between inadequate dietary intake and disease as major determinants of stunting. This study (Wondimagegn, 2014), therefore, showed that the above mentioned factors that determine malnutrition among children under the age of five years are common to almost all African countries.

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In Sub-Saharan African countries, the prevalence of stunting is highest among all other anthropometric indicators of measuring malnutrition among children. The stunting prevalence rates in countries like Ethiopia, Madagascar, Niger, Malawi, Senegal and Rwanda have reached alarming state, with more than half of children under the age of 5 stunted (Kothari and Noureddine, 2010). Todd and Meera (2006) initially provided explanations to the high rates of malnutrition in these countries by alluding to the fact that challenges of civil and ethnic conflicts, commodity price shocks, droughts and floods, among others are commonplace in these countries. It is worth noting that these problems only tend to exacerbate the determining factors of malnutrition studied by Wondimagegn (2014) in his systematic review of the relevant studies concerning the determinants of malnutrition among children in Africa.

In a study to assess the prevalence and determinants of malnutrition among under-five children of farming households in Kwara State in Nigeria, Babatunde and his colleagues (2011) performed anthropometric analysis on 127 children selected randomly from 40 rural villages in the State. Descriptive statistics from the anthropometric data showed stunting among the children to be 23.6%, followed by 22.0% of underweight and 14.2% of wasting. Regression analysis was carried out at the multivariate level in order to examine the factors that were strongly associated with the above malnutrition rates discovered at the descriptive analysis level. It was interesting to note that the findings of this study were not particularly different from the underlying biological and socio-economic causes studied by UNICEF (1998) and Wondimagegn (2014). The analysis revealed that the significant predictors of malnutrition in Kwara State were maternal education, Body Mass Index (BMI) of mother, calorie intake of the households, age of child, access to clean water and presence of improved toilet facility in the households.

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Malnutrition rates in Kenya over the past decades have also been experiencing some decline despite the high and worrying prevalence of stunting in the country (Masibo, 2013). According to recent nutritional studies (Kabubo-Mariara et al, 2009; Masibo, 2013) to examine the trend in malnutrition rates over the years, the rates of stunting, wasting and underweight have shown significant declines at the significant level of ($P<0.05$). The determinants of malnutrition among children under the age of five years that were observed during these trend studies included household wealth, maternal education, maternal Body Mass Index (BMI), size of the child at birth (Masibo, 2013) and child characteristics like age and sex of child (Kabubo-Mariara et al, 2009). Other major factors responsible for the observed trend of prevalence were share of women in a household and mother's education, as well as, type of place of residence (Kabubo-Mariara et al, 2009).

In 2002, a study was conducted in the Gambia and Niger to find out if mothers' level of education has any sort of impact on the nutrition and health status of children. The study was carried out by Oyekale and Oyekale (2002), and they employed the Foster-Greer-Thorbeck and probit regression approaches to analyze the data they collected. Results from their analyses showed that there was not much difference between stunting, wasting and underweight head counts within the rural and urban centers of Niger. One interesting pattern from their results showed that malnutrition was severest and highest in children whose mothers had below secondary education within Gambia and Niger. The results from their probit analysis revealed that attainment of secondary education by the mothers, urbanization, presence of pipe water, vaccination, medical care and breastfeeding significantly reduce the probability of stunting, wasting and underweight among the children. Oyekale and Oyekale (2002) did not particularly

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elaborate on the impact of paternal education on the health and nutrition of children but suggested this could be explored in future researches.

A classical study of poverty and its effect on malnutrition among children was carried out by Radhakrishna and Ravi (2004) when they assessed "Malnutrition in India - trends and its Determinants." They hypothesized that a trend of reduction in poverty will be matched by a significant decline in malnutrition among children under the age of five in India. The results, however, showed somewhat inconclusive relationship between poverty reduction and improvement in nutritional status. When the analyses were further stratified by the various States within India, it was discovered that some States of middle-income status like Kerala and Tamilnadu even had better nutritional achievement than higher income states like Maharashtra and Gujarat. Some of the poorest States in the Northeastern region also showed better nutritional trends than some of the middle income States. This was a completely new discovery since most of the literatures on the improvement of the nutritional status of children revealed economic growth and poverty reduction as major policy areas. The plausible explanations from these results could be that due to the socioeconomic inequalities within most of the States in India, interventions in the form of nutrition, health and education were targeted at these deprived regions to the neglect of the so-called developed States. This could explain why the poorest States in the Northeast had better nutritional scores compared to the socioeconomically developed States like Maharashtra and Gujarat (Radhakrishna et al, 2004).

In Sri-Lanka, Aturupane et al (2008) studied the determinants of child weight and height using a Quintile Regression approach. They suggested that the factors that influence the weight and height of children are multi-faceted and that an intervention to curtail malnutrition must entail economic, social and policy determinants of the malnutrition. The major conclusion from this

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study is that household expenditure per capita, educational levels of parents, as well as, the policy level interventions are fundamental to improving the nutritional status of children.

Just like the study conducted in Gambia and Niger by Oyekale and Oyekale in 2002 to assess the impact of maternal educational level on the nutritional status of the child, Frost et al (2005) carried out a similar study in Bolivia. This study models the various pathways linking the education of mothers and the nutritional status of children in Bolivia using a nationally representative sample of children. The pathways analysed in this study include socioeconomic status, health knowledge, modern attitudes towards health care, female autonomy and reproductive behaviour. Logistic regression results from the multivariate level analysis suggested that the most important pathways linking maternal education to nutritional status of children are the socioeconomic factors. Pathways like reproductive behaviours also influence the nutritional status of children but they did so independent of maternal education. The adjusted R-squared value from this analysis was 0.60, implying that the various pathways that were included in the regression model, together with maternal education, accounted for 60% of the variation in child's nutritional status.

Finally, Rayhan and Khan (2006) analyzed impact of some demographic, socioeconomic, environmental and health related factors on nutritional status of children under the age of five in Bangladesh. They used the Bangladesh Demographic and Health Survey 1999-2000 (BDHS 1999-2000) data and revealed the following: stunting (45%), wasting (10.5%) and underweight (48%). The major contributory factors to the high children malnutrition figures above were birth interval, the size of child at birth, BMI of mothers and the educational level of parents.

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2.5.2 Studies pertaining to Ghana

Within the Ghanaian context, there have been differences in the findings of the various studies attempting to explain the major risk factors of malnutrition among children under the age of five years.

A study by Appoh and Krekling (2005) has demonstrated a strong association between maternal nutritional knowledge and socio-economic status as major influences of nutritional status of children while another study (Amugsi et al, 2013) has shown inconsistent relationships between these factors and nutritional status of children. In the study conducted by Appoh & Krekling (2005) on maternal characteristics like education and nutritional knowledge, and their effects on the nutritional status of children in the Volta Region, the education of the mother had a significant relationship with the nutritional status of children in the region. However, this finding was only very conclusive at the bivariate level of analysis. When further analysis was carried out using logistic regression techniques, maternal nutritional knowledge and practices, and not maternal education, showed a significant relationship with children's nutritional status. Appoh and Krekling (2005) concluded that "mother's practical knowledge about nutrition may be more important than formal maternal education for a child's nutritional outcome".

Moreover, Darteh, Acquah, & Kumi-Kyereme (2014) found that sex of the child, as well as, mother's characteristics are significant predictors of nutritional status of children. In their study on "Correlates of stunting among children in Ghana", the independent variables that were used at both the bivariate and multivariate levels were region of residence, place of residence, child's age, sex of child, household size, source of drinking water, type of toilet facility, ethnicity, mother's level of education, wealth index and marital status, using the 2008 GDHS. The multivariate level analysis revealed that stunting was more prevalent among males than females,

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and that parity and age of mothers at birth are significant determinants of malnutrition among children in Ghana. Most of the findings from this study are supported by other studies investigating the determinants of malnutrition among children conducted by Van de Poel et al (2007) and Amugsi et al (2013).

In addition to the above, Van de Poel et al (2007) carried out a study on “Malnutrition and Socioeconomic Gaps in Malnutrition in Ghana” in order to deliver evidence on the determinants of malnutrition in Ghana. Using the height-for-age standardized scores of children from the 2003 Ghana Demographic Health Survey (DHS), it was revealed that poverty, education, health care and family planning services and regional characteristics significantly determine stunting among children under the age of five in the country. Also, it was suggested that nutritional studies should be directed towards the deprived and poor communities in the country.

Furthermore, Miah (2014) carried out a study on the risk factors for undernutritioin in children under five years old in Ghana. The study analysed the anthropometric data collected on 7550 children during the 2011 national MICS conducted by the Ghana Statistical Service (GSS) based on the UNICEF analytical model of child malnutrition. Unlike Darteh et al (2014), Miah’s dependent variables included not only stunting but also wasting and underweight in order to provide a complete picture of the nutritional status of children in Ghana. The findings from this study were not particularly different from other nutritional studies in Ghana (UNICEF Ghana, 2013; Van de Poel, 2007) that have specifically adapted the UNICEF conceptual framework. The bivariate level analysis from Miah’s work (2014) has revealed that some of the risk factors for malnutrition among children under the age of five years were diet intake and diseases, parity, size of child at birth, age and sex of child, among others. However, when a regression analysis was carried out at the multivariate level, it was clear that the major independent variables that

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were common to all of stunting, wasting and underweight are household wealth quintile, having more children at home, size of child at birth, ethnicity, region of residence and health insurance services for children.

Finally, Takyi (1999) conducted an investigative study on the nutritional status and nutrient intake of pre-school children in northern Ghana in order to ascertain whether the nutrient intake among the pre-school children in Saboba, a Sub-Sahelian setting, has met the acceptable standards. Takyi sampled 519 children from three pre-schools and five other localities to use for the studies, and assessed anthropometric measures of age, weight and height. The study results confirmed that the nutritional status of children within the Saboba township was generally poor, with 27% stunted, 4.4% wasted and 1.9% underweight. The major conclusion from the study was that the intake of essential nutrients like vitamin A, iron, zinc and vitamin C were generally low and this was the major factor behind the poor nutritional status of the pre-school children from Saboba. The major limitation of the study may be the difficulty to generalize the results for the whole northern Ghana due to the study being conducted in only one community.

2.6 Research Gap

The above review of various studies on the determinants of malnutrition among children has given an important insight into the factors that influence the nutritional status of children in Ghana and other parts of the developing world. The review of some studies pertaining to Ghana also revealed such factors as economic status of households, education of parents, source of drinking water, availability of toilet facilities, child morbidity, age of child, parity, size at birth, and availability of medical facilities, among others, as having significant influence on the nutritional status of children. It has also been very evident from these studies on children's nutritional status in Ghana (Miah, 2014; Amugsi et al, 2013; Akosa, 2013; Van de Poel et al,

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2007) that the regions in northern Ghana have the highest prevalence of malnutrition among children under the age of five.

What is not very evident from the literature is the possible factors that explain the high prevalence of malnutrition in the three northern regions of Ghana. Studies that investigated the nutritional status of children at the local and regional levels, especially the three northern regions where the prevalence of malnutrition is highest, are few and far between. This is the gap in the literature that this current study attempts to fill.

2.7 Theoretical Framework

An understanding of the complex and delicate causes of malnutrition is important to appreciate the depth and severity of the problem. As shown in Figure 2.1, in order to facilitate this in-depth analysis of malnutrition, UNICEF has developed a comprehensive theoretical framework as part of its Nutrition Strategy in 1998. The framework recognized that the determinants of malnutrition among children are multifaceted and three important theories underpinning the determinants of malnutrition are inherent in the framework. These theories are the immediate level influences, underlying biological and behavioral level influences, as well as, the socioeconomic and basic level influences that explain the nutritional status of children.

The immediate level factors include the intake of food and the episode of infectious diseases, which are predictors of malnutrition at the individual level. These are directly and indirectly linked to biological and behavioural factors like inadequate maternal and child care practices, an unhealthy household environment and the utilization of health care services. According to the UNICEF framework, these underlying biological and behavioural influences occur at the household or family level. Macro level factors like the social, economic and political

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environments of a country are the basic determinants of nutritional status of children (Torún, 2006).

The immediate level determinants generally include intake of micronutrients like iodine, iron, vitamin A and zinc, which influence the episode of infectious diseases like malaria, diarrhea and cholera among the children population. The analytical model also helps to explain biological factors like parity, birth interval, birth order, sex of child, size and weight of child at birth, and their relationships with the growth and nutritional status of children.

Moreover, such socioeconomic and environmental factors as place of residence, parental education, occupation and knowledge of nutritional practices, wealth index of households, type of toilet facilities and sources of drinking water form part of the underlying social, economic and basic level influence of malnutrition among children.

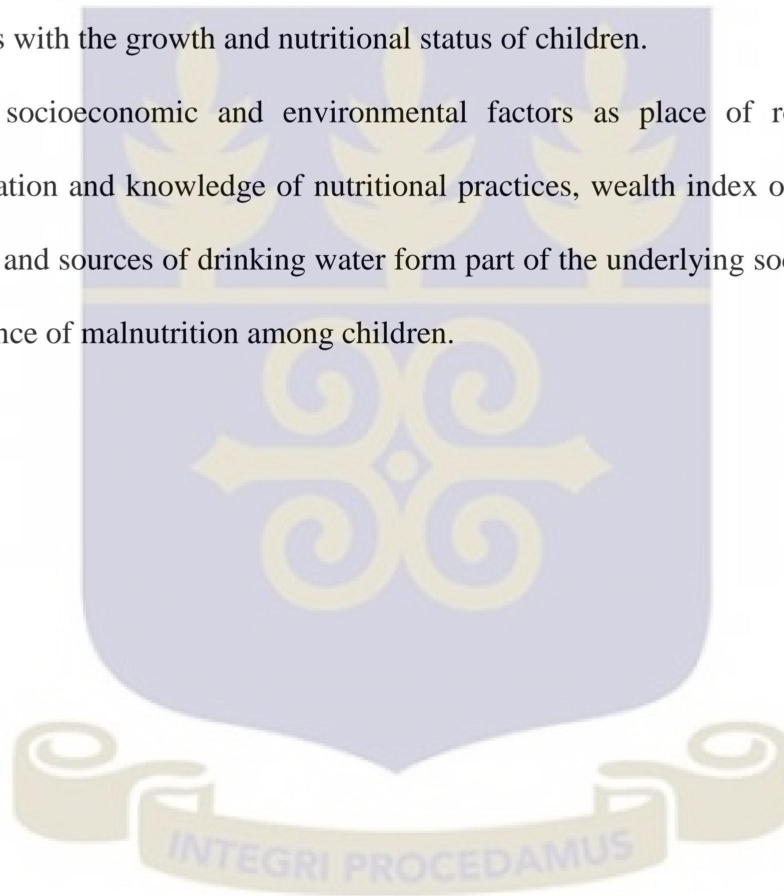

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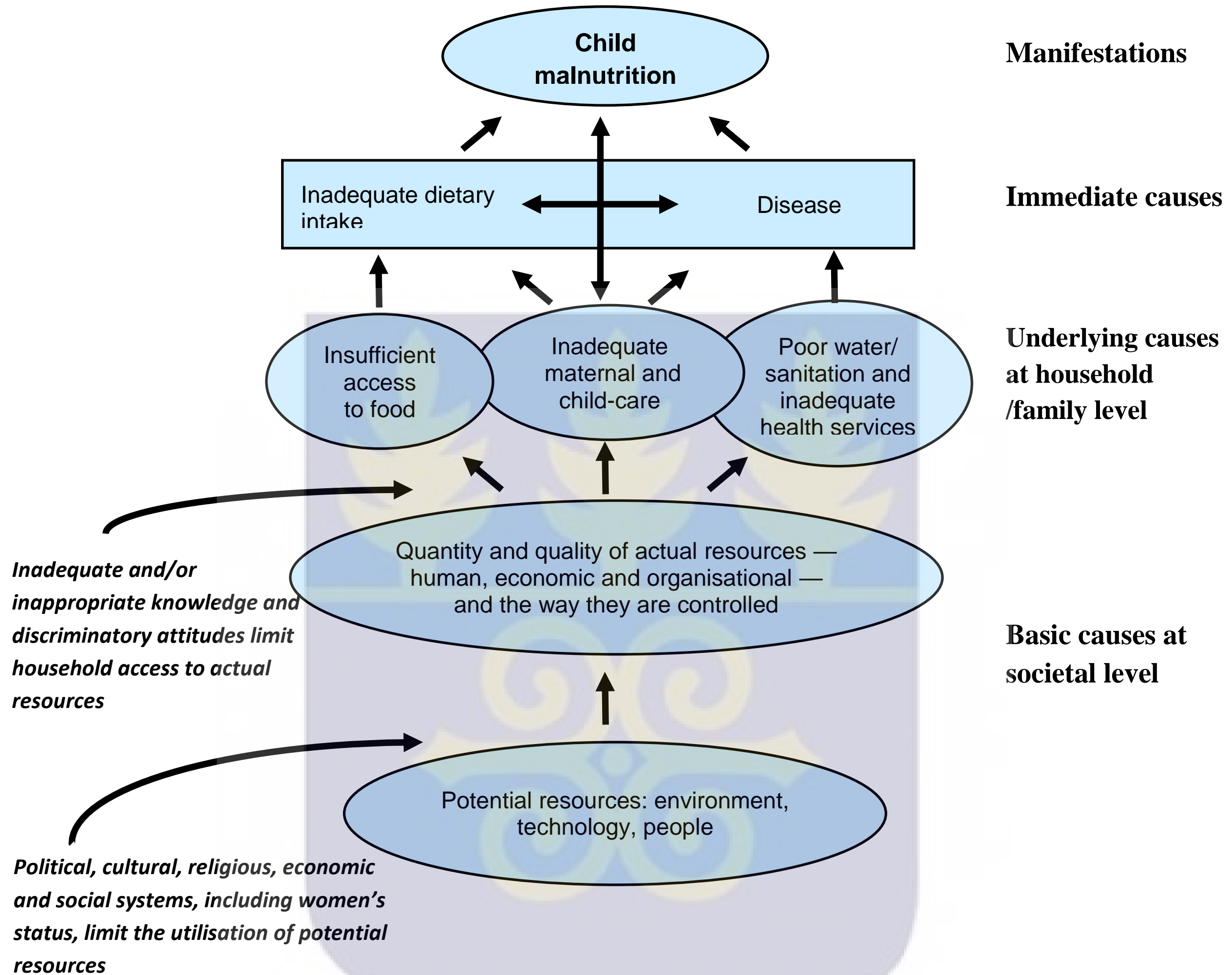
Figure 2.1: Theoretical framework: Causes of malnutrition among children



Source: UNICEF, 1998

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2.8 Conceptual Framework

Following the review of the literature and the UNICEF theoretical framework, the following conceptual framework (Figure 2.2) is adapted to analyze the nutritional status of children in the three northern regions of Ghana. According to the adapted framework, child and maternal factors including sex of child, age of child, size of child at birth, birth order, birth interval, age of mother at birth, marital status of mother, educational level of mother and nutritional status of the mother influence the nutritional status of children. Moreover, household factors like wealth index, place of residence and region of residence work through such intermediate variables as source of drinking water, type of toilet facility and episode of anaemia to influence stunting among children. Stunting, an indicator of chronic malnutrition, is used as the dependent variable in this study. The unique feature of stunting is that it indicates accumulation of malnutrition in children over a period of time. It is, therefore, a strong indicator of malnutrition among children under the age of five (WHO, 2006).

On the sex of child, male children are noted to be more active and engage in a lot of physical activities as explained by the biological makeup of males and females (Darteh et al, 2014; Kabubo-Mariara et al, 2009). Also, according to Amugsi et al (2013), malnutrition affects male and female children differently. Moreover, in Africa and the three northern regions, male children are preferred to girl children because male children are seen as a source of labour on the farms. This could affect the attention and care given to the female children, and can explain the differentials in stunting between the male and female children (Takyi, 1999).

The age of child is an important factor to assess the prevalence of stunting among children in the three northern regions (Babatunde et al, 2011). It is important to know if infants are more

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affected by stunting or if the children get more stunted once they cross the infant stage (Kabubo-Mariara et al, 2009).

The size of child at birth is also very influential in determining if the child will be stunted or not (Masibo, 2013). Stunting is a growth retardation indicator so children who are very small and smaller than average at birth may be biologically exhibiting growth retardation characteristics. According to Rayhan et al (2006), children who are very small and smaller than average at birth stand more chances of being stunted than children who are large at birth.

Moreover, the length of succeeding birth interval is an indication of birth spacing patterns. According to the literature review, birth interval of less than 24 months increases the vulnerability of children to malnutrition and increased risk of mortality (WHO, 2006). Short birth intervals are associated with small birth size and low birth weight, both of which are precursors to poor nutritional status in the early stages of life (WHO, 2006).

The birth order of the child is also a useful factor to consider according to the literature. If the child is the first, second, third, fourth, fifth or sixth child, it does not only provide information on the birth giving behaviour of the household but also means that resources will have to be shared among these children. The birth order could help in analyzing whether malnutrition is more prevalent in the second or third child in relation to the first.

According to Darteh et al (2014), mothers who are too young may not be emotionally and physiologically ready to cater for children. It has been suggested that mothers below the accepted reproductive ages of 15 could have their children suffering from physical growth.

Also, marriage is seen as a symbol of procreation and it is expected that married couples will be better resourced and prepared to cater for the nutritional and health needs of their children (Darteh et al, 2014).

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The educational level of the mother is also noted to affect children's malnutrition. According to Oyekale and Oyekale (2002) and Wondimagegn (2014), mothers with secondary or higher education have an understanding of nutritional requirements and practices. This is because educated mothers could be more conscious about their children's health and tend to look after their children in a better way.

The nutritional status of a mother may affect her ability to successfully carry, deliver, and care for her children (Masibo, 2013). Generally, the nutritional status of mothers is assessed using the Body Mass Index (BMI) as a proxy. Mothers who are malnourished before pregnancy, during pregnancy and after delivery could find it difficult to provide the necessary nourishment to facilitate the physical growth of the child.

Furthermore, wealth index is a composite measure of a household's cumulative living standard. Children from rich families have less probability of being malnourished compared to their counterparts from poor families (Aturupane et al, 2008; Kabubo-Mariara et al, 2009). Rich households can readily provide for safe water and improved toilet facilities to ensure the health and nutritional status of children compared to poor households (Wondimagegn, 2014).

On the place of residence, it has been shown in the literature review that the rate of malnutrition among children is higher in the countryside and rural areas compared to the developed urban areas (Kabubo-Mariara et al, 2009). This is because households in the rural areas may be deprived of amenities and could end up using unsafe water and unimproved types of toilet facilities which could endanger the health of children and affect their physical growth.

Furthermore, it has been conceptualized that the three regions have their respective socioeconomic characteristics which could impact household decision making in terms of spending on sanitation and health. The demographic and socioeconomic structure of these

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regions could influence households differently in terms of procuring safe water, health and toilet facilities which could have a direct impact on children's nutritional status (WFP, 2012).

Also, the source of drinking water of a household is linked with its socioeconomic status. Poor households are more likely to obtain drinking water from contaminated sources such as surface water or open wells. Infants and children from households that do not have a private tap are at greater risk of being malnourished than those from households with this facility (WHO, 2008).

The type of toilet facility also has influence on the nutritional status of children. According to Babatunde et al (2011), children from households with unimproved toilet facilities are more likely to be stunted than their counterparts in households with improved toilet facilities.

Anaemia is as a result of the lack of adequate amount of hemoglobin in the blood. The most prevalent causes of anaemia, especially among children are deficiencies in iron and folate. There are also other causes such as Vitamin B12 deficiency, protein deficiency, sickle cell disease, malaria and parasite infection (Baker-Henningham & Grantham-McGregor, 2004). It has been conceptualized that children suffering from anaemia could be facing any of these deficiencies and eventually encounter challenges with their physical growth.

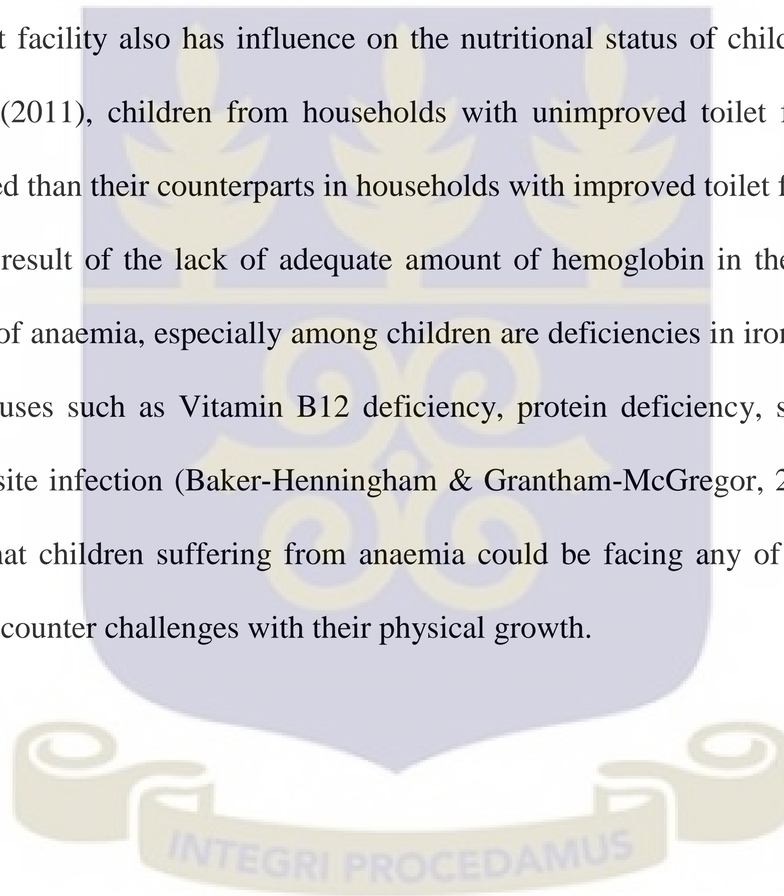

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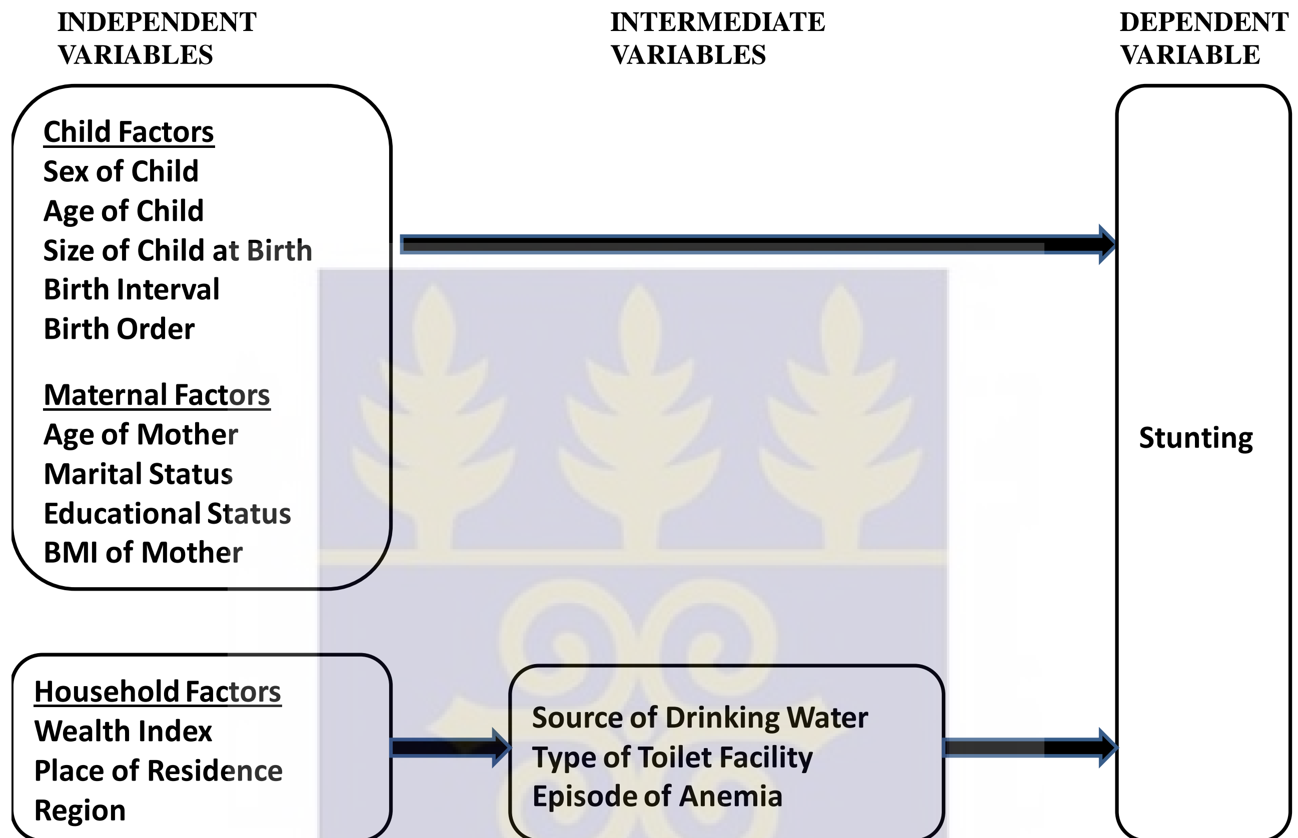
Figure 2.2: Conceptual framework: Determinants of malnutrition among children under the age of five in the three northern regions of Ghana



Adapted from UNICEF, 1998

2.9 Hypotheses

The following hypotheses have been examined in this study

- The higher the educational level of the mother, the less likelihood of stunting among children.
- The higher the wealth index of households, the less likelihood of stunting among children.
- Children residing in urban areas are less likely to be stunted as compared to children residing in rural areas

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CHAPTER THREE

METHODOLOGY

3.0 Introduction

The focus of this chapter is to specify the source of data and also discuss the analytical methods based on the selected variables for this study. The recoding of the variables, the specification of a reference category for each variable, the stages of analysis, the method of result interpretation, as well as, the limitations to the study have also been discussed in this chapter.

3.1 Source of Data

The 2008 Ghana Demographic and Health Survey (GDHS) is the source of data for this study. The 2008 GDHS is the fifth in a series of national-level population and health surveys conducted in Ghana as part of the global Demographic and Health Surveys (DHS) programme. Specifically, the 2008 GDHS has the primary objective of providing current and reliable information on fertility levels, marriage, sexual activity, fertility preferences, awareness and use of family planning methods, breastfeeding practices, nutritional status of women and young children, childhood mortality, maternal and child health, domestic violence, and awareness and behaviour regarding AIDS and other sexually transmitted infections (STIs) (GSS, 2008).

The survey used a two-stage sample design based on the 2000 Population and Housing Census to produce separate estimates for key indicators for each of the ten regions in Ghana. The GDHS is a household based sample survey and each of the households selected for the survey was eligible for interview with the Household Questionnaire. Data collection took place over a three-month period, from early September to late November 2008.

A total of 11,778 households were interviewed. In half of the households selected for the survey, all eligible women age 15-49 and all eligible men age 15-59 were interviewed with the Women's

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and Men's Questionnaires, respectively. A total of 4,916 women aged 15-49 and 4,568 men aged 15-59 from 6,141 households were interviewed.

The height and weight measurements of children under the age of five years were taken in the households selected for the individual interview. There were a total of 2,912 children under age five in the households during the survey, out of which complete data on height and weight measurements for 87% of these children were obtained. With regards to the measurements, lightweight, electronic seca scales with a digital screen, designed under the guidance of the United Nations Children's Fund (UNICEF) was used to collect the data on weight, while a measuring board produced by Shorr Productions was also used to obtain the height of the children. In order to obtain accurate measures, children less than 2 years of age were measured lying down on the board while those above 2 years were measured standing (Darteh et al, 2014).

This study utilises the 'children under five years of age' file (GHKR5Hsv) from the 2008 GDHS in order to assess the socioeconomic and biodemographic influences of nutritional status for this category of children. The children under the age of 5 file was initially weighted before data on the three northern regions were extracted for this study. The total sample size for this study after weighting and filtering for variables with missing values is 556. The unit of analysis for this study is, therefore, children less than 5 years of age.

3.2 Dependent Variables

The most commonly used and worldwide indicators for measuring malnutrition, especially among children are anthropometric measurements of age, height and length compared to the median of a reference population recommended by the World Health Organisation. For this study, the new WHO standards introduced in 2006 have been adopted for differentiating malnourished children from the nourished ones. This is because the new WHO standards (2006)

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are based on the standards of six countries while all other standards like the National Center for Health Statistics (NCHS) and the old WHO standards were based on just one country. The new WHO standards (2006), therefore, offer a much more robust basis for comparing the nutritional status of children.

Stunting is an indicator that provides information on the height of children, and it is defined as a low height for age such that children whose Height-for-Age Z-scores (HAZ) are below -2 Standard Deviation (< -2SD) of the WHO reference population are classified as stunted. Stunting is a permanent and long term manifestation of malnutrition among children due to deprivation of foods over a long period of time. The new WHO standards, introduced in 2006, for estimating the nutritional status of children have been used to differentiate malnourished children from the nourished ones. The dependent variable (stunting) has been categorized into a dummy variable so that "1 = Stunted and 0 = Not stunted". The first category of "Stunted" has been used as the reference for the interpretation of bivariate and multivariate results.

3.3 Independent Variables

Following the literature review and the analytical framework that have been adapted, the independent variables for this study are sex of child, age of child, size of child at birth, birth interval, birth order, age of mother at birth, marital status of mother, educational level of mother, the nutritional status of the mother, wealth index, place of residence and region. The intermediate variables include source of drinking water, type of toilet facility and the episode of anaemia.

The original categories of some of these variables have been renamed and re-coded based on the literature, the nature of the variables, the sample size and the profile of the study area. The following are the list of the selected variables and how they are operationalised for this study.

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Sex of Child

The sex of child is a nominal variable with the categories of female and male. This variable is coded as "1 = Male and 2 = Female". The male category is chosen as the reference for the binary logistic regression model.

Age of child

The age of child collected in months is used so that the nutritional status of infants can be accurately differentiated from the other age groups. This variable is coded as "1 = 0-11 Months, 2 = 12-23 Months, 3 = 24-35 Months, 4 = 36-47 Months and 5 = 48-59 Months". The age category of 0-11 Months is used as the reference category so as to analyse how the other age groups compare to the infants in terms of malnutrition. This is because the health and nutritional needs of infants is unique and it is considered a critical age group that defines the nutritional status of children in the future.

Size of Child at Birth

The size of child at birth is classified as "1 = Very Small, 2 = Smaller than Average, 3 = Average, 4 = Larger than Average and 5 = Very Large", based on the Ghana Statistical Service's classification. The Very Small category is used as the reference category at the multivariate level of analysis.

Birth Interval

The birth interval (in months) is a continuous variable that has been grouped into a dichotomous variable such that "1 = 0-23 Months and 2 = 24 Months and above". The classification is informed by the WHO's recommendation that to ensure the health of both mother and child, there should be at least a 24-month spacing between births. The 0-23 Months group has been used as the reference category for the regression analysis.

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Birth Order Number

The Birth Order Number of the children has been categorized into six categories. The first category is the 1 = 6th+ Child, followed by 2 = 5th Child, 3 = 4th Child, 4 = 3rd Child, 5 = 2nd Child and 6 = 1st Child. The 6th+ Child category has been used as the reference category.

Age of Mother at Birth

The age of the mothers at first birth have been re-coded into a 3-category of 15-19, 20-24 and 25+ because there are not enough counts in age categories beyond 30 years for effective statistical analysis. The "15-19" category has been used as the reference for the regression analysis.

Marital Status of the Mother

The original categories of marital status in the 2008 GDS are "never married, married, living together, widowed, divorced and not living together. Due to low frequencies in the other categories apart from the married category, marital status has been dichotomously classified as "1 = Currently married and 2 = Currently not married". The currently married category has been used as the reference category in the regression analysis.

Educational Level of Mother

The mother's educational level is a categorical variable with the following categories – No education, Primary, Secondary and Higher education. The categories of the educational level of the mother have been regrouped as "1 = No education, 2 = Primary and 3 = Secondary or Higher". The first category of No education has been used as the reference category for the regression analysis.

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Nutritional Status of the Mother

The nutritional status of the mother has been classified into two categories such that 1 = Malnourished (BMI < 18.5) and 2 = Nourished. It should, however, be noted that mothers who were obese and overweight are also collapsed with the nourished category based on this classification. The first category of nourished has been used as the reference category.

Wealth Index

The wealth index is a categorical variable with five categories of Poorest, Poorer, Middle, Richer and Richest. Due to the low frequencies in the Richest and Rich categories of wealth index from the three northern regions, this variable has been re-coded as "1= Poor (Poorest + Poorer), 2 = Middle and 3 = Rich (Richer + Richest). The poor category has been used as the reference for the regression modeling.

Region

The three northern regions of Northern Region, Upper West Region and Upper East Region are the foci of this study. These regions are coded as "1 = Northern, 2 = Upper East and 3 = Upper West. The first category of Northern Region is used as the reference category.

Type of Place of Residence

This variable is classified dichotomously as 1 = Rural and 2 = Urban with the rural people used as the reference category for the regression analysis.

Source of Drinking Water

The sources of drinking water captured by the GDHS are piped into dwelling, piped to yard/plot, public tap/standpipe, tube well or borehole, protected well, protected spring, unprotected well, unprotected spring, River/dam/lake/ponds/stream/canal/irrigation channel and cart with small tank. In line with the WHO's recommendation, the sources of drinking water are dichotomously

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classified as 1 = Unsafe and 2 = Safe. The water sources classified as safe are those piped into dwelling, piped to yard/plot, public tap/standpipe, tube well or borehole, protected well, protected spring while the unsafe sources are unprotected well, unprotected spring, river/dam/lake/ponds/stream/canal/irrigation channel and cart with small tank. For the purpose of the regression analysis, the unsafe category is used as the reference category.

Type of Toilet Facility

The type of toilet facility captured by the GDHS are those that flush to piped sewer system, flush to septic tank, flush to pit latrine, Ventilated Improved Pit latrine (VIP), pit latrine with slab, composting toilet, pit latrine without slab/open pit, no facility/bush/field and bucket/pan toilet. In line with the WHO's categorization, the type of toilet facility is classified as "1 = Unimproved and 2 = Improved". The types of toilet facility classified as improved include flush to piped sewer system, flush to septic tank, flush to pit latrine, Ventilated Improved Pit latrine (VIP), pit latrine with slab, composting toilet while the unimproved types are pit latrine without slab/open pit, no facility/bush/field and bucket/pan toilet. For the purpose of the regression analysis, the unimproved category is used as the reference category.

Episode of Anaemia

The original categories of the level of anaemia in the GDHS have been grouped into a dichotomous variable such that "1 = Anaemic and 2 = Not anaemic" with the first category chosen as the reference for the regression analysis.

3.4 Stages of Analysis

3.4.1 Univariate Analysis

At this stage, frequency distributions, percentages, pie charts and bar charts have been used to summarise variables like the sex of child, age of child, place of residence, maternal education,

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wealth index of households, among others. Moreover, the nature of distribution of the variables has been observed and checks were made for outliers.

3.4.2 Bivariate Analysis

Techniques of bivariate level analysis are employed to show the association between the independent variables and stunting among children within the three northern regions of Ghana. Cross-tabulations and Pearson's Chi-Square (χ^2) are computed to show the association between categorical variables like place of residence, maternal educational level, wealth index of households, and the indicator of stunting. At this stage, the significance level is set at 5%, with the Chi-Square value, degree of freedom and the resultant significance reported for each independent variable and stunting.

3.4.3 Multivariate Analysis

In an attempt to understand the relationship between the various groups of independent variables and stunting among children in northern Ghana, four separate binary logistic regression models were run. The first model looks at the relationship between child level factors and stunting; the second model looks at the maternal factors and stunting, the third model looks at household factors and stunting. The final model comprises of all factors and how they relate to stunting among children. These four binary logistic regression models have been specified below:

Stunting =*f*(Child factors)……………………………………………..model 1

Stunting = *f*(Maternal factors)………………………………….………...model 2

Stunting = *f*(Household factors)…………………………………........model 3

Stunting = *f*(Child factors + Maternal factors + Household factors)……model 4

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In assessing the models above, a binary logistic regression model was fitted because the outcome variable was dichotomously coded such that '1 = Stunted and 0 = Not stunted'. The binary logistic regression model is specified below:

$$\ln\left(\frac{\hat{p}}{(1-\hat{p})}\right) = b_0 + b_1X_1 + b_2X_2 + \ldots + b_pX_p \quad \text{...[5]}$$

From the equation 5, p is the expected probability of a child being stunted while (1-p) is the expected probability of a child not being stunted. The coefficients are represented by $b_0,\ldots,bp$. Additionally, X_1 to X_p represent the independent variables for this study.

Furthermore, the binary logistic regression results have been interpreted using the Odds Ratio (OR) approach. The OR represents the odds that an outcome will occur given a particular exposure compared to the odds of the outcome occurring in the absence of that exposure. The OR also indicates the quantum of change between the categories of an independent variable in relation to the reference of the dependent variable. It is also easy to interpret the OR because it eliminates the need of introducing logarithmic functions and equations to the results (Field, 2009). From the equation 6 below, odds ratio is denoted by OR, *Pi* represents the odds of a child being stunted while 1-*Pi* represents the odds of a child not being stunted.

$$OR = \frac{Pi}{1-Pi} \quad \text{..[6]}$$

The statistical analysis for the study was carried out using Statistical Package for the Social Sciences (SPSS) Version 20.0 and Windows 8.1 version of Microsoft Excel. SPSS was used to weight the data, filter for missing cases and run all the analyses while Microsoft Excel was used to sort the results of the analyses into reportable formats.

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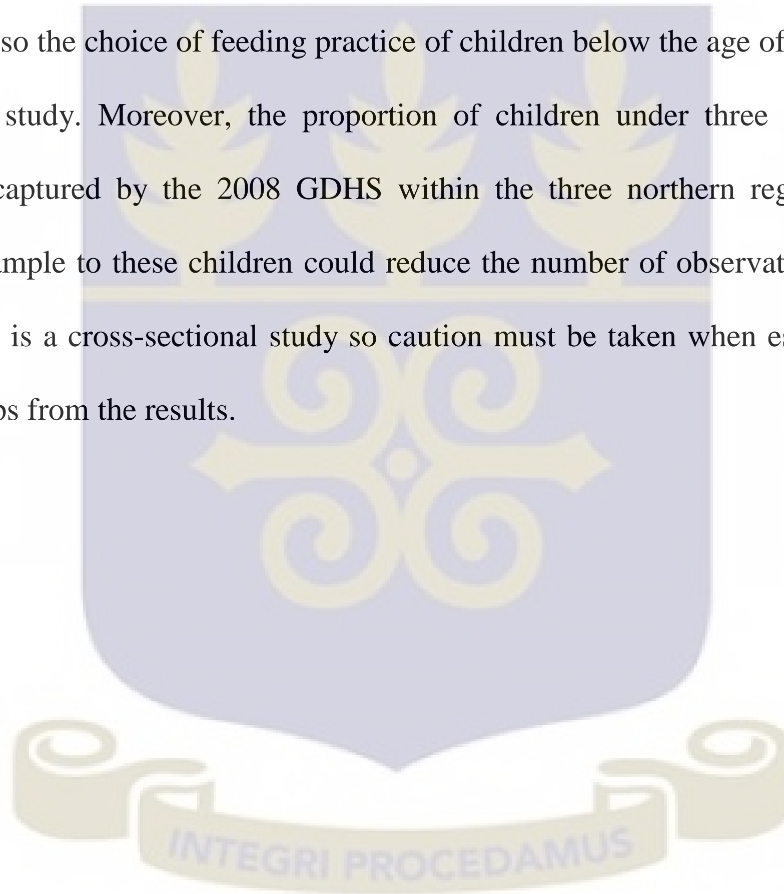
3.5 Limitation of the Study

Food consumption of children is one of the fundamental factors that influence their health, growth and nutritional status. However, this study will not measure the influence of food consumption of children because the 2008 GDHS only collected data on recent food consumption of children under three years who were in the same house with the mother. Also, the nutritional status of children is affected by feeding practices beyond the age of three (UNICEF, 2013) so the choice of feeding practice of children below the age of three will bias the outcome of this study. Moreover, the proportion of children under three years whose food consumption is captured by the 2008 GDHS within the three northern regions is very few. Restricting the sample to these children could reduce the number of observations for the study. Furthermore, this is a cross-sectional study so caution must be taken when establishing cause - effect relationships from the results.



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CHAPTER FOUR

CHARACTERISTICS OF THE STUDY POPULATION

4.1 Introduction

The focus of this chapter is to assess the distribution of children by the selected dependent, independent and intermediate variables so as to understand the nature of the variables within the three northern regions. The variables that have been examined at this stage include stunting, sex of child, age of child, size of child at birth, birth interval, birth order, age of mother at birth, marital status of the mother, educational level of mother, mother's nutritional status, wealth index, type of place of residence, source of drinking water, type of toilet facility, region and episode of anaemia.

4.2 Characteristics of Children under the Age of Five in the three Northern Regions

4.2.1 Stunting among Children under the Age of Five

Stunting has been used as an indicator of malnutrition among children in the study area. It is an indicator of chronic malnutrition among children due to prolonged deprivation of food. According to the literature on children nutritional status (UNICEF, 2009; Müller and Krawinkel, 2005; Williams, 2005; Van de Poel et al, 2007), it is the malnutrition indicator that has the highest incidence over the years. In the three northern regions together, the results indicated that more than 1 in every 4 children was stunted. This result is displayed in Figure 4.1.

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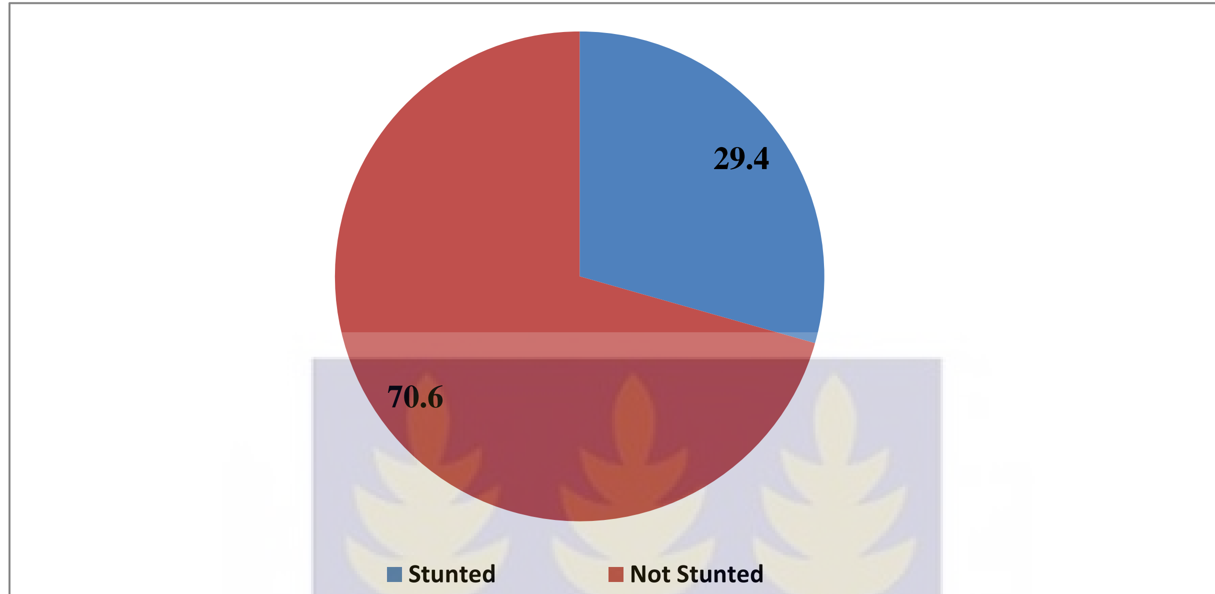
Figure 4.1: Percentage Distribution of Children by the Prevalence of Stunting



Source: Generated from the children's file of the 2008 GDHS dataset

4.2.2 Sex of Child

The results of the background characteristics of children displayed in Table 4.1 revealed that out of the 556 children in this study, more than half (54.3%) of them were males while 45.1% were females.

4.2.3 Age of child (in months)

The age distribution of children presented in Table 4.1 showed that infants constituted the highest proportion (23.2%), followed by children aged 48-59 months (22.2%), and then by children aged 12-23 months (20.3%), with no differences between the percentage of children aged 24-35 and 36-47 months. The functional definition of stunting is the measurement of height-for-age of children. This makes the age of children and its distribution in the study area a very important variable to assess.

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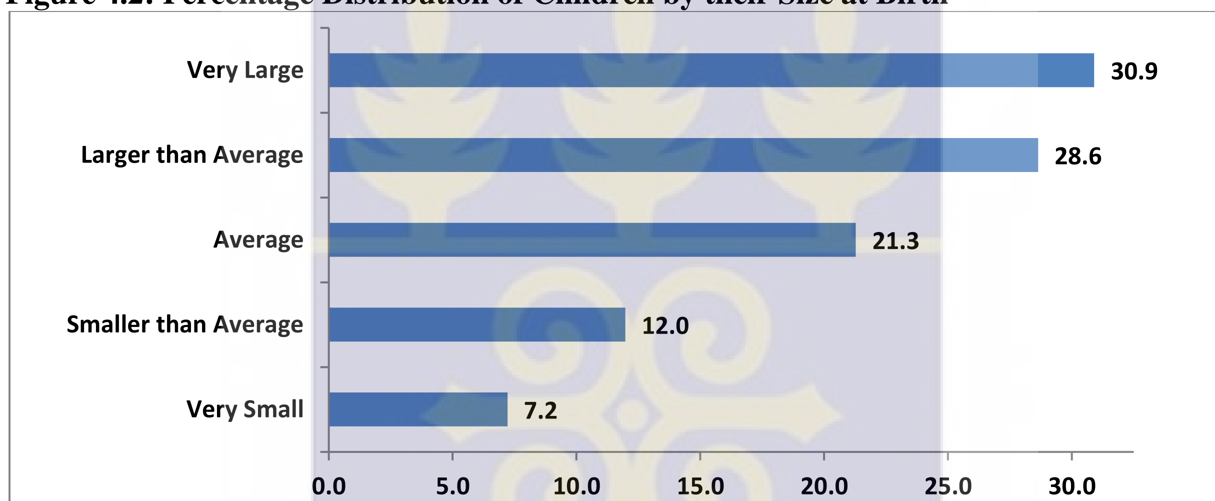
4.2.4 Size of Child at Birth

The distribution of children by their sizes at birth is displayed in Figure 4.2. It is evidenced that over the range of very small, through average, to very large, the highest proportions of the children (30.9%) were very large at birth and the lowest proportions (7.2%) were very small at birth. Stunting indicates how the child is growing over time so the size of child at birth could play an important role in the physical development of the child.

Figure 4.2: Percentage Distribution of Children by their Size at Birth



Source: Generated from the children's file of the 2008 GDHS dataset

4.2.5 Birth Interval

The distribution of children with regards to succeeding birth interval is displayed in Table 4.1. It was observed that more than three-quarters (78.2%) of the children were born within the 0-23 months interval while as low as 21.8% were born within the 24 months and above interval. According to the WHO (2006), after a live birth, the recommended interval between live births is at least 24 months in order to reduce the risk of adverse maternal, peri-natal and infant outcomes.

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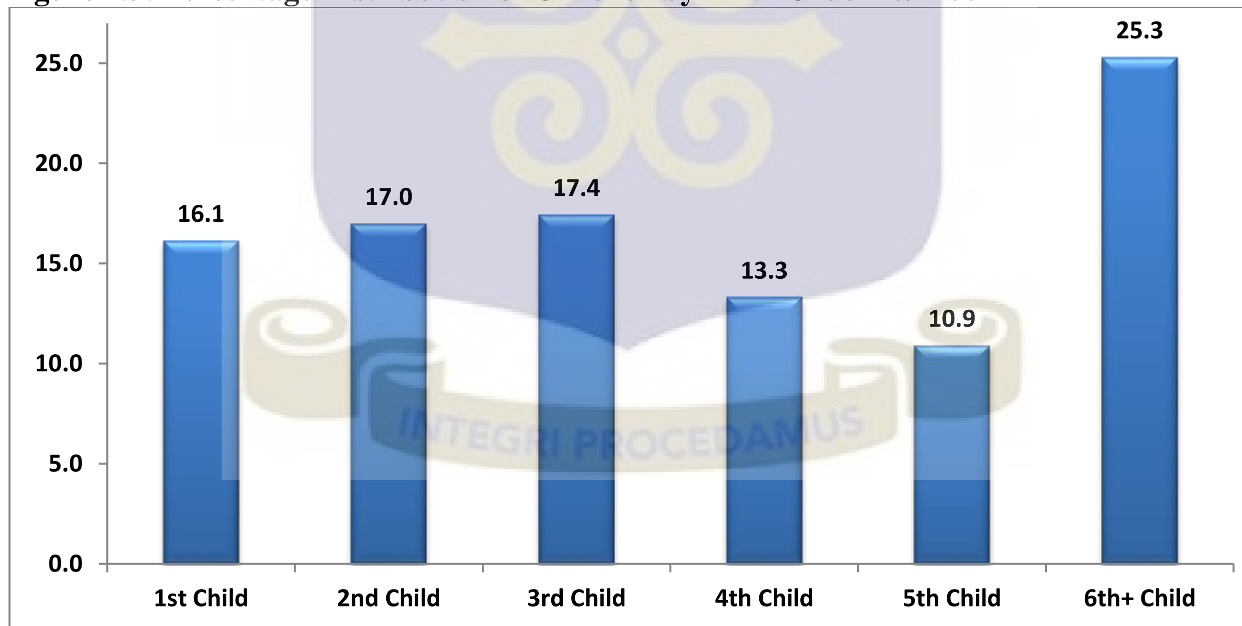
4.2.6 Birth Order Number

The order of births in the three northern regions, as shown by the Figure 4.3 indicates that the highest proportion (25.3%) of children under the age of five belonged to the 6th child category, followed by the 3rd child category (17.4%), with the 5th child category displaying the lowest percentage of 10.9%. This information can help to assess if the first set of children, second set of children, or those belonging to the 5th set are the ones with the highest prevalence of malnutrition. A study conducted by Babatunde et al (2011) revealed that the likelihood of malnutrition among children increases with an increasing birth order. This is particularly because a household with a high birth order means that resources, child care and attention may have to be divided between these children and this can have implications for the nutritional status of the children.

Figure 4.3: Percentage Distribution of Children by Birth Order Number



Source: Generated from the children's file of the 2008 GDHS dataset

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4.2.7 Age of Mother at Birth

The distribution of children by the age of mother at birth (see Table 4.1) revealed that majority of the children were born to women aged 15-19 (50.7%), followed by 20-24 (39.8%) and finally 25+ (9.6%) from the study area.

4.2.8 Marital Status of the Mother

In many traditional African societies, marriage is seen as a declaration of readiness to have a family, procreate and nurture the children. Table 4.1 shows that over 90% of the children had mothers who were currently married, with the remaining 5.7% of the children belonging to mothers who were currently not married.

4.2.9 Educational Level of Mother

Mothers are the caregivers of children and the educational level of mothers has a lot of implications for the health, wellbeing and the nutritional status of the children (Wondimagegn, 2014). The distribution of children by educational level of their mothers presented Figure 4.4 showed that the highest proportion of children (75.8%) had mothers with no education, followed by 14.4% for children whose mothers attained primary education and the least being 9.8% of children whose mothers had either secondary or higher education. In the three northern regions, the highest proportion of children belonging to mothers who had no education could negatively impact the nutritional outcomes of these children.

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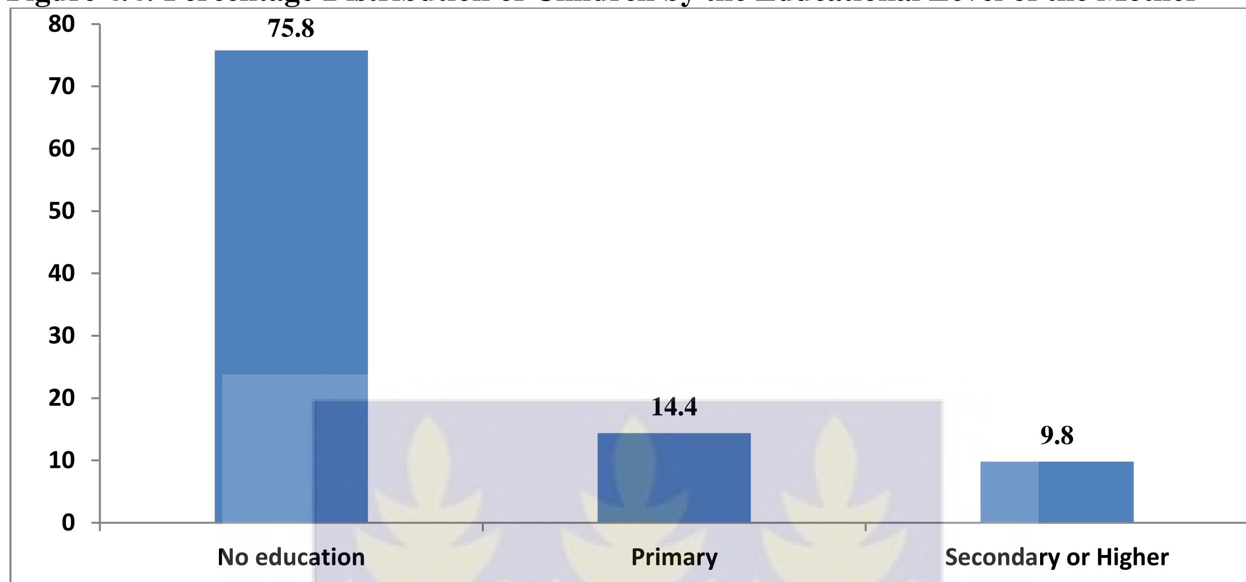
Figure 4.4: Percentage Distribution of Children by the Educational Level of the Mother



Source: Generated from the children's file of the 2008 GDHS dataset

4.3.0 Nutritional Status of the Mother

As revealed in Table 4.1, over 90% of mothers who reported for children during the survey were malnourished while as low as 9.3% of them were nourished. This could come as a support for the intergenerational cycle of malnutrition theory alluded to by Van de Poel et al (2007) and Amugsi et al (2013) that the current high proportion of malnourished northern women could give birth to children with low birth weight and continue the trend of malnutrition.

4.3.1 Wealth index of Household

The wealth index of a household is an indication of its socioeconomic status and can help assess whether the household is economically resourced to afford the health and nutritional needs of the children. As shown in Figure 4.5, majority of the children (80.4%) were in households classified as poor while less than 10% belonged to the rich households. In the three northern regions, the highest proportion of children belonging to poor households could have a major negative influence on the nutritional outcomes of these children.

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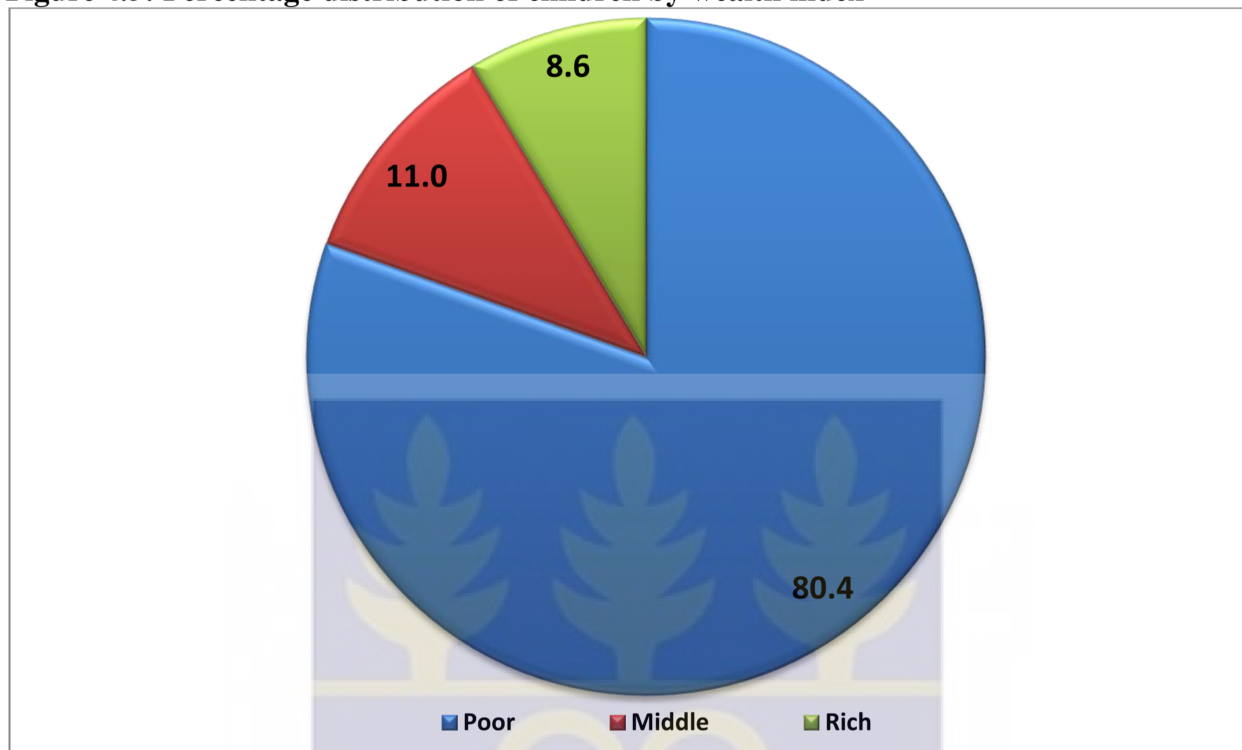
Figure 4.5: Percentage distribution of children by wealth index



Source: Generated from the children's file of the 2008 GDHS dataset

4.3.2 Type of Place of Residence

As shown in Table 4.1, more than three quarters of children (79.6%) were residing in the rural areas of the three northern regions while the remaining children (20.4%) were in the urban areas.

4.3.3 Region

It could be observed from Figure 4.6 that majority of the children were in the Northern Region (66.6%) while the lowest proportion is in the Upper West Region (11.6%), and with almost double of this proportion (21.7%) residing in the Upper East Region.

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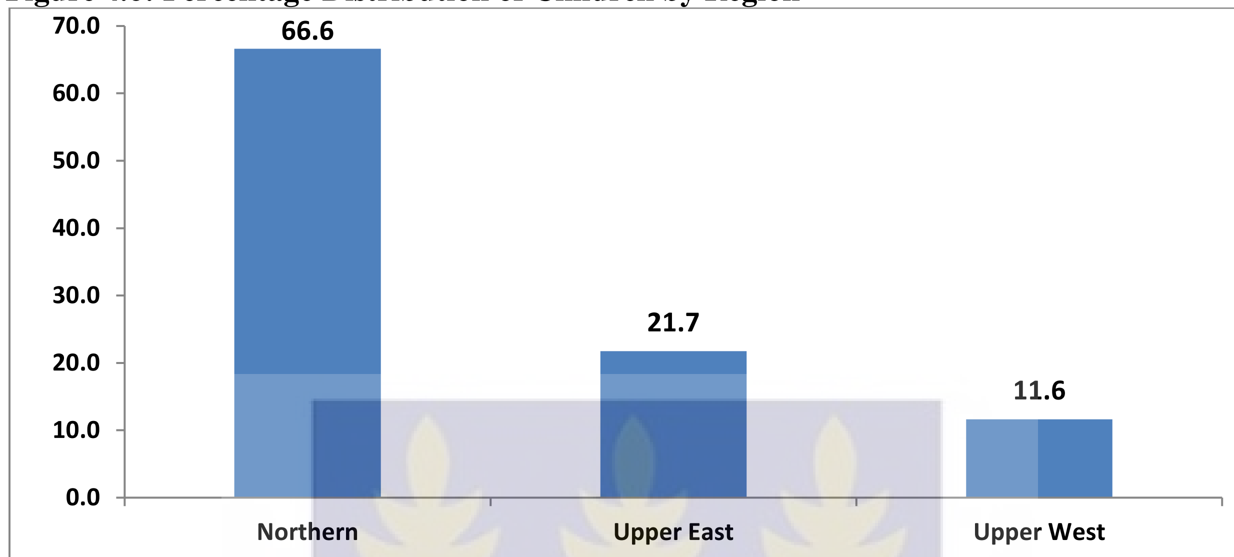
Figure 4.6: Percentage Distribution of Children by Region



Source: Generated from the children's file of the 2008 GDHS dataset

4.3.4 Source of Drinking Water

From Table 4.1, over 70% of the children belonged to households with safe sources of drinking water while only 21.2% belonged to households with unsafe sources of water. A major contributory factor could be the surge in the construction of boreholes in the three northern regions as part of donor and Government of Ghana projects to improve water supply in northern Ghana.

4.3.5 Type of Toilet Facility

The distribution of children by types of toilet facility displayed in Table 4.1 shows that over 80% of children lived in households with unimproved types of toilet facility while only 19% lived in households with improved types of toilet facility. This result could have consequences for children's health and growth in the three northern regions especially since the WHO recommended that households should procure and use the improved toilet facilities in order to ensure a healthy growth of children at the early stages of life.

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4.3.6 Episode of Anaemia

From Table 4.1, it can be concluded that there were more anaemic children (58.6%) compared to those children classified as Not Anaemic (41.4%) from the three northern regions.

Table 4.1: Percentage Distribution of Children by their Background Characteristics

	Frequency	Percentage (%)
Sex of Child		
Male	305	54.9
Female	251	45.1
Age of Child		
0-11 Months	129	23.2
12-23 Months	113	20.3
24-35 Months	95	17.2
36-47 Months	95	17.1
48-59 Months	124	22.2
Birth Interval		
0-23 Months	435	78.2
24 Months and above	121	21.8
Age of mother at Birth		
15-19 years	282	50.7
20-24 years	221	39.8
25+ years	53	9.6
Marital Status of the Mother		
Currently not married	32	5.7
Currently married	524	94.3
Nutritional Status of Mother		
Malnourished mother	505	90.7
Nourished mother	52	9.3
Type of Place of Residence		
Urban	113	20.4
Rural	443	79.6
Source of Drinking Water		
Unsafe	118	21.2
Safe	438	78.8
Type of Toilet Facility		
Unimproved	451	81.0
Improved	106	19.0
Episode of Anaemia		
Anaemic	326	58.6
Not Anaemic	230	41.4
TOTAL	**556**	**100.0**

Source: Generated from the children's file of the 2008 GDHS dataset

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CHAPTER FIVE

BACKGROUND CHARACTERISTICS OF CHILDREN AND STUNTING

5.1 Introduction

This chapter focuses on bivariate analysis by examining the relationship between the selected independent variables and the prevalence of stunting among children under the age of five in the three northern regions of Ghana. The variables analysed at this stage include sex of child, age of child, size of child at birth, birth interval, birth order, age of mother, marital status of the mother, educational level of mother, nutritional status of the mother, wealth index, place of residence, region, source of drinking water, type of toilet facility, episode of anaemia and their association with stunting. A test of association between these variables and stunting was conducted using Pearson Chi-square test with the P-value set at the 5% significance level.

The association indicated that the episode of anaemia, sex of child, size of child at birth, birth order, educational level of mother, nutritional status of the mother, age of the mother, marital status of the mother, wealth index, source of drinking water, type of toilet facility, type of place of residence and region were not significantly related with stunting among the children. However, variables like the age of child and birth interval had a significant association with stunting prevalence at the bivariate level.

5.2 Classification of Stunting by Characteristics of Children

5.2.1 Sex of Child and Stunting

Sex of the child is an important factor when it comes to the study of malnutrition because the prevalence of malnutrition is different for male and female children.

The cross-tabulation between sex of child and stunting (shown in Table 5.1) reveals that males are more stunted than females in the study area. This result is consistent with what was reported

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by Miah (2014) that male children have lower nutritional scores compared to female children. According to Torun (2006), this may be the result of biological, behavioural, and socio-cultural mechanisms of gender differences. Also, biologically, female subjects have an advantage for better health and longer survival because of the role of sex hormones in modulating lipid levels and increasing immune response Torun (2006). Following from this, a lack of enough food and nourishment will more likely lead to poor nutritional outcome for male children in relation to female children. At a p-value of 0.518, it can be concluded that the sex of a child does not a have a significant relationship with the stunting among the children in the three northern regions.

Table 5.1: Relationship between Sex of Child and Stunting

	Percentage of Stunting Categories		
Sex of child	Stunted	Not Stunted	Total
Male	30.4	69.6	100.0
Female	27.9	72.1	100.0
Total	29.3	70.7	100.0

Chi-Square (χ^2) = .418 Degrees of freedom = 1 Significance = .518

Source: Generated from the children's file of the 2008 GDHS dataset

5.2.2 Age of Child and Stunting

Age is an integral component in the computation of stunting among children. The result from Table 5.2 shows that stunting is increasing with increasing age of children under the age of five in the three northern regions. This finding is consistent with previous studies by Darteh et al, 2014, which showed that stunting is high among children of higher ages in relation to infants. This situation could probably be attributed to the fact that beyond 0-11 months, the children have almost fully been introduced to complementary feeding and a lack of nutritious food and healthy feeding practices at these ages could affect the physical growth of the children. The p-value (0.000) also indicates that age has a significant association with stunting among children under the age of five.

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Table 5.2: Relationship between Age of Child and Stunting

	Percentage of Stunting Categories		
Age of child	**Stunted**	**Not Stunted**	**Total**
0-11 Months	11.5	88.5	100.0
12-23 Months	30.4	69.6	100.0
24-35 Months	36.5	63.5	100.0
36-47 Months	36.5	63.5	100.0
48-59 Months	35.8	64.2	100.0
Total	**29.3**	**70.7**	**100.0**

$\chi^2 = 27.114$ Degrees of freedom = 4 Significance = .000

Source: Generated from the children's file of the 2008 GDHS dataset

5.2.3 Size of Child at Birth and Stunting

From Table 5.3, the highest proportion of stunted children were those with very small sizes at birth (35.0%) while the lowest proportions of stunted children were those with very large sizes at birth (21.5%). Van de Poel et al (2007) also found similar result using the 2003 Ghana DHS. The most plausible explanation to this result could be the intergenerational cycle of growth failure due to increased likelihood of mothers with low maternal height and weight measurements coupled with inadequate nutrition before and during pregnancy giving birth to smaller babies. At a p-value of 0.080, it can be concluded that the relationship between size at birth and stunting is not statistically significant at the 5% level despite the pattern shown by the result.

Table 5.3: Relationship between Size of Child at Birth and Stunting

	Percentage of Stunting Categories		
Size of child at birth	**Stunted**	**Not Stunted**	**Total**
Very Small	35.0	65.0	100.0
Smaller than Average	33.3	66.7	100.0
Average	29.4	70.6	100.0
Larger than Average	34.6	65.4	100.0
Very Large	21.5	78.5	100.0
Total	**29.3**	**70.7**	**100.0**

$\chi^2 = 8.329$ Degrees of freedom = 4 Significance= .080

Source: Generated from the children's file of the 2008 GDHS dataset

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5.2.4 Birth Interval and Stunting

It can be observed from the Table 5.4 that stunting was more prevalent in children born within the 24 months and above succeeding interval. This is in contrast with the result from other studies (WHO, 2006; UNICEF, 2013) that children born below the recommended 24-month interval had high malnutrition results compared to those born 24 months and above. The associated p-value (0.002) with this result suggests that birth interval had a significant relationship with stunting.

Table 5.4: Relationship between Size of Child at Birth and Stunting

	Percentage of Stunting Categories		
Birth interval	**Stunted**	**Not Stunted**	**Total**
0-23 Months	26.2	73.8	100.0
24 Months and above	40.5	59.5	100.0
Total	**29.3**	**70.7**	**100.0**

χ^2 = 9.328 Degrees of freedom = 1 Significance = .002

Source: Generated from the children's file of the 2008 GDHS dataset

5.2.5 Birth Order Number and Stunting

The results in Table 5.5 show that there is not much variation between the birth order categories and stunting. This is not surprising because previous studies have been divided as to which birth order has the highest prevalence of malnutrition. This result, however, shows that stunting is slightly highest (30.9%) among the second child category but at the reported p-value (0.996), we can conclude that the relationship between birth order number and stunting is not significant.

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Table 5.5: Relationship between Birth Order Number and Stunting

	Percentage of Stunting Categories		
Birth Order Number	**Stunted**	**Not Stunted**	**Total**
6th+ Child	30.0	70.0	100.0
5th Child	27.9	72.1	100.0
4th Child	28.4	71.6	100.0
3rd Child	27.8	72.2	100.0
2nd Child	30.9	69.1	100.0
1st Child	30.0	70.0	100.0
Total	**29.3**	**70.7**	**100.0**

χ^2 = .355 Degrees of freedom = 5 Significance = .996

Source: Generated from the children's file of the 2008 GDHS dataset

5.2.6 Age of Mother and Stunting

According to the UNICEF framework adopted for this study, children born to very young mothers could be suffering growth defects because mothers who are too young at the time of giving birth may not be physiologically and emotionally ready for the stress of nurturing children. It is therefore not surprising that the highest proportion of stunted children (30.9%) belonged to mothers aged 15-19 compared to the higher age categories (see Table 5.6). However, we can conclude that there is no significant relationship (P = 0.706) between age of mother and stunting among children under the age of five in northern Ghana.

Table 5.6: Relationship between Age of Mother and Stunting

	Percentage of Stunting Categories		
Age of Mother at Birth	Stunted	Not Stunted	Total
15-19 years	30.9	69.1	100
20-24 years	27.6	72.4	100
25+ years	27.8	72.2	100
Total	**29.3**	**70.7**	**100**

χ^2 = .696 Degrees of freedom = 2 Significance = .706

Source: Generated from the children's file of the 2008 GDHS dataset

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5.2.7 Marital Status of the Mother and Stunting

It was expected that stunting would be much lower for children with married mothers since marriage is seen as a source of wealth accumulation and the declaration of readiness to procreate. A closer look at the result in Table 5.7 suggests otherwise because stunting was slightly higher for children with married mothers (29.4%) than it was for children whose mothers are currently not married (28.1%). However, the computed p-value of 0.879 implies that the marital status of the mother is not significantly associated with stunting among children in the three northern regions of Ghana.

Table 5.7: Relationship between Marital Status of Mother and Stunting

	Percentage of Stunting Categories		
Marital Status of the Mother	**Stunted**	**Not Stunted**	**Total**
Currently not married	28.1	71.9	100.0
Currently married	29.4	70.6	100.0
Total	**29.3**	**70.7**	**100.0**

χ^2 = .023 Degrees of freedom = 1 Significance = .879

Source: Generated from the children's file of the 2008 GDHS dataset

5.2.8 Educational Level of the Mother and Stunting

The result presented in Table 5.8 shows that children of mothers with no education had the second highest score for stunting (28.4%) while the largest proportion of stunted children belonged to mothers with a primary education (35.8%). It is not surprising to find that the stunting score was lowest for children whose mothers reached secondary school or higher levels of education. This is because with a higher level of education, mothers appreciate and understand nutritional and health requirements in taking care of children. According to Oyekale and Oyekale (2002), it is the mothers' educational level that is fundamental to the implementation of targeted interventions aimed at improving the nutrition and health status of children. This is probably because mothers are generally seen as caregivers of children so their understanding of nutritional

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practices which could be obtained through higher education will be important in reducing malnutrition among the children. However, the results so far indicate that the educational level of the mother is not significantly related to stunting since the p-value of 0.385 is greater than 0.05.

Table 5.8: Relationship between Educational Level of Mother and Stunting

	Percentage of Stunting Categories		
Educational Level of Mother	**Stunted**	**Not Stunted**	**Total**
No education	28.4	71.6	100.0
Primary	35.8	64.2	100.0
Secondary or Higher	27.3	72.7	100.0
Total	**29.4**	**70.6**	**100.0**

χ^2 = 1.909 Degrees of freedom = 2 Significance = .385

Source: Generated from the children's file of the 2008 GDHS dataset

5.2.9 Nutritional Status of the Mother and Stunting

The nutritional status of the mother before pregnancy, during pregnancy and after delivery is fundamental to the health of the child especially during breastfeeding. Using the BMI of the mother as a proxy to measure the nutritional status, the results (Table 5.9) revealed that the proportion of stunted children was higher for malnourished mothers (29.7%) compared to nourished mothers (26.9%). This is consistent with the findings from Rayhan et al (2006) that concluded that malnutrition is higher among children with acutely malnourished mothers compared to children with mothers who are not malnourished. From Table 5.15, we can conclude that the nutritional status of the mother and stunting are not significantly related ($P > 0.05$).

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Table 5.9: Relationship between Nutritional Status of Mother and Stunting

	Percentage of Stunting Categories		
Nutritional Status of Mother	Stunted	Not Stunted	Total
Malnourished mother	29.7	70.3	100
Nourished mother	26.9	73.1	100
Total	**29.4**	**70.6**	**100**

χ^2 = .175 Degrees of freedom = 1 Significance = .675

Source: Generated from the children's file of the 2008 GDHS dataset

5.3.0 Wealth Index of Household and Stunting

Cross tabulations of wealth index and stunting presented in Table 5.10 indicates that the highest proportion of stunted children were found in poor households compared to the middle and the rich household categories. This result is not unlikely because it was generally expected that poor households would not be economically resourced to afford the health and nutritional needs of their children. This finding is also consistent with the results of UNICEF (2013) that concluded that the economic and wealth status of households determine the nutritional status of children in developing countries. Also, wealth is not significantly associated with stunting at the p-value of 0.176.

Table 5.10: Relationship between Wealth Index of Household and Stunting

	Percentage of Stunting Categories		
Wealth index of Household	**Stunted**	**Not Stunted**	**Total**
Poor	31.0	69.0	100.0
Middle	21.3	78.7	100.0
Rich	22.9	77.1	100.0
Total	**29.3**	**70.7**	**100.0**

χ^2 = 3.470 Degrees of freedom = 2 Significance = .176

Source: Generated from the children's file of the 2008 GDHS dataset

5.3.1 Type of Place of Residence and Stunting

The result of the cross-tabulation of place of residence and stunting displayed in Table 5.11 shows that more urban children (31.0%) were stunted than rural children (29.1%). This is in

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contrast to what was reported by Miah (2014) that rural children are more socioeconomically deprived and malnourished than their counterparts in the urban areas. This is probably because most specific nutrition intervention programmes are carried out in the rural areas at the expense of the urban areas hence the nutritional status of children in the rural areas could be improving as a result of this reason (Radhakrishna & Ravi, 2004). The associated p-value of 0.689 implies that type of place of residence is not significantly related to stunting among children in the three northern regions.

Table 5.11: Relationship between Type of Place of Residence and Stunting

	Percentage of Stunting Categories		
Place of Residence	**Stunted**	**Not Stunted**	**Total**
Urban	31.0	69.0	100.0
Rural	29.1	70.9	100.0
Total	**29.4**	**70.6**	**100.0**

χ^2 = .160 Degrees of freedom = 1 Significance = .689

Source: Generated from the children's file of the 2008 GDHS dataset

5.3.2 Region of Residence and Stunting

The distribution of stunted children in the three northern regions (Table 5.12) reveals that the Upper East Region had the highest proportion of stunted children (33.9%), followed by Northern Region (28.8%) and the Upper West Region (23.1%). This result is not surprising since most developmental studies carried out in the three northern regions revealed that the Upper East is the most ecologically and socioeconomically disadvantaged among the three northern regions. The geographical outlook of the three northern regions reveals that the Upper East usually experiences the longest period of drought with irregular rainfall patterns throughout the year (DFID, 2005). This could have adverse repercussions for agriculture and food production. Moreover, at a P-value of 0.289, there is no significant relationship between region of residence and stunting among children in the study area.

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Table 5.12: Relationship between Region of Residence and Stunting

	Percentage of Stunting Categories		
Region	**Stunted**	**Not Stunted**	**Total**
Northern	28.8	71.2	100.0
Upper East	33.9	66.1	100.0
Upper West	23.1	76.9	100.0
Total	**29.3**	**70.7**	**100.0**

χ^2 = 2.482 Degree of Freedom = 2 Significance = .289

Source: Generated from the children's file of the 2008 GDHS dataset

5.3.3 Source of Drinking Water

The results in Table 5.13 reveal that more children were stunted in households with unsafe sources of drinking water (32.2%) than those in households with safe source of drinking water (28.7%). The result is in line with the recommendation from WHO that feeding children with water from unsafe sources could negatively affect their physical growth and development. This result supports the findings from the Ghana Statistical Service in 2008 that households using water from unsafe sources expose children to infectious diseases which only worsens their nutritional and health outcomes over a period of time. The associated P-value of 0.459 indicates that the relationship between source of drinking water and stunting is not significant.

Table 5.13: Relationship between Source of Drinking Water and Stunting

	Percentage of Stunting Categories		
Source of Drinking Water	**Stunted**	**Not Stunted**	**Total**
Unsafe	32.2	67.8	100.0
Safe	28.7	71.3	100.0
Total	**29.4**	**70.6**	**100.0**

χ^2 = .549 Degrees of freedom = 1 Significance = .459

Source: Generated from the children's file of the 2008 GDHS dataset

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5.3.4 Type of Toilet Facility and Stunting

As displayed in Table 5.14, stunting was higher among children from households using unimproved types of toilet facility (31.2%) compared to those using improved types of toilet facility (21.7%).

The results from the table support the review of the literature by Wondimagegn (2014) that revealed that malnourished children have consistently been found to be in households using unimproved type of toilet facility. At a p-value of 0.053, type of toilet facility is not significantly related with stunting among children at the 5% level.

Table 5.14: Relationship between Type of Toilet Facility and Stunting

	Percentage of Stunting Categories		
Type of Toilet Facility	**Stunted**	**Not Stunted**	**Total**
Unimproved	31.2	68.8	100.0
Improved	21.7	78.3	100.0
Total	**29.4**	**70.6**	**100.0**

χ^2 = 3.731 Degrees of freedom = 1 Significance = .053

Source: Generated from the children's file of the 2008 GDHS dataset

5.3.5 Anaemia and Stunting among Children

The prevalence of anaemia among children, especially when caused by iron and folate deficiencies has health and growth consequences for children. These minerals are needed for the formation of hemoglobin in the blood which helps in regulating the general immunity of the child (Baker-Henningham & Grantham-McGregor, 2004). The results from Table 5.15, however, reveals that out of the 556 children studied from the study area, the proportion of stunted children was slightly higher in non-anemic children (31.3%) compared to anemic children (29.7%). It can, however, be concluded that the relationship between anaemia episode and stunting is not significant at P-value = 0.387.

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Table 5.15: Relationship between Anaemia and Stunting

	Percentage of Stunting Categories		
Episode of Anaemia	**Stunted**	**Not Stunted**	**Total**
Anemic	27.9	72.1	100
Not anemic	31.3	68.7	100
Total	**29.3**	**70.7**	**100**

χ^2 = .748 Degrees of freedom = 1 Significance = .387

Source: Generated from the children's file of the 2008 GDHS dataset

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CHAPTER SIX

DETERMINANTS OF MALNUTRITION AMONG CHILDREN UNDER THE AGE OF FIVE IN THE THREE NORTHERN REGIONS OF GHANA

6.1 Introduction

At this stage, a binary logistic regression technique has been adopted to analyse the determinants of malnutrition among children under the age of five in the three northern regions of Ghana. This approach is the best at the multivariate stage when the dependent variable has only two categories. In this study, stunting has been classified dichotomously such that 1 = Stunted and 0 = Not stunted. The interpretation of the results is based on the Odd Ratios (OR), which indicate the nature of the net impact of the independent variable on the probability of the outcome occurring. Odd ratios greater than one (OR>1) indicates an increased chance of the outcome occurring; while OR less than one (OR<1) signifies a decreased chance of an outcome occurring and odd ratios equal to one (OR=1) suggests an equal chance of an outcome occurring as the reference category.

Following the modified conceptual framework for this study, four binary logistic regression models were run so as to monitor the significant predictors of malnutrition across these models. The first model was run to examine the relationship between the intermediate variables and stunting. The second model looks at the variation in stunting explained by the selected household variables. In the third model, the relationships between stunting and all the independent variables excluding the intermediate variables were assessed. Finally, a fourth model was run to examine the relationship between the independent variables, intermediate variables and stunting among children under the age of five in the three northern regions. Each of the four models is described

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below but the discussion of each variable is based on the fourth model since it incorporates all variables used in this study.

6.2 Intermediate Variables and Stunting

The model (Table 6.1) does not fit the data structure on which it was built since the Model Significance of 0.155 is greater than any of the three thresholds (1%, 5% and 10%) for significance. As a result of this, it is not the best fitting model for predicting stunting using these intermediate variables.

Table 6.1: Variations in Stunting by Selected Intermediate Variables (Model I)

	Exp(B) [95% C.I. for EXP(B)]	Sig.
Constant	0.464	.000
Source of Drinking Water		
Unsafe (RC)	1.000	
Safe	0.878 [0.564, 1.367]	.564
Type of Toilet Facility		
Unimproved (RC)	1.000	
Improved	0.613 [0.369, 1.019]*	.059
Episode of Anaemia		
Anemic (RC)	1.000	
Not Anemic	1.199 [0.827, 1.737]	.339
Nagelkerke R^2= 0.013 ***P < 0.000 **P < 0.05 *P < 0.10	**Model Sig. = 0.155**	

(RC) =Reference Category; Reference category for the dependent variable is 'stunted'

Source: Computed from the children's file of the 2008 GDHS dataset

6.3 Household Factors and Stunting

The second model in Table 6.2 examines the variation in stunting explained by the selected household factors. This model is significant (P = 0.042) at the 5% significance level and shows that the selected household factors explained 2.9% of the variation in stunting. From model 2, Wealth Index and Place of Residence were significantly related to stunting at the 5% significance level. Also, there is a decreasing likelihood of stunting as the economic status of households

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improves from poor to middle through to rich wealth index. The likelihood of stunting is also lower among children resident in urban areas in comparison to children resident in rural areas.

Table 6.2: Variations in Stunting by Selected Household Variables (Model 2)

	Exp(B) [95% C.I. for EXP(B)]	Sig.
Constant	.897	.734
Wealth Index		
Poor (RC)	1.000**	.017
Middle	0.342 [0.149, 0.783] **	.011
Rich	0.387 [0.166, 0.902] **	.028
Place of Residence		
Rural (RC)	1.000	
Urban	0.460 [0.241, 0.878]**	.018
Region		
Northern (RC)	1.000	.308
Upper East	1.292 [0.825, 2.025]	.263
Upper West	0.773 [0.413, 1.445]	.419
Nagelkerke R^2= 0.029 ***P < 0.000 **P < 0.05 *P < 0.10 Model Sig. = 0.042		

(RC) =Reference Category; Reference category for the dependent variable is 'stunted'

Source: Computed from the children's file of the 2008 GDHS dataset

6.4 Independent Variables and Stunting

The third model which is displayed in Table 6.3 is run to assess the relationship between only the independent variables and stunting among children. This model is significant (P = 0.000) at the 1% significance level and the independent variables explained 13.8% of the variation in stunting among children. From this model, Wealth Index of Households, Place of Residence, Age of Child and Size of Child at Birth were significantly related to stunting among children under the age of five in the three northern regions of Ghana. It is interesting to note that Wealth Index and Place of Residence, which were significant in model 2, remained significant when the other independent variables were introduced.

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Table 6.3: Variations in Stunting by Selected Independent Variables (Model 3)

	Exp(B) [95% C.I. for EXP(B)]	Sig.
Constant	0.538	0.390
Sex of Child		
Male (RC)	1.000	
Female	0.763 [0.513, 1.134]	0.181
Age of Child		
0-11 Months (RC)	1.000***	0.001
12-23 Months	3.509 [1.761, 6.993] ***	0.000
24-35 Months	4.268 [2.106, 8.648] ***	0.000
36-47 Months	3.891 [1.878, 8.064] ***	0.000
48-59 Months	3.829 [1.826, 8.028] ***	0.000
Size of Child at Birth		
Very small (RC)	1.000	0.128
Smaller than average	0.873 [0.365, 2.089]	0.760
Average	0.675 [0.302, 1.507]	0.337
Larger than average	0.866 [0.402, 1.866]	0.714
Very large	0.459 [0.206, 1.023]*	0.057
Birth Interval		
0-23 Months (RC)	1.000	
24 months and above	1.458 [0.851, 2.498]	0.170
Birth Order Number		
6th+ Child (RC)	1.000	0.969
5th Child	1.007 [0.535, 1.895]	0.982
4th Child	0.835 [0.449, 1.553]	0.568
3rd Child	0.894 [0.457, 1.748]	0.742
2nd Child	0.771 [0.377, 1.575]	0.476
1st Child	0.994 [0.508, 1.947]	0.987
Age of Mother at Birth		
15-19 (RC)	1.000	0.786
20-24	0.888 [0.587, 1.343]	0.573
25+	1.088 [0.537, 2.204]	0.815
Marital Status		
Currently not married (RC)	1.000	
Currently married	0.943 [0.389, 2.283]	0.896
Education Level of Mother		
No education (RC)	1.000	0.295
Primary	1.458 [0.830, 2.562]	0.190
Secondary or Higher	1.562 [0.704, 3.465]	0.273

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Table 6.3: Variations in Stunting by Selected Independent Variables (Model 3) Continues

Nutritional Status		
Malnourished (RC)	1.000	
Nourished	0.965 [0.484, 1.924]	0.920
Wealth Index		
Poor (RC)	1.000**	0.017
Middle	0.335 [0.140, 0.805] **	0.015
Rich	0.297 [0.109, 0.806] **	0.017
Place of Residence		
Rural (RC)	1.000	
Urban	0.424 [0.214, 0.838] **	0.014
Region		
Northern (RC)	1.000	0.225
Upper East	1.178 [0.721, 1.926]	0.513
Upper West	0.622 [0.319, 1.210]	0.162
Nagelkerke R^2= 0.138 ***P < 0.000 **P < 0.05 *P < 0.10 Model Sig. = 0.000		

(RC) =Reference Category; Reference category for the dependent variable is 'stunted'

Source: Computed from the children's file of the 2008 GDHS dataset

6.5 Independent Variables (including intermediate variables) and Stunting

In order to examine the consistency of the relationship shown by Wealth Index, Place of Residence, Age of Child and Size of Child at Birth, a fourth model involving all the independent variables and the selected intermediate variables was run (see Table 6.4). This model is significant (P = 0.001) at the 1% significance level which implies that the model fits the data structure well. Also, the proportion of the variation in stunting explained by the model is 14.4% which suggests that the remaining 85.6% of the variation in stunting could be explained by other variables not included in this model. Interestingly, the fourth model also revealed that Wealth Index of Households, Place of Residence, Age of Child and Size of Child at Birth were the significant predictors of malnutrition among children in northern Ghana. The discussion (Section 6.6) of how all the selected factors relate to stunting among children under the age of five in the study area are, therefore, based on Model 4 since this model incorporates the impact of all the factors.

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Table 6.4: Variations in Stunting by Selected Independent and Intermediate Variables (Model 4)

	Exp(B) [95% C.I. for EXP(B)]	Sig.
Constant	0.699	0.637
Sex of Child		
Male (RC)	1.000	
Female	0.765 [0.513, 1.140]	0.188
Age of Child		
0-11 Months (RC)	1.000***	0.001
12-23 Months	3.440 [1.724, 6.863] ***	0.000
24-35 Months	4.186 [2.060, 8.507] ***	0.000
36-47 Months	3.780 [1.817, 7.862] ***	0.000
48-59 Months	3.781 [1.796, 7.959] ***	0.000
Size of Child at Birth		
Very small (RC)	1.000	0.149
Smaller than average	0.898 [0.373, 2.163]	0.810
Average	0.689 [0.308, 1.542]	0.365
Larger than average	0.875 [0.405, 1.890]	0.735
Very large	0.471 [0.210, 1.053]*	0.067
Birth Interval		
0-23 Months (RC)	1.000	
24 months and above	1.485 [0.864, 2.554]	0.153
Birth Order Number		
6th+ Child (RC)	1.000	0.969
5th Child	0.990 [0.524, 1.870]	0.975
4th Child	0.840 [0.450, 1.567]	0.584
3rd Child	0.885 [0.452, 1.732]	0.721
2nd Child	0.762 [0.372, 1.564]	0.459
1st Child	1.006 [0.512, 1.975]	0.986
Age of Mother at Birth		
15-19 (RC)	1.000	0.672
20-24	0.860 [0.567, 1.304]	0.477
25+	1.128 [0.554, 2.297]	0.741
Marital Status		
Currently not married (RC)	1.000	
Currently married	0.939 [0.386, 2.286]	0.890
Education Level of Mother		
No education (RC)	1.000	0.315
Primary	1.396 [0.790, 2.467]	0.251
Secondary or Higher	1.646 [0.733, 3.695]	0.227

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Table 6.4: Variations in Stunting by Selected Independent and Intermediate Variables (Model 4) Continues

Nutritional Status		
Malnourished (RC)	1.000	
Nourished	0.959 [0.480, 1.914]	0.905
Wealth Index		
Poor (RC)	1.000*	0.054
Middle	0.385 [0.157, 0.943]**	0.037
Rich	0.346 [0.124, 0.967]**	0.043
Place of Residence		
Rural (RC)	1.000	
Urban	0.371 [0.180, 0.766]***	0.007
Region		
Northern (RC)	1.000	0.296
Upper East	1.214 [0.724, 2.033]	0.462
Upper West	0.676 [0.341, 1.340]	0.262
Source of Drinking Water		
Unsafe (RC)	1.000	
Safe	0.830 [0.496, 1.388]	0.477
Type of Toilet Facility		
Unimproved (RC)	1.000	
Improved	0.650 [0.332, 1.270]	0.208
Episode of Anaemia		
Yes (RC)	1.000	
No	1.078 [0.722, 1.609]	0.713
Nagelkerke R^2= 0.144 ***P < 0.000 **P < 0.05 *P < 0.10 Model Sig. = 0.001		

(RC) =Reference Category; Reference category for the dependent variable is 'stunted'

Source: Computed from the children's file of the 2008 GDHS dataset

6.6 Discussion

Sex of Child

Sex of Child is not significant with stunting. However, as revealed by Amugsi et al (2013) and Kabubo-Mariara et al (2009), malnutrition affects male and female children differently and the result of the OR in Model 4 (see Table 6.4) reveals that female children were 23.5% less likely to be stunted compared to male children in the three northern regions.

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Age of Child

The results revealed that age of child is significantly related to stunting at the 1% significant level across all the age categories used in this study. This is also consistent with the result obtained from the bivariate analysis where the age of child was found to be significantly related to stunting at the 1% significance level. Similar to Darteh et al (2014), it can be concluded that the likelihood of stunting increased with an increasing age of child. The plausible explanation for this finding could be that once children in the study area grow beyond the infant ages, they are introduced to complementary feeding which may lack the nutritional standard especially from the three northern regions.

Size of Child at Birth

The very large category of the size of child at birth was significantly related to stunting at the 10% significance level from the Model 4. Also, there was a declining likelihood of stunting as the size of child at birth increased. For the significant category of very large, the OR from Model 4 revealed that children with size at birth classified as very large had 52.9% less likelihood of stunting compared to children with very small size at birth. This is consistent with the finding by Masibo (2013) that the higher the birth size of a child at birth, the less the likelihood of that child getting stunted.

Birth Interval

This variable was not significantly related to stunting among children under the age of five in the three northern regions of Ghana. This is a deviation from the bivariate results where birth interval was significantly related to stunting but this could however be due to the presence of other child factors in the binary regression model. The results of the Odd Ratio for succeeding

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birth interval categories reveal that children born within 24 months and above interval were 48.5% more likely of getting stunted compared to those born within 0-24 month interval. This is in stark contrast to what was recommended by UNICEF and WHO that there should be at least 24 months birth interval to ensure the health and nutritional status of the children (UNICEF, 2013).

Education Level of Mother

The educational level of the mother and stunting were not significantly related but this could be due to the presence and significance of other socioeconomic variables like wealth index and place of residence. When it comes to the educational level of the mother and the likelihood of stunting among children, Amugsi et al (2013) reported that the gap between the educational level of mothers and nutritional status of children is closing. The results of this study also revealed a similar outcome because the likelihood of stunting was increasing as the educational level of the mother increased from no education through to secondary or higher education. For instance, for children whose mothers attained primary education, their likelihood of stunting was 39.6% more likely compared to the reference category while for children whose mothers attained secondary or higher education, their likelihood of stunting was 64.6% more likely compared to the reference category of no education. Radhakrishna & Ravi (2004) also found a similar result but concluded that it could possibly be due to the fact that interventions in the form of nutrition and health are targeted at children whose parents attained low educational levels to the neglect of children whose parents are highly educated.

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Nutritional Status of the Mother

This variable was not significantly related to stunting among children under the age of five in the three northern regions but the likelihood of stunting was slightly less (4.1%) for children whose mothers were nourished compared to children whose mothers were malnourished.

Wealth Index

Model 4 revealed that wealth index of household was significantly related to stunting among children under the age of five in the three northern regions. From the Odd Ratios (OR) associated with the categories of Wealth Index, we can conclude that the likelihood of stunting decreased as the economic status of the household improved. This is because children from the middle wealth index category had 61.5% less likelihood of getting stunted compared to the reference category of poor. This probability decreased further as we move to the rich households because children from here had 65.4% less likelihood of stunting compared to the poor category. This finding is consistent with the results of Darteh et al (2014) that explained that rich households are able to afford the health and nutritional needs of children compared to poor households.

Place of Residence

The place of residence of household and stunting were significantly related at the 1% significance level. The results of the OR in Table 6.4 indicate that children residing in the urban areas had 62.9% less likelihood of stunting compared to their rural counterparts in the three northern regions of Ghana. This finding contradicts the result of the bivariate analysis that showed that urban children were slightly more stunted rural children. This could be attributed to the presence and possible effects of other socioeconomic variables like wealth index, source of drinking water and types of toilet facility in the regression model. The findings also reflect the

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inequalities within the three northern regions and support the findings from Van de Poel et al (2007) that urban areas are blessed with amenities like health facilities, schools, safe water sources and electricity, hence the risk of malnutrition could be lower in the urban areas in relation to the rural areas. The knowledge of differentials in the likelihood of stunting for rural and urban children within the three northern regions could be useful for implementing nutrition interventions in this part of the country.

Region of Residence

Region did not significantly relate to stunting among children under the age of five. It can however be concluded that the odds of stunting is highest for children in the Upper East Region. Children in the Upper East Region were 21.4% more likely to be stunted while those in Upper West Region were 32.4% less likely to be stunted in relation to the Northern Region. This finding is not surprising because according to the Department for International Development in 2005, the Upper East Region is the most ecologically and socioeconomically disadvantaged in the country. This could affect food production in the region and starve many households of foods in the right quantity and proportion to nourish children on consistent basis.

Source of Drinking Water

The source of drinking water did not significantly relate to stunting but the odd of stunting was less (17%) for households drinking and feeding children from the safe sources. This is in line with the WHO recommendation that households should procure safe sources of drinking water like the pipe and boreholes in order to improve the nutritional and health status of children.

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Type of toilet Facility

The type of toilet facility did not significantly relate to stunting among children. However, children from households using the improved types of toilet facilities like the Ventilated Improved Pit (VIP) latrine, Composite Toilets, Flush to Piped Sewer System etc had 35% less likelihood of stunting in relation to children from households using the unimproved types. This also comes as a support of the WHO recommendation that households should procure the improved type of toilet facility so as not to leave children vulnerable to infections that can endanger their physical growth (Babatunde et al, 2011).

Episode of Anaemia

Anaemia episode was not significant with stunting among children under the age of five in the three northern regions of Ghana. However, contrary to the expected outcomes of this study, the odd of stunting was 7.8% more for children without anaemia in relation to anemic children. Since anaemia in children is caused by a deficiency in essential mineral like iron, it was expected that children with enough iron supplementation would have less likelihood of stunting compared to anemic children. This outcome could possibly be due to the omission of iron supplementation of children from this analysis since data on iron supplementation does not cover all children below age five.

Finally, other variables like the Birth Order Number, Age of Mother at Birth and Marital Status of the Mother were not significantly related to nutritional status of children under the age of five in the study area.

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CHAPTER SEVEN

SUMMARY, CONCLUSION AND RECOMMENDATIONS

7.1 Summary

The main objective of this study was to examine the determinants of malnutrition among children under the age of five in the three northern regions of Ghana. Studies have investigated the nutritional status of children at the national level yet little is known when it comes to local and regional level determinants. It is the focus of this study to fill this gap in the literature on the determinants of malnutrition among children in the three northern regions where the problem actually exists. The specific objectives of this study were to assess the relationships between wealth status of household, educational level of mother, place of residence and the prevalence of stunting among children in the three northern regions.

The independent variables selected for this study include sex of child, age of child, size of child at birth, birth interval, birth order, age of mother at birth, marital status of the mother, educational level of mother, mother's nutritional status, wealth index, type of place of residence, source of drinking water, type of toilet facility, region and episode of anaemia. The selection of these variables was guided by the UNICEF analytical framework for the determinants of malnutrition among children under the age of five.

The hypotheses that were proposed for this study include the following:

- The higher the educational level of the mother, the less the likelihood of stunting among children.
- The higher the wealth index of households, the less the likelihood of stunting among children.

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- Children residing in urban areas are less likely to be stunted in relation to children residing in rural areas.

To meet the objectives of the study and test these hypotheses, data from the children's file of the 2008 GDHS was used. The study focused on 556 children after the data was initially weighted and thoroughly cleaned to eliminate missing cases so that only the accurate sample of children is analysed. Three stages of analyses were carried out in this thesis – univariate, bivariate and multivariate analyses. The univariate analysis was used to examine the distribution of children by their demographic and socioeconomic characteristics in the study area. At the bivariate level, a Pearson Chi-square was computed to test for the association between each independent variable and stunting with the P-value set at the 5% significance level. Finally, multivariate analysis was carried out using binary logistic regression to identify which of the selected independent variables significantly influence the prevalence of stunting among the children. Four different regression models were run based on the modified analytical framework for the study.

The results of the bivariate and multivariate analysis revealed some similar findings from the literature, with few interesting variations. Variables like the age of child and birth interval had a significant association with stunting at the bivariate level. The binary logistic regression results showed that the age of child was significant at all the three significance levels of 1%, 5% and 10%. Also, size of child at birth was significant at the 10% level; wealth index of households and type of place of residence were both significant at the 5% and 10% levels. The Nagelkerke R^2 value of 0.144 indicates that the independent variables explained 14.4% of the variation in stunting among the children.

Following the hypotheses of the study, the educational level of the mother did not show a significant relationship with stunting and the hypothesis about maternal education and stunting is

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rejected. This is because the regression model (see Table 6.4) revealed an increasing likelihood of stunting among children as the educational level of their mothers increased. This contradicts the set hypothesis. The wealth index of households showed a significant relationship with stunting among children and the hypothesis that "the higher the wealth index of households, the less the likelihood of stunting among children" was accepted. This is because the odds of stunting for children declined as the wealth status of the household increased. Finally, place of residence showed a significant relationship with stunting and, therefore, the hypothesis that urban children are less likely to be stunted than rural children was accepted.

7.2 Conclusion

One interesting result at the univariate level of analysis was that 78.2% of children under the age of five were born within the 0-23 month interval. This did not come close to meeting the WHO recommendation which is that the required birth interval after a live birth should be at least 24 months. The situation could highlight challenges with unmet needs and low contraceptive usage in northern Ghana. Also, it was discovered that about 75% of mothers had no education while the combination of the poorest and poorer households formed a little over 80% of the sample that was used for the study. These results highlighted the socioeconomic profiles of the study area.

Moreover, in line with the objectives of this study, the wealth index of household and place of residence were significantly related to stunting. It was also observed that urban residence and higher wealth status of households lead to a declining likelihood of stunting. The educational level of the mother and stunting were not significantly related.

Finally, the results of this study showed that age of child, size of child at birth, wealth index and place of residence were the key determinants of malnutrition among children in the three northern regions of Ghana according to the 2008 GDHS and the analytical methods adopted.

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7.3 Recommendations

Based on the findings from this study, the following recommendations are made:

- There should be a revision, intensification and effective implementation of livelihood enhancement interventions like the Livelihood Empowerment Against Poverty Programme (LEAP) in northern Ghana with over 80% of households found to be poor and the likelihood of stunting higher for economically disadvantaged households. This could be done through innovative irrigation strategies and targeted financial policies that can help the northern people upscale their agricultural produce and diversify their economies.
- Developmental efforts in northern Ghana should extend to the remote and rural areas in the three northern regions. This is because the likelihood of stunting was found to be considerably less in urban areas in relation to the rural areas and this could be a testament to the rural-urban divide in northern Ghana.
- Birth spacing campaigns should be intensified, with access and usage of contraception facilitated across the three northern regions of Ghana. This is particularly important because a little over 78% of births were found to be within 0-23 month interval and this does not conform to the WHO recommendation that there should be at least 24 month interval between live births.
- Finally, further studies should be conducted to assess the determinants of malnutrition at the district levels of the three northern regions so as to broaden knowledge on the risk factors of malnutrition among children at the district and sub-district levels in northern Ghana.

INTEGRI PROCEDAMUS

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REFERENCES

Akosa, A. (2013). Malnutrition among Children in Ghana. Accra, Greater Accra Region, Ghana: Ghana Health Service.

Amugsi, D., Maurice, M., & Lartey, A. (2013). An analysis of socio-demographic patterns in child malnutrition trends using Ghana demographic and health survey data in the period 1993–2008. *BMC Public Health*, 12 : 960.

Appoh, L., & Krekling, S. (2005). Maternal nutritional knowledge and child nutritional status in the Volta Region of Ghana. Volta Region, Ghana: Maternal and Child Nutrition.

Aturupane, H., Deolalikar, A., & Dileni, G. (2008). The Determinants of Child Weight and Height in Sri Lanka: A Quantile Regression Approach. Sri-Lanka: UNU-WIDER Research Paper No.53.

Ayaya, S., Esamai, F., Rotich, J., & Olwambula, A. (2005). Socio-economic factors predisposing under five-year-old children to severe protein energy malnutrition. *Kenya, Eastern African Medical Journal.*, 415 - 421.

Babatunde, R., Olagunju, F. I., Fakayode, S., & Sola-Ojo, F. (2011). Prevalence and Determinants of Malnutrition among Under-five Children of Farming Households. Kwara State, Nigeria: Canadian Center of Science and Education, Journal of Agricultural Science.

Baker-Henningham, H., & Grantham-McGregor, S. (2004). Nutrition and Child Development in, The Nutrition Society Textbook Series, Public Health Nutrition. pp. 250 - 259. United Kingdom: Blackwell Publishing.

Black, R. E, V. C. (2013). Maternal and child undernutrition and overweight in low-income and middle-income countries. *Lancet*, 382-396.

University of Ghana http://ugspace.ug.edu.gh

Black, R., Allen, L., Bhutta, Z., Caulfield, L., de Onis, M., & Ezzati, M. (2008). Maternal and child undernutrition: global and regional exposures and health consequences. *Lancet*, 243-260.

Brown, K. H. (1998). *Complementary feeding of young children in developing countries: A review of current scientific knowledge.* Geneva: World Health Organisation.

Caulfield, L., de Onis, M., Blossner, M., & Black, R. (2004). Undernutrition as an underlying cause of child deaths associated with diarrhea, pneumonia, malaria and measles. *American Journal of Clinical Nutrition. Vol 80.*, 193 - 198.

Darteh, E., Acquah, E., & Kumi-Kyereme, A. (2014). Correlates of stunting among children in Ghana. Ghana: Licensee BioMed Central Ltd.

de Onis, M., Frongillo, E., & Blossner, M. (2000). *Is malnutrition declining? An analysis of changes in levels of child malnutrition since 1980*. Retrieved from www.who.org.za: http://www.who.org.za

de Onis, M., Blossner, M., & Borghi, E. (2011). Prevalence and trends of stunting among pre-school children, 1990-2010. *Public Health Nutrition*, 1 - 7.

DFID. (2005). Economic growth in northern Ghana. United Kingdom: Department for International Development.

Duggan, M., & Golden, B. (2005). Deficiency diseases, in Human Nutrition. 11th edition. United Kingdom: Elsevier Churchill Livingstone.

FAO. (2008). *The State of Food Insecurity in the World 2008.* Rome: Food and Agriculture Organization.

Frost, M., Forste, R., & David, W. (2005). Maternal education and child nutritional status in Bolivia: Finding the links. *Social Science and Medicine, Volume. 60*, 395–407.

University of Ghana http://ugspace.ug.edu.gh

Gallager, M. (2008). The nutrients and their metabolism. *Krause's Food & Nutrition. 12th Edition*, 65 - 67.

Golden, M., & Golden, B. (2000). Severe Malnutrition. *Human Nutrition and Dietetics, 10th Edition*, 515 - 525.

Gongwer, C. R., & Aryeetey, R. (2014). Implementing nutrition interventions in Ghana at district level: gaps and opportunities. Ghana: African Scholarly Science Trust.

Grantham-McGregor, S., Cheung, Y., Cueto, S., Glewwe, P., Richter, L., & Strupp, B. (2007). Developmental potential in the first 5 years for children in developing countries. *The Lancet*, 369 (9555): 60-70.

GSS, NMIMR. (2004). *Ghana Demographich and Health Survey 2003.* Calverton, Maryland: Ghana Statistical Service (GSS).

GSS. (2008). *Children's Health and Nutritional Status in Ghana.* Accra: Ghana Statistical Service.

Kabubo-Mariara, J., Ndenge, G., & Kirii, D. (2009). Determinants of Children's Nutritional Status in Kenya: Evidence from DHS. *Centre for the Study of African Economies (CSAE) Conference on "Reducing Poverty and Inequality: How can Africa be included?* Oxford: Journal of Agricultural Economics.

Kothari, M., & Noureddine, A. (2010). *Nutrition Updates.* Calverton, MD, USA.: IFC Macro.

Masibo, P. (2013). Trends and Determinants of Malnutrition among Children Age 0-59 Months in Kenya (KDHS 1993 - 2008-2009). Maryland, USA: ICF International.

Mason, J. (2007). *The relationship between nutritional status and acute illnes*. Retrieved from www.ocw.tufts.edu: http://www.ocw.tufts.edu

University of Ghana http://ugspace.ug.edu.gh

McKeever, P., & Miller, K. (2004). Mothering children who have disabilities: a Bourdieusian interpretation of maternal practices. *Social Science and Medicine*, 1177-1191.

Miah, R. (2014). Risk factors for undernutritioin in children under five years old in Ghana. Accra, Ghana: Ghana Health Service.

Müller, O., & Krawinkel, M. (2005). *Malnutrition and health in developing countries.* Retrieved from www.equityhealthj.com: http://www.equityhealthj.com

Olson, C. (2001). Nutrition and Health Outcomes Associated with Food Insecurity and Hunger. *Journal of Nutrition, Vol.129*, pp.521-524.

Owolabi, A., Aderonmu, A. O., & Ojeifeitimi, E. O. (2003). A study on under nutritional status and its determinants in a semi-rural community of lle-lfe. *Nutrition and Health*, 21-27.

Oyekale, A., & Oyekale, T. (2002). Do mothers' educational levels matter in child Malnutrition and health outcomes in Gambia and Niger? Nigeria: Department of Agricultural Economics, University of Ibadan.

Oyelami, O., & Ogunlesi, T. (2007). Kwashiorkor – is it a dying disease? South. *South African Medical Journal. Vol. 97*, 65 - 68.

Parks, & Naomi. (2012). *What Is Overnutrition and Undernutrition?* Livestrong.

Pelletier, & Frongillo. (2003). Changes in child survival are strongly associated with changes in malnutrition in developing countries. *Journal of Nutrition*, 107-119.

Pereira, S. (1991). Protein Energy Malnutrition: Kwashiorkor and Marasmic Kwashiorkor, Part 2: Clinical Aspects and Treatment in Clinical Nutrition of the Young. New York: Raven Press Ltd.

Radhakrishna, R., & Ravi, C. (2004). Malnutrition in India: Trends and Determinants. *Economic and Political Weekly, Vol 39 (7)*, pp. 671-676.

University of Ghana http://ugspace.ug.edu.gh

Rayhan, I., & Khan, M. (2006). Factors causing malnutrition among under five children in Bangladesh. *Pakistan Journal of Nutrition, Vol.5(6)*, 558-565.

Rikimaru, T., Yartey, J., Taniguchi, K., & Kennedy, D. (1998). Risk factors for the prevalence of malnutrition among urban children in Ghana. *Journal of Nutritional Science and Vitaminology*, 44 (3): 391 - 407.

Sahn, D. E., & Stifel, D. (2002). Robust Comparisons of Malnutrition in Developing Countries. *American Journal of Agricultural Economics*, 84(3):716-735.

Smith, L. C., & Haddad, L. L. (1999). Explaining Child Malnutrition in Developing Countries: A Cross-Country Analyis. Washington, D.C, USA: IFPRI FCND Discussion Paper No. 60, IFPRI.

Strobel, S., & Ferguson, A. (2006). Immune function, food allergies and food intolerance. United Kingdom: Elsevier Churchill Livingstone.

Takyi, E. E. (1999). Nutritional status and nutrient intake of preschool children in northern Ghana. *East Africa Medical Journal*, 510-515.

Todd, B., & Meera, S. (2006). *Trends and Issues in Child Undernutrition, 2nd edn.* Washington DC, USA: World Bank.

Torún, B. (2006). *Protein-Energy Malnutrition in, Modern Nutrition in health and disease.* United State of America: Lippincott Williams & Wilkins.

Torún, B., & Chew, F. (1994). *Protein-Energy Malnutrition in, Modern Nutrition in health and Disease; 8th Edition.* United State of America: Lea & Febiger.

Turnham, D. (2005). Inter-micronutrient topics. United Kingdom: Elsevier Churchill Livingstone.

University of Ghana http://ugspace.ug.edu.gh

UNICEF. (2009). *Tracking progress on child and mother nutrition: A survival and development priority*. New York: USA: United Nations Children's Fund.

UNICEF. (2013). *Improving Child Nutrition: the achievable imperative for global progress*. UNICEF.

Van de Poel, E., Hosseinpoor, A., Jehu-Appiah, C., Vega, J., & Speybroeck, N. (2007). Malnutrition and the disproportional burden on the poor: the case of Ghana. *International Journal of Equity and Health*, 6-21.

WFP. (2005). *A Manual: Measuring and Interpreting Malnutrition and mortality*. Geneva: World Food Programme.

WFP. (2012). *Comprehensive food security and vulnerability analysis-Ghana: A focus on Northern Ghana*. Accra: MoFaAMaGSSG.

WHO. (1997). *Global database on malnutrition*. Geneva: World Health Organization.

WHO. (2006). *Child growth standards: Background 1*. Geneva: World Health Organisation.

WHO. (2006). *Report of a Technical Consultation on Birth Spacing*. Geneva: World Health Organisation; Department of Making Pregnancy Safer and Department of Reproductive Health and Research.

WHO. (2007). *Community-Based Management of Severe Acute Malnutrition*. Geneva: World Health Organisation.

Williams, A. (2005). Clinical Nutrition. 378 - 411. Pediatric Nutrition, The Nutrition Society Textbook Series, .

Wittenberg, D. (2004). Nutritional disorders in, Nutritional and metabolic disorders. *Paediatrics and Child Health, Oxford*.

University of Ghana http://ugspace.ug.edu.gh

Wondimagegn, Z. (2014). Magnitude and Determinants of Stunting Among Children in Africa: A Systematic Review. Hawassa, Ethiopia: Nutrition and Food Science.

World Bank. (2006). *The World Bank. Repositioning Nutrition as Central to Development: A Strategy for Large-Scale Action.* Washington : The World Bank.

Zere, E., & McIntyre, D. (2003). Inequities in under-five child malnutrition in South Africa. *International Journal for Equity in Health*, Vol. 2, no. 7. Retrieved from www.equityhealthj.com: http://www.equityhealthj.com