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DECLARATION

I **Promise Eweh**, certify that apart from reference to other works, which have been duly acknowledged, the dissertation is the result of my own research work carried under the supervision of **Professor Samuel Nii Ardey Codjoe**.

None of the work has been reproduced or represented for the award of an academic certificate. I am therefore solely responsible for any short comings that may be found in this research work.

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ABSTRACT

Reports that emanated from the 2008 Ghana Demographic and Health Survey indicated that anaemia among women in the country stood at 59 per cent, making it a severe public health problem based on the classification of the World Health Organisation. Majority of studies on the aetiology and determinants of anaemia among Ghanaian women were community based and did not permit an understanding of the problem among women of different socio-demographic groups residing in the larger spatial units of the country. This study sought to fill this research gap and to more importantly identify risk factors that predisposed women to the disease.

Data for the study were collected as part of the Ghana Demographic and Health Survey which was conducted in 2008. This survey is based on a nationally representative sample and has been conducted on a five year interval since 1988. In half of the households where interviews were conducted, consenting women of reproductive age were tested for anaemia using the HemoCue system. In all, 4758 women of reproductive age were screened for anaemia.

Results from the univariate analysis showed that 41.2 per cent of Ghanaian women did not have anaemia. For those who tested positive for anaemia, it was observed that 38.8 per cent, 18 per cent and 2 per cent were mildly, moderately and severely anaemic respectively. Anaemia levels varied among women of different social and demographic statuses. Proportion of women who did not have anaemia was significantly lower among urbanites than rural dwellers. With respect to education, a preponderance of the subjects with no anaemia had higher education. No anaemia was however below 50 per cent in the other educational attainments, reaching as low as 36.4 per cent for women with primary education.

Results from the multinomial logistic regression indicated that place of residence, source of water for drinking and type of toilet facility were not risk factors for anaemia. The results further showed that women with higher education were significantly less likely than women with no education to have moderate and mild anaemia. Non-pregnant women were also significantly less likely to have severe and moderate anaemia compared to pregnant women. Similarly, women who slept under insecticide treated bed nets a day before the survey were also significantly less likely to have severe anaemia compared to those who did not.

Other studies on anaemia that focused on children under age 5 and used data from the 2008 Demographic and Health Survey also reported a prevalence of 78 per cent. Implementation of a National Anaemia Prevention and Control Programme was thus recommended to reduce prevalence as well as anaemia related mortality. Other recommendations based on the identified risk factors included increasing intake of intestinal parasite drugs in pregnant women along with encouraging intermittent iron supplementation in women of reproductive age.

DEDICATION

This work is dedicated to the late Hudzegor Dorgbetor.

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LIST OF ABBREVIATIONS

CEB	Children Ever Born
CSIR	Centre for Scientific and Industrial Research
DHS	Demographic and Health Survey
DOT	Directly Observed Therapy
FAO	Food and Agriculture Organization
FHD	Family Health Division
GAIN	Global Alliance for Improved Nutrition
GDHS	Ghana Demographic and Health Survey
GHS	Ghana Health Service
HIV	Human Immunodeficiency Virus
HSAO	Health Sector Advisory Office
ICPD	International Conference on Population and Development
ITNs	Insecticide-Treated Nets
IUD	Intrauterine Device
JHS	Junior High School
MDG	Millennium Development Goals
MICAH	Micronutrients and Health
MOST	Micronutrient Operational Strategies and Technology
NaNA	National Nutrition Agency
NCGC	National Clinical Guideline Centre
NDPC	National Development Planning Commission

NHIS	National Health Insurance Strategy
ODS	Office of Dietary Supplements
PATH	Program for Appropriate Technology in Health
RBCs	Red Blood Cells
SHS	Senior Secondary School
SPSS	Statistical Package for Social Scientists
UNICEF	United Nations Children's Fund
USAID	United States Agency for International Development
VIP	Ventilated Improved Pit latrine
WFP	World Food Programme
WHO	World Health Organization

CHAPTER ONE

INTRODUCTION

1.1 Background of the Study

Anaemia is derived from the Greek word "*anaimia*", a term that denotes "being without blood". It is defined as a state in which the quality and/or quantity of circulating red blood cells are below normal (NCGC 2011). Due to this deficiency, red blood cells are unable to transport enough oxygen to tissues which perform critical functions in the human body. Anaemia is mostly classified as mild, moderate or severe. This categorization is determined largely by haemoglobin concentration in the blood which can be measured directly, has an international standard and is not influenced by changes in technology (NCGC 2011). Anaemia is usually characterised by signs and symptoms such as extreme body weakness, soft skin, bad appetite and constant thirst. Other noticeable signs include loss of normal colour of the skin and lips.

Anaemia, specifically that caused by iron deficiency is the most common type of anaemia that is experienced globally (WHO 2011). In fact, anaemia and iron deficiency are so closely knit that the two terms are used interchangeably and it becomes literally impossible to make a comment of one whilst ignoring the other. However, Jain and Sharma (2012) note that "there are cases where a person may not be anaemic but is mildly or moderately iron deficient". Aside iron deficiency anaemia, other agents that could initiate or aggravate anaemia are malaria, hookworm infestation, schistosomiasis and haemorrhage in childbirth (Viveki *et al.* 2012; WHO 2001; CDC 1998; Menendez *et al.* 1997).

Kotecha (2011) notes that two billion people, comprising over 30 per cent of the world's population are anaemic. Similarly, iron deficiency is noted as "the most common nutritional disorder in the world" (Kotecha 2011). Estimates indicate that about 4-5 billion people, representing 66-80% of the world's population may be iron deficient (Gibney *et al.* 2004).

Unlike malaria and the African sleeping sickness that are considered endemic due to their localisations, anaemia is a global public health problem that affects populations in all regions of the world. Although persons of any sex and age can suffer from anaemia, women, particularly pregnant women and young children are identified as the groups that are most vulnerable to the disease (WHO 2011; WHO 2008; Hyder 2002). In the case of pregnant women the risk of anaemia infection is due to the competing needs of the mother and foetus for iron supplementation (WHO 2011; Glover-Amengor *et al.* 2005). In both women and young children, prevalence of anaemia in low-income countries is higher than in high-income countries (Hyder 2002). Hein and Kohlmorgen (2003) also note that "nine out of ten anaemia sufferers live in developing countries".

The WHO using data spanning a period of 12 years (1993–2005) estimates that 468 million non – pregnant women (30.2 per cent) and 56 million pregnant women (41.8 per cent) are anaemic (WHO 2008). In both non-pregnant and pregnant women, anaemia is higher in South-East Asia than in any other region of the world (WHO 2008). The same study indicates that anaemia is high in Africa where prevalence levels among non-pregnant and pregnant women are 69.9 million (47.5%) and 17.2 million (57.1%) respectively (WHO 2008). In non-pregnant and pregnant women, the greatest proportion of women infected with anaemia is found in Africa. However the greatest number of women infected with the disease is found in South East Asia (WHO 2008).

The 2008 Demographic and Health Survey reported anaemia prevalence of 59 per cent among Ghanaian women aged 15 – 49 (GSS *et al.* 2009). Factors that account for anaemia among Ghanaian women are inadequate dietary intake of iron, malaria, and intestinal worm infestation (GSS *et al.* 2004). Efforts to address the anaemia problem started in 1996 when the United States Agency for International Development (USAID) in collaboration with the United Nations Children's Fund (UNICEF) initiated the Micronutrient Operational Strategies and Technology (MOST) project (Ghartey, 2010). Strategies that were implemented to curb the problem included iron supplementation, administration of new malaria drugs and de-worming.

Pockets of other strategies that have been implemented include the Family Health Division's (FHD) training of over 100 private health practitioners from the three northern regions, Ashanti and Brong Ahafo Regions on the control of anaemia (GHS, 2009). The Directly Observed Therapy (DOT) programme which primarily targets malaria control also had a component that sought to reduce anaemia. Under this subcomponent, "Community Change Agents" were trained to disseminate information on issues that related to anaemia (Ghartey, 2010).

1.2 Problem Statement

Prevalence of anaemia among Ghanaian women increased from 45 per cent in 2003 to 59 per cent in 2008 (GSS *et al.* 2009). It is estimated that 20 per cent of maternal deaths are attributable to the disease (GHS 2011). This is at par with the same percentage of maternal deaths caused by complications resulting from abortions (HSAO, 2008).

It is further projected that if present levels of anaemia remain unchecked, the lives of 9000 women will be lost by 2020 (GHS 2011). Studies at sub-regional levels also point to a growing prevalence of anaemia among Ghanaian women. Glover-Amengor *et al.* (2005) and Baidoo *et al.* (2010) have independently reported prevalence of 57.1 per cent and over 50 per cent among pregnant women in the Sekyere-West and East Districts of the Ashanti region.

Anaemia prevalence of 59 per cent (GSS *et al.* 2009) puts Ghana at the outer limit of the WHO's classification of anaemia as a problem of public health significance. This classification shows that countries with anaemia prevalence of 40 per cent or more comprise those where anaemia is a severe public health problem (WHO 2008). Between 2002 and 2008, anaemia featured consistently as the tenth cause of outpatient morbidity in Ghana (GHS 2010). Further, anaemia was the third cause of admission and mortality at all ages in 2008, constituting 5.3 per cent and 7.3 per cent of morbidity and mortality respectively (GHS 2010). These figures indicate the importance of the anaemia problem in contemporary Ghana.

Anaemia in women has been associated with "increased maternal and perinatal mortality, preterm delivery and low birth weight" (Hyder 2012). Further, infants born to anaemic mothers are at a greater risk of developing anaemia (Hyder 2012). This consequently affects physical and cognitive development, as well as increased risk of morbidity (Hyder 2012; WHO 2013). Anaemia prevalence and its consequent effects could even be worse since malaria is classified "hyper – endemic" in Ghana. By and large, anaemia prevalence is high and is a national problem that requires research and intervention.

1.3 Rationale of study

Although significant progress has been made in the achievement of some Millennium Development Goals (MDGs), others, specifically the reduction of maternal mortality ratio still leaves a lot to be desired (NDPC 2012). According to WHO (2012) maternal mortality has reduced from 580 per 100,000 live births in 1990 to 350 per 100,000 in 2010. This in fact indicates that some progress has been made. However, it is feared that Ghana may be unable to meet the target of 185 per 100,000 live births in 2015. If this happens Ghana would not only have failed at achieving target 5 of the MDGs but also the International Conference on Population and Development (ICPD) target of 60 maternal deaths per 100,000 live births. The GSS *et al.* (2009) indicates that "one-fifth of perinatal mortality and one-tenth of maternal mortality are attributable to iron deficiency anaemia".

Anaemia is also noted to be the cause of increased risk of premature delivery and low birth weight (GSS *et al.* 2009). In light of the targets that have to be achieved under Goal 5 of the MDGs and the ICPD Programme of Action, it is necessary to undertake research that will unravel the determinants of anaemia in Ghana. Community level studies on determinants of anaemia among Ghanaian women (Fuseini *et al.* 2010; Baidoo *et al.* 2010; Glover-Amengor *et al.* 2005) aside the pitfall of sole focus on pregnant women also lack generalisation to the national economy. This study which shall depend on a nationally representative sample is thus intended to contribute to a limited body of literature on anaemia among Ghanaian women at the macro level.

1.4 Objectives

The general objective of the study was to examine anaemia prevalence among Ghanaian women and to identify factors that were strongly associated with the disease. Specific objectives formulated to achieve this general objective are:

a. To identify levels of anaemia among Ghanaian women.
b. To examine the socio-demographic factors that were associated with anaemia among Ghanaian women.
c. To come up with findings, policy recommendations and strategies that would significantly reduce anaemia.

1.5 Conceptual Framework for Study

Conceptual framework for the study was adapted from a model of the determinants of anaemia by Balarajan *et al.* (2011). The framework shown in figure 1 identifies a network of environmental, socio-demographic, and nutritional factors that are associated with the development of anaemia in women and children. In all, thirteen independent variables for which data were available were adapted for the study (Please see Table 3.1 for details and respective measurements).

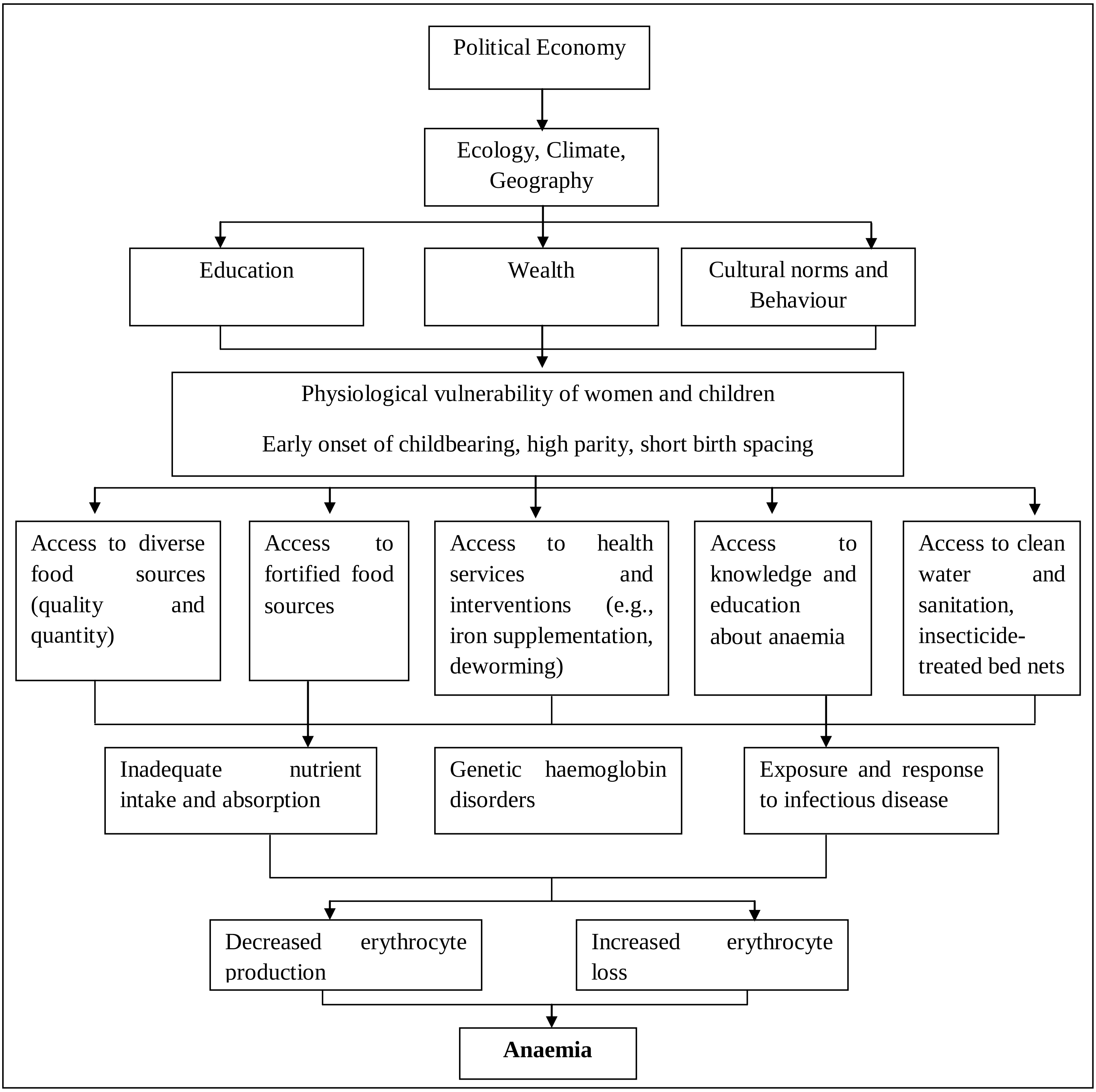
At the top of the model can be found Political Economy. According to Balarajan and colleagues, "anaemia prevalence is inversely correlated with economic development at the state level".

Available data which closely approximated and were used to examine the influence of the state on anaemia prevalence were Place and Region of Residence; thus these two variables served as proxies for the Political Economy variable.

Education and wealth were of major consideration in the study. The roles of these in anaemia were respectively assessed by analysing data on educational attainment and wealth quintile of women. Cultural norms and behaviour, especially those relating to food consumption were also assessed in the study. However, since data on these were not specifically collected as part of the DHS exercise, datum provided on ethnicity was used as a proxy. Ethnicity was the preferred proxy as norms and behaviours are embedded in the cultures and practices of ethnic groups.

Variables that pertain to physiology and how they predispose women to anaemia were also investigated. The relationship between early onset of childbearing, high parity and anaemia were assessed by examining data on age at first birth and total children ever born. Also of equal importance were ages of women and their statuses regarding pregnancy and lactation. Lastly, variables such as source of drinking water, type of toilet facility, use of insecticide treated nets and their association with anaemia were also at the heart of the inquiry.

Figure 1 Conceptual Model of the Determinants of Anaemia



Source: Balarajan *et al.*, 2011

The framework shows that among the factors that lead to anaemia in women are education and wealth. Higher maternal education leads to "increased knowledge about health and nutrition and to an increase in the quality of the diets of children". Women with higher education are likely to earn better income than their counterparts; thus they are in a position to purchase the quantity and quality of foods that can continuously restore depleted iron stores and further provide them with the essential micronutrients. Prevention of anaemia on the basis of the ability of women to purchase the right quantity and quality of foods also depends on their wealth status.

Physiology of women put them at greater risks of anaemia, explaining why women have been the major focus of research than adult males. Women normally go through life often having to adjust to the processes of menarche, pregnancy, childbirth and lactation. These processes if not well managed can result in iron depletion and consequently anaemia. Early onset of childbearing especially for teenagers leads to substantial demands for iron. High parity and gravidity are also associated with anaemia (Al-Farsi *et al.* 2011; Taseer *et al.* 2011). Pregnant women have an increased risk of haemorrhage prior to, at the time of delivery, and after delivery. "Therefore, higher parity exposes women more frequently to periods of hemorrhage risk". Additionally, hormonal changes associated with pregnancy "lead to an increase in plasma volume which causes reduction in haemoglobin level", consequently resulting in anaemia (Al-Farsi *et al.* 2011).

Infections such as hookworm and schistosomiasis are related to hygiene, basic sanitation and safe water. These infections aside their role in the development of trichinosis and haemorrhage are also principal contributors to anaemia. Thus in communities where access to improved sources of drinking water and basic sanitation are lacking, risk of anaemia is high. Malaria parasites also represent a major cause of anaemia in women, especially in tropical countries.

Aside its primary role in the destruction of infected red blood cells (RBCs), malaria infection also results in the excessive removal of non-infected RBCs and limits their production According to Igwe *et al.* (2007); Insecticide-Treated Nets (ITNs) "have been shown to reduce the number of infective mosquito bites by 70-90% in a variety of ecologic settings". Thus some studies have focused on the effects of ITNs on anaemia by examining prevalence between users and non-users (See Lengeler 2009; Igwe *et al.* 2007).

Food systems and distribution of health facilities and services normally place women in rural areas at greater risk of anaemia than women urbanites. Women in rural areas, especially pregnant women may be exempted from consuming iron rich foods since food taboos are likely to be practiced in rural than urban areas. Aside this, health facilities, services and personnel may be inadequate in rural areas. These deny women, especially gravid women of crucial services and diagnostic tests that can help in the early detection of anaemia. Additionally, regional disparities in food production and regional wealth may also place women in certain regions at greater risk of anaemia than others.

1.6 Hypotheses

Three major hypotheses were formulated to guide the study.

These were:

a. Women with no education were more likely to be anaemic than those with higher education.

b. Women who lived in rural areas were more likely to be anaemic than those who lived in urban areas.

c. Women in the lowest wealth quintile were more likely to be anaemic than those who were located in the highest quintile.

1.7 Organisation of Study

The study was organised into seven chapters. Chapter one introduces the reader to the study and discusses the problem statement, objectives and hypotheses amongst others. Chapter two reviewed literature that examined prevalence of anaemia at different spatial levels on the one hand and how variables adapted for the study were linked to anaemia on the other hand. In chapter three, methodologies for the study as well as the study's limitations were clearly laid out. In chapter four, univariate analyses comprising the socio-demographic backgrounds of subjects of the study were examined. Chapters five and six focused independently on bivariate and multivariate analysis. Chapter seven provides a summary of findings, conclusions and recommendations for research and policy.

CHAPTER TWO

LITERATURE REVIEW

Whilst global statistics report anaemia prevalence of 12.7 per cent among men, the prevalence of the disease among non-pregnant and pregnant women is 30.2 per cent and 41.8 per cent respectively (WHO 2008). This substantial difference in prevalence is attributed to factors ranging from fundamental biological differences between men and women (primarily placing women at greater risks), to more complex factors such as the influence of disease causing agents and socioeconomic factors. For instance critical biological functions such as menstruation put women at a greater risk of anaemia due to the monthly loss of blood and its consequent depletion of iron (UNICEF 2002). The risk is even higher in women who experience heavy menstrual bleeding (menorrhagia). According to Duckitt and Collins (2011), menorrhagia causes anaemia in two-thirds of women with objective menorrhagia. Hope also (2000) notes that "menorrhagia is the commonest cause of iron deficiency anaemia in the western world" where intake of iron tablets is reportedly low due its undesirable side effects.

Beyond menorrhagia, another factor that can result in anaemia among women is modern contraceptive use. According to Ashford (2003) "rising rates of contraceptive use have reduced unmet need for family planning in most countries". PATH (2008) also states that 63 per cent of women in developing countries now use a method of family planning against an initial figure of 10 per cent in 1960. Pala and Dundar (2008) in their study reported that anaemia prevalence among women who used modern methods of contraception was 31.0 per cent whilst that of traditional method users was 29.5 per cent.

Also, over one-half of the modern method users used the Intrauterine Device, also known as the IUD. Of those subjects who used IUD, the prevalence of anaemia was 38.9 per cent whilst prevalence in other modern method users was 22.2 per cent. Hassan *et al.* 1999 also noticed that "use of IUD was significantly associated with the highest prevalence of anaemia among all contraceptive users (64.9 per cent). IUD users also had the lowest level of hemoglobin compared to nonusers or users of other methods". Borghei *et al.* 2011 note that one of the major side effects of the IUD, which was predominantly used among their subjects, was its associated "increase in duration and/or amount of menstrual bleeding and iron deficiency anaemia". Generally, though it is "one of the most effective and long-lasting methods", the copper-bearing substance in the IUD is known to result in heavier menstrual bleeding (WHO 2011), increased duration of menstrual periods (El-badrawi and Hafez 1980) and the consequent development of anaemia in women who have low iron blood stores (USAID 2011).

Women of reproductive age who are fecund, not using any form of modern contraception but engaged in regular sexual intercourse have an increased risk of pregnancy. Pregnancy also represents another change in the physiology of women that increases the risk of anaemia. According to Kozuma (2009) nearly 20 per cent of pregnant women suffer from anaemia. This is primarily caused by iron deficiency, folic acid deficiency or a combination of both. Pregnancy is associated with increased demand for iron and folic acid in women since the foetus receives large amounts of what was originally stored in the body; as a result, pregnant women require about one-half of what was originally present in their body whilst they were in the non-pregnant state to be able to make up for this loss (Kozuma 2009). Dim and Onah (2007) in a study of the prevalence of anemia among pregnant women in Enugu (Nigeria) found that 40.4 per cent of the women were anaemic (with haemoglobin below 11 grams per decilitre, though none were severely anaemic).

They also found that prevalence was “significantly higher among those who registered for antenatal care in the third trimester than in those who registered in the second trimester”. Similarly, Baidoo *et al.* (2010) and Karaoglu *et al.* (2010) also found that the highest prevalence of anaemia was found in the second and third trimester respectively. According to Blackburn (2007) “the need for iron begins early in the second trimester and peaks in the second half of pregnancy”. Just around this time (during the first month of the second trimester), the greatest amount of foetal growth occurs (Greenberg *et al.,* 2011). As growth in the foetus is experienced, “the rate of iron transfer across the placenta increases. Thus transport of iron from mother to foetus is greatest during the last few months of gestation” (Blackburn, 2007). Other studies have also shown higher prevalence of anaemia among primigravidae (women who are pregnant for the first time) than multigravidae (those who have had two or more previous pregnancies). For instance Idowu *et al.* (2005) found that 80.6 per cent of primigravidae were anaemic whilst a corresponding 74.5 per cent of multigravidae were also anaemic. Similar findings are reported by Akanbi *et al.* (2005) and Okafor *et al.* (2012).

Anaemia is also noted to be high among women who lactate. For instance Umeta (2008) reported a prevalence of 22.3 per cent among lactating women in some urban slum communities of Addis Ababa. Agarwal *et al.* (2006) also found that 92.2 per cent of lactating Indian women who were tested in their study were anaemic. Similarly, the National Nutrition Agency of Gambia also reported a prevalence of 65.2 per cent (NaNA, 2006). Lactating mothers are amongst groups that have a high risk of iron deficiency anaemia. According to Nazir (2011) lactating women do not make up for the iron loss that is normally associated with pregnancy; thus anaemia that develops during the process of gestation is usually carried beyond childbirth.

In most tropical areas of the world, malaria, hookworm infection and schistosomiasis are prevalent and known to result in anaemia (Hotez and Molyneux 2008; Glover-Amengor *et al.* 2005). An estimate of the Global Health Observatory of the WHO indicated that malaria cases and recorded deaths due to the disease stood at 216 million and 150,000 respectively in 2010. Malaria prevalence is known to be higher in pregnant women than non-pregnant women. According to the WHO (2013) risk of malaria infection during pregnancy is increased since the immunity of pregnant women is significantly reduced. Malarial anaemia is initiated through three main processes. Aside its primary role in the destruction of infected red blood cells (RBCs), malaria infection also results in the excessive removal of non-infected RBCs and limits their production (Haldar and Mohandas 2009; Ouma *et al.* 2007; Menendez *et al.* 2000). Plasmodium falciparum, vivax, ovale, malariae, and knowlesi constitute the dominant species of the malaria parasite; with the most dangerous being Plasmodium falciparum. It remains the major cause of malaria in Africa, especially sub – Saharan Africa (WHO 2012) and its role in anaemia infection is substantiated by several studies. According to Nussenblatt and Semba (2001) malarial anaemia is one of the most common and severe outcomes of plasmodium falciparum. Quintero *et al.* (2011) also point out that in Africa where the falciparum species is known to be prevalent, "anaemia is responsible for about half of the malaria-related deaths". In a study on malaria and anaemia among pregnant women in Kenya, Ouma *et al.* (2007) found malaria parasites to be a significant determinant of anaemia at both the univariate and multivariate level of analysis. Other works that have reported significantly lower haemoglobin in malaria infected women compared with their non-infected counterparts are the ones by Adam *et al.* 2005; Achidi *et al.* 2005; and Menendez *et al.* 2000.

Aside malaria, hookworm infections and schistosomiasis represent two other important risk factors for anaemia infection in women. Hotez *et al.* (2008) point out that hookworm infection and schistosomiasis constitute two of the world's most dominant human parasitic infections. They affect hundreds of millions of people in developing countries "and rank closely behind malaria as the most prevalent human parasitic diseases" (Hotez *et al.* 2008). According to Nour (2010) schistosomiasis affects about 200 million people globally. Of this number, 20 per cent (forty million) of those infected are women of childbearing age. The prevalence of the disease is higher in tropical countries, particularly sub-Saharan Africa where poor hygiene and environmental conditions boost a continuous rotation of the disease's transmission cycle. The WHO ranked "schistosomiasis as the third most devastating tropical disease, following malaria and intestinal helminthiasis"; all of these infections are known to significantly increase the risk of anaemia infection. With respect to schistosomiasis, the risk of anaemia infection is mostly related to urinary schistosomiasis, also known as bilharziasis (Sousa-Figueiredo 2012; Hoque 2009; Stoltzfus and Dreyfuss 1998). Urinary schistosomiasis is transmitted by swimming or wading in water bodies that are habitats for infected snails. Hoque (2009) in a study of risk factors for anaemia in pregnancy reported that pregnant women with schistosomiasis were 12 times more likely to develop anaemia than non-infected ones. As in the case of intestinal helminthiasis, schistosomiasis is also known to cause "chronic haemorrhage and iron deficiency, resulting in the development of anaemia" (Hoque 2009).

The role of hookworm infection in anaemia is one that is substantiated by the works of Hotez *et al.* 2009; Brooker *et al.* 2008; and Brentlinger *et al.* 2003. Hotez *et al.* (2009) aside their recognition of the infection as a determinant of maternal anaemia, also regard it as "the highest-burden neglected tropical disease".

According to Brooker *et al.* (2008) out of the estimated 148 million women of reproductive age living in sub-Saharan Africa, 37.7 million (25 per cent) were infected with hookworms. They further estimated that between 25 and 33 per cent of pregnant women were infected with hookworm, putting them at a greater risk "of preventable hookworm-related anaemia". By comparing haemoglobin concentration with intensity of hookworm infection, Brooker and his colleagues found that "heavy intensities of hookworm infection were associated with lower levels of haemoglobin than light infection intensities". Similar studies carried out by Brentlinger *et al.* (2003) and Dreyfuss *et al.* (2000) at the state and community level respectively confirm the findings of Brooker *et al.* Brentlinger *et al.* (2003) undertook a retrospective review of hospital data in the state of Chiapas in Mexico and found that "hemoglobin levels were significantly lower in hookworm-infected women (mean 4.1 g/dl) than in uninfected women (mean 7.0 g/dl)". Dreyfuss *et al.* (2000) also identified hookworm infection intensity as the strongest predictor of iron status. In the communities where they collected data for their study, the observed anaemia prevalence was 73 per cent, with hookworm accounting for 54 per cent of cases of moderate to severe anemia during pregnancy. The mechanism by which hookworm infection results in anaemia is explained by intestinal blood loss which, in turn, contributes to anaemia (Brooker *et al.* 2008).

Food systems and nutrition remain crucial to understanding the nature of the anaemia problem amongst women. Globally, inadequate dietary intake of iron is the leading cause of both iron deficiency and anaemia. Iron constitutes an essential element of proteins and enzymes. It is required for transporting oxygen to cells and for maintaining good health (ODS 2007). Iron deficiency is associated with "low dietary intake of iron, inadequate absorption of iron, or excessive blood loss" (ODS 2007). Two forms of dietary iron are identified namely, heme and nonheme (Hyder, 2002).

Heme iron is present in animal foods such as red meats, fish, and poultry whilst nonheme iron is present in cereals, soybeans, spinach and bread (ODS 2007). "Heme iron is absorbed better than nonheme iron, but most dietary iron is nonheme iron" (ODS 2007). The Nutrition Profile Report of Ghana indicates that per capita supply of foods rich in heme iron (meat, milk, eggs, and animal fats) remains low (FAO 2009). However, the country "has a relatively high per capita supply of fish and seafood" (FAO 2009). Cereals (sources of nonheme iron) are cultivated in vast areas of the northern regions. According to the FAO, the highest production of millet, sorghum and rice are in the Sudan and Guinea Savannah Agro-Ecological Zones of the country (FAO 2005). These agro-ecological zones also support animal husbandry and poultry. In the most densely populated parts of the Upper East, farming around compounds is usually accompanied with poultry and livestock rearing. Despite the apparent availability of heme and nonheme iron foods, malnutrition is reportedly high among women and children in the three northern regions than in any other part of the country. Consumption of iron rich foods in other areas of the country is also conditioned by their availability. For example, in the coastal zone, the "main staple food is maize, and diets include fish obtained from nearby fishing villages" (Hartog 1972). Iron consumption is thus more satisfactory than in the forest zone where the basic diet is high in carbohydrate but substantially low in other nutrients. The consumption of starchy and high carbohydrate foods is a situation that extends beyond the borders of Ghana to other sub-Saharan African countries. According to Lopriore and Muehlhoff (2003), although food availability has improved in West Africa, "the dietary energy and protein supplies are still below requirements". "Consumption of animal foods rich in heme iron is also limited". They also argue that West African diets tend to be poor in bioavailable iron since cereal diets that are mostly consumed inhibit the absorption of iron and other micronutrients.

Among the factors that determine preference for foods are their availability, pricing, nutrition education and customs (Hartog 1972). Customs and practices associated with food abound and are known to influence the consumption behaviour of people in many regions of the world. Although these customs (food taboos) permeate through all sections of society, the groups that are mostly affected by them are children, pregnant women and women in general (Oniang'o *et al.* 2003; Haidar 2010). A study in Indonesia revealed that 26 per cent of pregnant women avoided fishes, meat, vegetables and chicken eggs for fear that their consumption would prolong delivery and further result in ill effects on the new baby (Oni and Tukur 2012). Food taboos were also reported among 69 per cent of pregnant women in a study conducted in Tanzania. It was believed that eating fish and farm meat would hurt the mother's abdomen, cause late delivery, and make children take on characteristics of farm animals (Oni and Tukur 2012). In Ghana, Codjoe and Owusu (2011) in an article on climate change/variability and food systems also reported that eating of snails, alligators and certain fish species were forbidden in one of the three communities they studied. These practices restrict accessibility to diverse sources of both heme and nonheme iron and increase the risk of anaemia in communities where they are highly entrenched. Despite the many reported cases of food taboos, further evidence has to be examined to actually determine their influence on food consumption. For instance Ene-Obong *et al.* (2001) reported that food taboos did not affect nutrient intake since only 5-11 per cent of women observed them. Accordingly, this finding was in consonance with that of other studies that had examined the food taboo and consumption relationship. Essentially, these studies point to the fact that food taboos are mostly breached than followed. Findings from these bring to the fore one of the major methodological setbacks of the structural functional approach. This paradigm which has its roots in sociology postulates that behaviour is driven by efforts of community members to conform to the moral codes of society.

As can be clearly seen, although food taboos are mostly used as an explanatory variable in the assessment of anaemia prevalence, there appears to low adherence to them.

Pica is another sub-component of the food-anaemia relationship that requires some review. The term is defined by Kettaneh *et al.* (2005) as a “compulsive ingestion of nonfood substances”. Lacey (1990) also defines it as “a perverted appetite for substances inappropriate for consumption, such as kaolin (cited in Garnier *et al.*, 2008). Pica has strong cultural underpinnings and is seen as an outcome of nutrient deficiency, particularly that of iron (Kettaneh *et al.* 2005; Danford 1982). Kettaneh *et al.* in a study of pica-practice amongst adults who lived in the suburbs of Paris noticed a high prevalence of iron deficiency (44 per cent) among patients who practiced pica; and the practice was seen to be higher in non-Europeans than their counterparts. This is consistent with findings of other studies as pica “has been reported to be associated with severe iron deficiency anaemia in up to half of patients” (Garnier *et al.* 2008). Koryo-Dabrah *et al.* (2012) in a study of dietary practices and nutrient intakes of pregnant women in Accra also found that over 40 per cent of the subjects practiced pica in the second and third trimester. The practice was found to be higher in the first trimester where half of the respondents consumed substances such as sticks, clay and ice cubes. The finding of Koryo-Dabrah *et al.* is confirmed by previous work by Tayie (2004) who also reported that a substantial percentage of study subjects (48 per cent) practiced pica, mostly in the form of clay eating.

Guyatt and Snow (2001) acknowledge the role of iron and folate deficient diets, malaria, and hookworm in anaemia infection. They also speak of Human Immunodeficiency Virus (HIV) as another risk factor. This is confirmed by Meda *et al.* 1999 who in a study concluded that anaemia prevalence was higher in HIV-infected women (78.4 per cent) than in women who tested negative for the disease (64.7 per cent).

HIV infection is a risk factor in anaemia as changes brought on by the disease lead to "decreased RBC production, increased RBC destruction, and ineffective RBC production" (Volberding *et al.* 2004).

Glover-Amengor *et al.* (2005) in a study on determinants of anaemia in pregnancy reported that "level of education did not significantly affect the degree of anaemia". This is in contrast to the findings of Lokare *et al.* (2012) who concluded that level of education of women and socioeconomic status significantly accounted for anaemia prevalence. The findings of Lokare *et al.* are further corroborated by several other studies including that of Bechuram *et al.* (2006) who also saw a significant association between educational status, economic position and anaemia prevalence during pregnancy (cited in Tsehayu 2009). The association between level of education and prevalence of anaemia is explained by Variyam *et al.* (1999) who reported that higher maternal education leads to "increased knowledge about health and nutrition and to an increase in the quality of the diets of children". Wondu and Bijlsma (2012) also point out that educated women are "likely to earn better incomes, consume diversified foods, and utilize health systems for early treatment of diseases" than their uneducated counterparts.

Place of residence is another variable that is associated with prevalence of anaemia. Ayoya *et al.* (2011) undertaking a descriptive review of data based on DHS and National Nutrition Surveys found that anaemia was higher in rural than in urban areas. This pattern was found in 14 out of the 15 West and Central African countries they studied. Glover-Amengor *et al.* 2005 and Baidoo *et al.* 2010 on separate studies conducted in Ghana also reported higher prevalence of anaemia among subjects who lived in rural than in urban areas. According to Opara (2011) rural dwellers do not know the quantity and quality of food to be consumed. As a result, "they continue to take a particular type of diet which may not be enough" to meet the nutritional requirements of the body.

Conversely in urban areas "food consumption patterns become more diverse as a result of increased food choice in markets and the change in lifestyles associated with higher income levels" (Lopriore and Muehlhoff 2003). For instance, bread and rice (both sources of nonheme iron) are available on a daily basis and sold in local shops and streets in most West African cities (Lopriore and Muehlhoff 2003). Increased incomes, the need for couples to reduce time spent in preparing food, greater availability of bread and most importantly urbanisation have led to increased bread consumption (Hartog 1972). Likewise, consumption of poultry meat and wheat is higher in urban areas than in rural areas (FAO 2009). Rural inhabitants also consume more starchy roots and pulses than do urbanites. Again, diets of rural dwellers are poorer in micronutrients than diets consumed by inhabitants of urban areas (FAO 2009). Thus urbanites have access to diverse and fresh sources of iron that are less likely to be available in rural areas.

Batool *et al.* (2010) and Karaoglu *et al.* (2010) in separate studies conducted at Pakistan and Turkey respectively pointed out the association between income and anaemia prevalence. In both studies, income levels negatively correlated with severity of anaemia. Other studies such as the ones by Owolabi *et al.* (2011) have similarly corroborated findings of Batool *et al.* and Karaoglu *et al.* Baidoo *et al.* (2010) in a community based study in Ghana suggested that high prevalence of anaemia among subjects was as a result of malnutrition and low incomes. High incidence of anaemia among lower income groups is a phenomenon that is also visible at regional levels. Balarajan *et al.* (2011) state that whereas anaemia prevalence in countries with low levels of development is estimated at 43 per cent, the estimate for highly developed countries is only 9 per cent.

CHAPTER THREE

METHODOLOGY

3.1 Study Area and Subjects

Tests for haemoglobin levels of Ghanaian women were carried out as part of the 2008 Ghana Demographic and Health Survey. In half of the households where interviews were conducted, consenting women of reproductive age were tested for anaemia. In all, 4758 women of reproductive age were screened for anaemia. Trained personnel with the interviewing teams performed the test using the HemoCue system. A consent statement was initially read to eligible respondents and to parents or persons responsible for unmarried women between ages 15 and 17. For those who consented to participating in the test, the palm side of the end of a finger "was pricked with a sterile, non-reusable, self-retractable lancet". A drop of blood was collected on a HemoCue microcuvette, which served as the measuring device. This was placed in a HemoCue photometer which displayed results of the measurement. Anaemia was categorised into three namely mild, moderate and severe. Mild anaemia corresponded to (10.0-10.9 grams/decilitre for pregnant women and 10.0-11.9 g/dL for non-pregnant women). Similarly, moderate anaemia corresponded to (7.0-9.9 g/dL). Persons with haemoglobin less than 7.0 g/dL were classified as severely anaemic.

Table 3.1 Variables and Measurements

Dependent Variable (Anaemia)

Not anaemic
Mild 10.0 – 10.9 g/dL (Pregnant women)

Mild: 10.0 – 11.9 g/dL (Non-pregnant women)

Moderate: 7.0 – 9.9 g/Dl

Severe: <7.0 g/dL

Independent Variables

1. Age of woman

15 – 19
20 – 24
25 – 29
30 – 34
34 – 39
40 – 44
45 – 49

2. Number of Children Ever Born

0
1
2
3
4
5
6
7
8
9

10+

3. Pregnancy Status

No
Yes

4. Lactating Status

No
Yes

5. Type of Place of Residence

Rural

Urban

6. Educational Attainment

No education
Primary
Middle School/Junior High School
Senior High School
High

7. Region of Residence

Western
Central

Greater Accra
Volta
Eastern
Ashanti
Brong Ahafo
Northern
Upper East
Upper

8. Wealth Quintile

Poorest
Poorer
Middle

Richer
Richest

Independent variables…	
9. Ethnicity *Akan* *Ga/Dangme* *Ewe* *Guan* *Mole-Dagbani* *Grussi* *Gruma* *Other*	**12. Mosquito Bed Net(s) Slept Under** *No net* *Only treated nets* *Both treated and untreated nets* *Only untreated nets* **13. Age of Woman at First Birth** *12 – 14* *15 – 19* *20 – 24* *25 – 29* *35 – 39*
10. Source of Drinking Water *Improved source of drinking water* *Unimproved source of drinking water*	
11. Type of Toilet Facility *Improved toilet facility* *Unimproved toilet facility*	

3.2 Data Analyses

Secondary data on levels of anaemia and socio-demographic characteristics of women were used for the analyses. Data were analysed using the Statistical Package for the Social Sciences (SPSS). The data were weighted following the procedure presented in the "Guide to DHS Statistics." At the preliminary stage, univariate and bivariate analysis were performed. With respect to the latter, independent variables were related to anaemia by the aid of the crosstabs option in SPPS. Chi-square procedures were further performed to examine whether results of the cross tabulations were statistically significant.

At the multivariate level, a multinomial logistic regression with no anaemia as base category was performed to determine the risk factors for mild, moderate and severe anaemia.

3.3 Missing Data on Variables Included In Analysis

Variable	Number of Cases	Proportion of Sample
Region of Residence	4	0.0008407
Ethnicity	1	0.0002102
Education	5	0.0010509
Wealth Index	2	0.0004203
Currently Pregnant	2	0.0004203
Currently Breastfeeding	1	0.0002102
Type of Toilet Facility	71	0.0149222
Mosquito Bed Net(s) Slept Under	2	0.0002102
Age of Woman at first Birth	1593	0.3348045

3.4 Testing of Hypotheses

Three levels of the dependent variable into which subjects were classified (severe, moderate and mild anaemia) all represent some form of anaemia. Thus it becomes difficult to make a simple decision on whether women in a particular social or demographic class are less likely than women in another class to have anaemia. Further, results from the multinomial logistic regression (please see chapter 6) showed that whereas women in a particular social or demographic class maybe significantly more or less likely to have severe anaemia, results for moderate and mild for this same class of women may not be significant. In the final analysis, a decision to support or reject a hypothesis was based on significant results for at least two levels of anaemia. The table below illustrates how decisions to accept or reject the hypotheses formulated were reached.

Table 3.4 Testing of Hypotheses

Variable for which hypothesis is formulated	Severe anaemia	Moderate anaemia	Mild anaemia	Decision
Education	Less likely (but not significant)	Less likely (significant)	Less likely (significant)	Hypothesis accepted
Place of Residence	Less likely (but not significant)	Less likely (but not significant)	Less likely (but not significant)	Hypothesis rejected
Wealth Quintile	Less likely (but not significant)	More likely (but not significant)	Less likely (significant)	Hypothesis rejected

Source: Author's Construct

3.5 Limitations

Limitations for the study were twofold; first were limitations regarding operationalization of some variables at the bivariate and multivariate level of analysis. The second limitation related to the explanative power of variables that were used in the study. It is noteworthy that although sample size for the study was 4758, frequencies run for some independent variables did not add up to this number. In some instances responses either fell short by 1, 2 or 4 cases. However analyses were still performed since these were insignificant and would not have a substantial effect on the results in general. The most pronounced of these variables were source of water for drinking and type of toilet facility used. In the 2008 DHS survey, data were collected from usual residents of households as well as visitors who spent the night preceding the survey. This allowed for analysis of data for both de jure and de facto residents. However answers from de jure residents on source of water for drinking and type of toilet facility were not considered and entered as part of the data.

This shrunk the sample size by 62 and 71 for source of water for drinking and type of toilet facility respectively. Regardless, the analyses were still performed considering the adjustment. Also of important consideration is age of woman at first birth. Result on age of woman at first birth did not include women who had not given birth before. Due to this exemption, the sample shrunk by 1593; thus univariate and bivariate analysis for this variable was based on 3165 women.

Analysis of data at the univariate and bivariate level was based on 13 variables; however this was reduced to 11 variables at the multivariate analysis. This was due to challenges with two variables namely age of woman at first birth and total children ever born. It was observed that women who had not given birth before were intrinsically eliminated at the multivariate stage, making it practically impossible to make them the reference category. Also whereas the sample size for the variables differed from each other by 1, 2 or 4 women, variation exceeded 1000 women for these two variables.

Outside these methodological setbacks, the study as a whole had some limitations which must be highlighted. First the study focused on socio-demographic factors; thus the roles of nutrition variables were not assessed in the development of anaemia in women. Similarly parasitic and helminth infections which are documented to cause anaemia in developing and tropical countries were equally not assessed.

CHAPTER FOUR

BACKGROUND OF RESPONDENTS

4.1 Age of Woman

Anaemia is a major public health problem that affects women of reproductive age. Thus, it was imperative to analyse distribution of women among the reproductive age groups. In Table 4.1, the frequency and percentage distribution of women by age groups are shown. Data on other demographic and socioeconomic variables investigated in this study are similarly presented in Table 4.1. Over one-fifth of subjects for the study fell within the 15 – 19 age category. Age groups 20 – 24 and 25 – 29 also contained substantial numbers of women and had respective proportions of 17.9 per cent and 16.8 per cent. The age groups with the least proportions of women were 40 – 44 (9.5 per cent) and 45 – 49 (8.7 per cent).

4.2 Region of Residence

Beyond an estimate that indicated the national prevalence of anaemia, it was also necessary to understand the distribution of the disease among various spatial units of the country. This was crucial for identifying target areas that would be the focus for programme implementation as well as future research.

With respect to the distribution of subjects by region of residence, the Ashanti (20.4 per cent) and Greater Accra (17.5 per cent) regions had the greatest share. Conversely, the Upper East (5.0 per cent) and Upper West (2.5 per cent) regions had the least proportions of subjects. The remaining regions had proportions slightly below 9 per cent or above it.

This pattern corresponded to population distribution of the country based on the 2010 census report.

4.3 Place of Residence

Factors that predispose women to anaemia such as accessibility to adequate and quality foods, food taboos and income differ among urbanites and rural dwellers. Distribution of subjects by place of residence was somewhat equivalent as 48.2 per cent of women lived in rural areas while the remaining 51.8 per cent lived in urban areas. Urban areas were defined to include settlements with population of 5000 or more whereas rural areas had populations of less than 5000 persons.

4.4 Ethnicity

Food customs and taboos are embedded in the cultural practices of ethnic groups in Ghana. Thus by using ethnicity as a proxy for these customs and practices, an analysis could be made of the levels of anaemia among and between the ethnic groups. Majority of women for the study were Akan and formed about 51 per cent of the total number of subjects. Women from other prominent ethnic groups, namely the Mole-Dagbani, the Ewe and the Ga/Dangme also constituted respectively 16 per cent, 12.9 per cent and 7.1 per cent of the sample. Women from smaller ethnic groups such as the Guan (2.5 per cent) and Grussi (2.4 per cent) were also selected as part of the sample.

4.5 Educational Attainment of Women

Education "leads to increased knowledge about health and nutrition" of women. Also, women who are educated are "likely to earn better incomes, consume diversified foods, and utilise health systems for early treatment of diseases".

Educational attainments were unsatisfactory; only 3.6 per cent of the subjects had been educated beyond the secondary school level. Moreover, over one – fifth of the subjects did not have any form of formal education. Twenty per cent of the subjects had been educated to the Primary School level; and for those in transition to the Junior High School, this was most unsatisfactory as they should have completed this level seven years prior to the survey (supposing the starting age for kindergarten was pegged at age 5). Forty five per cent as well as 10 per cent of the subjects have been educated to the Junior High and Senior High School respectively.

4.6 Wealth Index

The wealth index is an important proxy for determining the socio-economic status of women and for further analysing its relationship with anaemia. As shown in Table 4.1, 15.9 per cent of women were classified as the poorest. Other sub categories such as the poorer and middle wealth indexes also had respective percentages of 18.2 and 20.2. On the whole, though some variations existed, distribution of women among the various wealth indexes was not very marked.

4.7 Pregnancy Status

Pregnant women have a high risk of developing anaemia due to increased demand for iron and folic acid during pregnancy. Women who were not pregnant at the time of the survey constituted 92.7 per cent of subjects. Conversely, 349 women (7.3 per cent) were pregnant.

4.8 Lactating Status

Lactating mothers have a high risk of anaemia due in part to the demand for iron and folic acid during pregnancy. Also, anaemia that develops during the process of gestation is usually carried beyond childbirth. Women who were not breastfeeding at the time of the survey constituted 78.7 per cent of subjects. Conversely, those who were breastfeeding formed 21.3 per cent of the subjects.

4.9 Children Ever Born

Investigating determinants of anaemia requires consideration of the differential parity of women and its likely association with the disease. Women classified as nulliparous constituted 33.4 per cent of the subjects. Primiparous women comprised 13.7 per cent of the subjects whereas multiparous women formed 34.3 per cent of the subjects. Lastly, grand multiparous women made up 18.6 per cent of the subjects.

4.10 Source of Water for Drinking

Table 4.1 further shows distribution of subjects by source of drinking water. A preponderance of the subjects depended on improved sources of drinking water (78.6 per cent) compared to 21.4 per cent who relied on unimproved sources. Improved sources of water included water piped into dwellings, rainwater collection, and protected wells amongst others. Unimproved sources also comprised water collected from unprotected springs, rivers and ponds.

According to the WHO (2011), "an improved drinking-water source is one that by the nature of its construction and design adequately protects the source from outside contamination, in particular by faecal matter".

4.11 Type of Toilet Facility

Majority of women used improved toilet facilities (69.5). These facilities comprised ventilated improved pit, pit latrine with slap and flush to septic tank amongst others. 30.5 per cent of the subjects also used facilities that were unimproved. For instance, nearly 20 per cent of the subjects did not have any facility; other subjects also depended on the bucket/pan toilet. "Improved sanitation includes sanitation facilities that hygienically separate human excreta from human contact".

4.12 Mosquito Bed Net(s) Slept Under

From Table 4.1 it can be observed that 71.8 per cent of women interviewed did not sleep under any net a day before the interview was conducted. For those who did, 18.7 per cent slept under only treated nets whilst another 9.5 per cent did so under only untreated nets.

4.13 Age of Woman at First Birth

Nearly half of the women who had given birth before had their first birth at ages 15 to 19. This was followed by women who had their first birth at ages 20 – 24 (36 per cent). Thus based on this sample, it could be said that 83.6 per cent of Ghanaian women had their first birth before age 25.

The table also shows that 3.8 per cent of women had their first birth before age 15. Conversely a nominal 1.8 per cent and 0.3 per cent of women had their first birth ages 30 – 34 and 35 – 39 respectively.

4.14 Anaemia Status of Women

Forty one per cent of the subjects did not have anaemia. This suggested that 58.8 per cent of the subjects were anaemic. Most of the women classified as anaemic had mild anaemia (38.8 per cent). This was in turn followed by moderate (18.0 per cent) and severe (2 per cent) anaemia. Proportion of women with anaemia reduced with its severity.

Table 4.1 Background Characteristics of Respondents

Background Characteristics	Frequency	Percent
Age		
15-19	997	21.0
20-24	853	17.9
25-29	800	16.8
30-34	619	13.0
35-39	624	13.1
40-44	451	9.5
45-49	414	8.7
Region of Residence		
Western	428	9.0
Central	411	8.6
Greater Accra	831	17.5
Volta	417	8.8
Eastern	466	9.8
Ashanti	971	20.4
Brong Ahafo	422	8.9
Northern	453	9.5
Upper East	236	5.0
Upper West	119	2.5
Place of Residence		
Urban	2293	48.2
Rural	2465	51.8

Source: Ghana Demographic and Health Survey (2008)

Table 4.1 Background Characteristics of Respondents (continued)

Background Characteristics	Frequency	Percent
Ethnicity		
Akan	2416	50.8
Ga/Dangme	337	7.1
Ewe	612	12.9
Guan	119	2.5
Mole-Dagbani	762	16.0
Grussi	114	2.4
Gruma	181	3.8
Other	216	4.5
Education Attainment		
No Education	1011	21.3
Primary School	964	20.3
Middle School/JHS	2130	44.8
Senior Secondary School	475	10.0
Higher	173	3.6
Wealth Index		
Poorest	758	15.9
Poorer	866	18.2
Middle	962	20.2
Richer	1088	22.9
Richest	1082	22.8

Source: Ghana Demographic and Health Survey (2008)

Table 4.1 Background Characteristics of Respondents (continued)

Background Characteristics	Frequency	Percent
Currently Pregnant		
No	4407	92.7
Yes	349	7.3
Currently Breastfeeding		
No	3743	78.7
Yes	1014	21.3
Total Children Ever Born		
0	1590	33.4
1	652	13.7
2	629	13.2
3	526	11.1
4	474	10.0
5	314	6.6
6	229	4.8
7	152	3.2
8	97	2.0
9	47	1.0
10 or more	48	1.0

Source: Ghana Demographic and Health Survey (2008)

Table 4.1 Background Characteristics of Respondents (continued)

Background Characteristics	Frequency	Percent
Source of Water		
Improved source of water	3691	78.6
Unimproved source of water	1005	21.4
Type of Toilet Facility		
Improved toilet facility	3256	69.5
Unimproved toilet facility	1431	30.5
Type of mosquito bed net(s) slept under last night		
No net	3415	71.8
Only treated nets	890	18.7
Only untreated nets	451	9.5
Age at First Birth		
12 – 14	121	3.8
15 – 19	1506	47.6
20 – 24	1137	36.0
25 – 29	333	10.5
30 – 34	58	1.8
35 – 39	10	0.3
Anaemia Status		
Severe	95	2.0
Moderate	856	18.0
Mild	1845	38.8
Not anemic	1962	41.2
Total	**4758**	**100**

Source: Ghana Demographic and Health Survey (2008)

CHAPTER FIVE

LEVELS OF ANAEMIA AMONG GHANAIAN WOMEN

5.1 Type of Place of Residence and Anaemia Status

Thirty eight per cent of women in rural areas did not have anaemia compared to 44.7 per cent for women who lived in urban areas. Thus anaemia was higher in rural areas than in urban areas. Anaemia was also higher in rural than in urban areas when mild, moderate and severe anaemia were considered. Sixty-three per cent of women who were severely anaemic were rural dwellers. The association between place of residence and anaemia status was statistically significant, $\chi 2$ (1, N = 4758) = 24.32, $p<0.01$.

5.2 Region of Residence and Anaemia Status

Table 5.1 shows that 51.7 per cent, 49.2 per cent and 42.2 per cent of women residing in the Upper East, Greater Accra and Brong Ahafo regions respectively did not have anaemia. Proportion of women with no anaemia was however lower for women in the Western (28.7 per cent), Upper West (32.8 per cent) and Central (36.5 per cent) regions. This suggested that prevalence of anaemia was higher among women in these three regions compared to the other regions. Mild anaemia was highest among women in the Western (42.3 per cent) and Central (47.2 per cent) regions. Moderate anaemia was also highest in the Western (25.7 per cent) and Upper West (22.7 per cent) regions. Lastly, severe anaemia was highest among women in the Upper West (4.2 per cent), Western (3.3 per cent) and Ashanti (2.6 per cent) regions. The association between region and anaemia status was statistically significant, $\chi 2$ (27, N = 4754) = 117.31, $p<0.01$.

5.3 Educational Attainment and Anaemia Status

Nearly 58 per cent of women with higher education were not anaemic. Proportions of women who did not have anaemia were lower than 50 per cent in the other educational attainments, with the lowest being primary education (36.4 per cent). From the table, it can be deduced that anaemia was higher among women with primary education, no education and Junior High School education. With the exception of women with no education, it can be realised that proportion of women with no anaemia increased with educational level. For instance the proportion of women with Junior High School education who did not have anaemia represented an increment of 5.4 per cent over what was reported for those with Primary education. Similarly the increment was by 11.6 per cent between Senior High School and Higher education. Anaemia does not necessarily reduce with educational attainment; this is because no anaemia was higher for women with no education (40.1 per cent) than for women with primary education (36.4 per cent). Reduction in prevalence of mild and severe anaemia initiated from the primary school level. However this could not be said about moderate anaemia as the prevalence among women with Senior High School education (17.5 per cent) was higher than for women with Junior High School education (16.2 per cent). The results showed that anaemia was lowest for women with higher education when all statuses of anaemia were considered. The association between educational attainment and anaemia status was statistically significant, $\chi2$ (12, N = 4753) = 49.07, $p<0.01$.

5.4 Wealth Quintile and Anaemia Status

Proportion of women who did not have anaemia was lower for women in the poorer (37.0 per cent) and poorest (38.9 per cent) wealth quintiles. It was however higher among women in the middle (40.7 per cent), richer (42.0 per cent) and richest (46.1 per cent) wealth quintiles. It can be observed that increases in proportion of women with no anaemia began from the poorer wealth quintile. A careful examination of results on the proportion of women with no anaemia suggested that over half of women in all wealth quintiles had some form of anaemia. Mild anaemia was highest among women in the poorest (39.6 per cent) and poorer (42.6 per cent) wealth quintiles whereas moderate anaemia was highest among women in the Poorest (19.3 per cent) and middle (18.8 per cent) wealth categories. Severe anaemia was also highest among women in the middle (2.3 per cent) and poorer (3.0 per cent) wealth quintiles. The association between wealth quintile and anaemia status was statistically significant, $\chi 2$ (12, N = 4756) = 30.04, $p<0.01$.

5.5 Ethnicity of Woman and Anaemia Status

Proportion of women with no anaemia did not exceed 50 per cent in all of the ethnic groups. No anaemia was higher among Ewe (43.6 per cent) and Mole-Dagbani (43.8 per cent). Alternatively, it was lower among Grussi (32.5 per cent) and Guan (34.5 per cent) women. Thus it can be deduced that anaemia was higher among women in these two ethnic groups than among women in the other groups. Mild anaemia was higher among Ga/Dangme (40.7 per cent) and women of other (40.7 per cent) ethnic groups. Moderate anaemia was also higher for Guan (21.8 per cent) and Mole-Dagbani women. With respect to severe anaemia, prevalence was highest among Grussi (4.4 per cent), Guan (3.4 per cent) and Ewe (2.3 per cent) women.

Results of the chi-square test suggested that ethnicity and anaemia status were independent.

5.6 Age of Women and Anaemia Status

No anaemia was not positively or negatively correlated with age. For all the age groups, proportion of women with no anaemia was below 50 per cent. This suggested that more than half of the women in all the age groups were anaemic. No anaemia was lowest for women aged 15-19 (37.1 per cent) whereas it was highest among women aged 45-49 (46.4 per cent). Thus it could be concluded that women aged 15-19 were more anaemic than women in the other reproductive age groups. Mild, moderate and severe anaemia did not follow any pattern. Mild anaemia was higher among women aged 15 – 19 (43.5 per cent), 30 – 34 (39.3 per cent) and 20 – 24 (39.0 per cent). Moderate anaemia was also higher among women aged 35 – 39 (20.0 per cent), 20 – 24 (18.8 per cent) and 25 – 29 (18.5 per cent). Lastly, severe anaemia was higher among women aged 45 – 49 (4.7 per cent), 40 – 44 (2.7 per cent) and 20 – 24 (2.1 per cent). A chi-square test of independence was performed to examine the relationship between age of woman and anaemia status. The association between age of woman and anaemia status was statistically significant, $\chi 2$ (18, N = 4758) = 45.47, $p<0.01$.

5.7 Age at First Birth and Anaemia Status

Age at first birth and no anaemia were not positively or negatively correlated. Half of the women who had their first birth at ages 25-29 were not anaemic. Similarly, no anaemia among women who had their first birth at ages 30-34 and 20-24 were 42.6 per cent and 40.9 per cent respectively. The result suggested that anaemia was highest among women who had their first birth at ages 15-19 whereas it was lowest for women who had their first birth at 25-29. Mild anaemia was highest for women with first births at ages 35 – 39 (40.0 per cent) and lowest for those who had their first child at ages12 – 14. Moderate anaemia was also highest for women who had their first birth at ages 12 – 14 (22.3 per cent) and lowest for women aged 25 – 29 (14.4 per cent). Results of the chi-square test indicated that age at first birth and anaemia status were independent.

5.8 Children Ever Born (CEB) and Anaemia Status

Results in the table indicates that for women with 0 to 5 CEB, proportion with no anaemia hovered around 40 per cent though this did not exceed 45 per cent. Proportion of women with no anaemia did not increase with CEB; however it could be observed from the table that reduction in no anaemia began for women with 5 CEB. Mild anaemia was higher for women with 9 (44.7 per cent) and 6 (41.5 per cent) CEB whereas it was lower for women with 10 or more (33.3 per cent). Moderate anaemia was also higher for women with 5 (22 per cent) and 9 (21.3 per cent) CEB whereas it is lower for 10 or more (14.6 per cent), 0 (17.0 per cent), and 4 (17.1 per cent). Results of the chi-square test indicated that children ever born and anaemia statuses were independent.

5.9 Pregnancy Status of Woman and Anaemia

Thirty per cent of pregnant women did not have anaemia compared to 42 per cent for non-pregnant women. Thus it can be inferred that anaemia was substantially higher among pregnant women than non-pregnant women. Mild anaemia was however higher among non-pregnant women (40 per cent) than pregnant women (23.5 per cent). Proportion of pregnant women with moderate anaemia was more than twice the corresponding prevalence for non-pregnant women. Similarly, prevalence of severe anaemia in pregnant women was more than threefold that for non-pregnant women. Severe anaemia for pregnant women was also the highest when compared with results of the other socio-demographic variables. Anaemia among pregnant women was exceedingly high considering that antenatal care coverage was about 95 per cent at the time of the survey (GSS *et al.* 2009). Among the factors that could be the result of this high prevalence could be low intake of de-worming medicines (35 per cent). The association between pregnancy status and anaemia status was statistically significant, $\chi 2$ (3, N = 4756) = 177.09, $p<0.01$.

5.10 Lactating Status of Woman and Anaemia Status

Proportion of non-lactating women (42.1 per cent) who did not have anaemia was higher than for those who were lactating (38.2 per cent). Proportion of lactating mothers with mild anaemia (43.7 per cent) was higher than for women who were not lactating. However, moderate and severe anaemia were slightly higher among women who were not lactating than those who were. The association between lactating status and anaemia was statistically significant, $\chi 2$ (3, N = 4757) = 13.20, $p<0.01$. The proportion of lactating women who did not have anaemia (38.2 per cent) suggested that nearly 62 per cent had anaemia. This is high when compared with prevalence of other countries.

For instance Gebremedhin and Enquselassie (2011) using data from the 2005 Ethiopian DHS reported that 31.3 per cent of lactating mothers were anemic. Results presented by Ayoya *et al.* (2011) also indicated that prevalence of anaemia among lactating women was greatest for Ghanaian (61.8 per cent) and Malian women (63.1 per cent).

5.11 Source of Drinking Water and Anaemia Status

Forty two per cent of women who depended on water from unimproved sources were not anaemic compared to 41 per cent for those who used water from improved sources. Mild anaemia was higher for women who relied on unimproved sources of water (40.3) than for women who used water from improved sources (38.4). Moderate and severe anaemia were both higher for women who relied on improved sources of water than for those who did not. Results of the chi-square test indicated that type of toilet facility and anaemia statuses were independent.

5.12 Type of Toilet Facility and Anaemia Status

Forty-two per cent of women who utilised improved toilet facilities did not have anaemia compared to 41 per cent who relied on unimproved toilet facilities. Differences in anaemia prevalence based on type of toilet were not very marked. Mild and severe anaemia were higher though not substantial among women who used unimproved toilet facilities than women who used improved toilet facilities. Results of the chi-square test indicated that type of toilet facility and anaemia statuses were independent.

5.13 Mosquito Bed net (s) Slept Under and Anaemia Status

Forty-two per cent of women who did not slept under any net did not have anaemia compared to 40.1 per cent for those who slept under treated bed nets. Also, 41.7 per cent of women who slept under untreated nets did not have anaemia. Thus it could be observed that the differences in no anaemia were not very marked when the mosquito bed net women slept under a day before the survey was conducted were not very marked. Mild anaemia was highest among women who slept under untreated nets (39.7 per cent) followed by treated nets (39.6) and no net at all (38.4 per cent). On the other hand, moderate anaemia was highest for women who slept under treated nets (19.1 per cent), followed by no net (17.9 per cent) and untreated net (16.6 per cent). Severe anaemia was highest for women who did not sleep under any net (2.2 per cent), followed by untreated nets (2.0 per cent) and treated nets (1.2 per cent). Results of the chi-square test indicated that mosquito bed net slept under and anaemia statuses were independent.

Table 5.1 Levels of Anaemia amongst Ghanaian women

Variable	**Anaemia Status**				
Place of Residence	**Mild**	**Moderate**	**Severe**	**Not Anaemic**	Count
Rural	40.8	18.7	2.4	38.1	2293
Urban	36.6	17.2	1.5	44.7	2465
Total	38.8	18.0	2.0	41.2	4758
χ2=24.32	*degree of freedom=1*			*p.value=.000*	
Region of Residence					
Western	42.3	25.7	3.3	28.7	428
Central	47.2	15.1	1.2	36.5	411
Greater Accra	36.5	13.1	1.2	49.2	831
Volta	38.1	17.5	2.4	42.0	417
Eastern	41.8	14.4	2.4	41.4	466
Ashanti	37.6	19.8	2.6	40.1	971
Brong Ahafo	34.8	21.3	1.7	42.2	422
Northern	36.4	22.1	1.1	40.4	453
Upper East	36.4	10.6	1.3	51.7	236
Upper West	40.3	22.7	4.2	32.8	119
Total	38.8	18.0	2.0	41.2	4754
χ2=117.307	*degree of freedom=27*			*p.value=0.000*	

Source: Ghana Demographic and Health Survey (2008).

Table 5.1 Levels of Anaemia amongst Ghanaian women (continued)

Variable	**Anaemia Status**				
Educational Attainment	**Mild**	**Moderate**	**Severe**	**Not Anaemic**	Count
No education	38.1	20.5	1.4	40.1	1011
Primary	40.2	20.2	3.1	36.4	964
Junior High School	40.0	16.2	2.0	41.8	2130
Senior High School	35.4	17.5	1.5	45.7	475
Higher	27.7	14.5	0.6	57.2	173
Total	38.8	18.0	2.0	41.2	4753
$\chi2$=49.069	*degree of freedom=12*			*p.value=.000*	
Wealth Index					
Poorest	39.6	19.3	2.2	38.9	758
Poorer	42.6	17.4	3.0	37.0	866
Middle	38.1	18.8	2.3	40.7	962
Richer	38.1	18.2	1.7	42.0	1088
Richest	36.3	16.5	1.0	46.1	1082
Total	38.8	18.0	2.0	41.3	4756
$\chi2$=30.040	*degree of freedom=12*			*p.value=0.003*	

Source: Ghana Demographic and Health Survey (2008).

Table 5.1 Levels of Anaemia amongst Ghanaian women (continued)

Variable	**Anaemia Status**				
Ethnicity	**Mild**	**Moderate**	**Severe**	**Not Anaemic**	Count
Akan	39.2	17.9	2.1	40.8	2416
Ga/Dangme	40.7	16.6	1.8	40.9	337
Ewe	37.7	16.3	2.3	43.6	612
Guan	40.3	21.8	3.4	34.5	119
Mole-Dagbani	35.0	19.6	1.6	43.8	762
Grussi	45.6	17.5	4.4	32.5	114
Gruma	39.8	18.2	1.1	40.9	181
Other	40.7	18.1	0.9	40.3	216
Total	38.8	18.0	2.0	41.3	4757
χ2=21.553	*degree of freedom=21*			*p.value=.426*	
Age at first Birth					
12 – 14	32.2	22.3	3.3	42.1	121
15 – 19	39.9	18.7	2.0	39.4	1506
20 – 24	38.0	18.7	2.4	40.9	1137
25 – 29	33.0	14.4	2.1	50.5	333
30 – 34	34.5	20.7	1.7	42.6	58
Total	38.1	18.5	2.2	41.3	3155
χ2=18.484	*degree of freedom=12*			*p.value=.102*	

Source: Ghana Demographic and Health Survey (2008).

Table 5.1 Levels of Anaemia amongst Ghanaian women (continued)

Variable	**Anaemia Status**				
Age Group	**Mild**	**Moderate**	**Severe**	**Not Anaemic**	Count
15 – 19	43.5	17.6	1.8	37.1	997
20 – 24	39.0	18.8	2.1	40.1	853
25 – 29	35.6	18.5	1.1	44.8	800
30 – 34	39.3	16.8	1.1	42.8	619
35 – 39	37.7	20.0	1.9	40.4	624
40 – 44	39.0	17.5	2.7	40.8	451
45 – 49	33.3	15.7	4.6	46.4	414
Total	38.8	18.0	2.0	41.3	4758
$\chi 2$=45.47	*degree of freedom=18*			*p-value=.000*	
Pregnancy Status					
Non-pregnant	40.0	16.2	1.6	42.2	4407
Pregnant	23.5	40.1	6.6	29.8	349
Total	38.8	18.0	2.0	41.3	4756
$\chi 2$= 177.092	*degree of freedom=3*			*p.value=.000*	
Lactating Status					
Not lactating	37.5	18.4	2.1	42.1	3743
Lactating	43.7	16.5	1.7	38.2	1014
Total	38.8	18.0	2.0	41.2	4757
$\chi 2$= 13.201	*degree of freedom=3*			*p.value=.004*	

Source: Ghana Demographic and Health Survey (2008).

Table 5.1 Levels of Anaemia amongst Ghanaian women (continued)

Variable	**Anaemia Status**				
Total Children Ever Born	**Mild**	**Moderate**	**Severe**	**Not Anaemic**	Count
0	40.1	17.0	1.6	41.3	1590
1	36.8	17.9	1.7	43.6	652
2	37.2	19.2	1.4	42.1	629
3	38.2	18.1	3.2	40.5	526
4	38.2	17.1	3.4	41.4	474
5	36.9	22.0	1.6	39.5	314
6	41.5	18.3	0.9	39.3	229
7	41.4	17.1	2.6	38.8	152
8	40.2	18.6	3.1	38.1	97
9	44.7	21.3	0.0	34.0	47
10+	33.3	14.6	6.2	45.8	48
Total	38.7	18.0	2.0	41.3	4758
χ2= 30.585	*degree of freedom=30*			*p.value=.436*	
Source of Drinking Water					
Improved source	38.4	18.6	2.1	41.0	3691
Unimproved source	40.3	15.9	1.7	42.1	1005
Total	38.8	18.0	2.0	41.2	4696
χ2= 4.65	*degree of freedom=3*			*p.value=1.99*	

Source: Ghana Demographic and Health Survey (2008).

Table 5.1 Levels of Anaemia amongst Ghanaian women (continued)

Variable	**Anaemia Status**				
Type of toilet facility	**Mild**	**Moderate**	**Severe**	**Not Anaemic**	**Count**
Improved toilet	38.7	18.1	2.0	42.0	3256
Unimproved toilet	39.1	17.7	2.1	41.0	1431
Total	38.8	18.0	2.0	41.2	4687
χ2= .229	*degree of freedom=3*			*p.value=.973*	
Type of mosquito bed net(s) slept under					
Treated nets	39.6	19.1	1.2	40.1	890
Untreated nets	39.7	16.6	2.0	41.7	451
Total	38.8	18.0	2.0	41.3	4756
χ2=5.047	*degree of freedom=6*		*p.value=.538*		

Source: Ghana Demographic and Health Survey (2008).

CHAPTER SIX

RISK FACTORS FOR SEVERE, MODERATE AND MILD ANAEMIA

Table 6.1 shows the overall relationship between the independent variables and anaemia status. The model was significant at the 0.01 level, suggesting that there was a relationship between the independent variables and anaemia status. Table 6.2 shows the relationship of specific independent variables and anaemia status. The significance values indicated that five independent variables, namely, region of residence, educational attainment, age of woman, pregnancy and lactation status had a significant association with anaemia status. The Nagelkerke R-Square, shown in Table 6.2 suggested that 9.4 per cent of the variation in anaemia status was as a result of the combination of the independent variables.

Table 6.1 Overall Relationships between Independent Variables and Dependent Variable

Model	Model Fitting Criteria	Likelihood Ratio Tests		
	-2 Log Likelihood	Chi-Square	df	Sig.
Intercept Only	8706.828			
Final	8292.368	414.449	105	.000

Source: Computed from 2008 Ghana Demographic and Health Survey.

Table 6.2 Relationship of Individual Independent Variables to Anaemia Status

Effect	Model Fitting Criteria	Likelihood Ratio Tests		
	-2 Log Likelihood of Reduced Model	Chi-Square	df	Sig.
Intercept	8292.368	.000	0	.
Place of Residence	8296.540	4.172	3	.244
Region of Residence	8394.682	102.313	27	.000
Educational attainment	8324.383	32.014	12	.001
Wealth Quintile	8303.586	11.217	12	.510
Ethnic Group	8314.741	22.372	21	.378
Age of Woman	8345.062	52.694	18	.000
Pregnancy status	8441.591	149.223	3	.000
Lactation status	8303.387	11.019	3	.012
Mosquito bed net slept under	8304.680	12.312	6	.055

Nagelkerke R-Square=.094

Source: Computed from 2008 Ghana Demographic and Health Survey.

Table 6.3 shows risk factors for severe, moderate and mild anaemia. Women who lived in urban areas were 23 per cent, 16 per cent and 15 per cent less likely than women in rural areas to have severe, moderate and mild anaemia respectively; however none of these was significant. Thus the hypothesis that women who lived in rural areas were more likely to have anaemia than women who lived in urban areas was not supported. Malaria is a major cause of anaemia and for a malaria endemic country like Ghana, women in both urban and rural areas could be equally prone to malaria parasites. Another reason could be that although iron deficiency is the leading cause of anaemia, there remain other numerous types of anaemia which are not influenced by socio-demographic factors. Thus odds of anaemia may not be significantly different between urban and rural areas when this is considered. For instance place of residence would not play any part in aplastic anaemia which results from inability of the bone marrow to produce enough red blood cells. Similarly, place of residence would not play any part in other genetic haemoglobin disorders such as sickle cell disease and thalassemia. These conditions naturally predispose people to anaemia and unless their distributions are skewed in one type of place of residence than the other, no relationship could be established between them. Ngnie-Teta *et al.* (2008) using data from the 2001 Mali Demographic and Health Survey found that women who lived in rural areas were more likely than women urbanites to be anaemic ($P<0.001$). Likewise, Gebremedhin and Enquselassie (2011) using data from the 2005 Ethiopia DHS reported that women who lived in rural areas "were twice more likely to have anemia than urban dwellers". Thus although the hypothesis that women who lived in rural areas were more likely than women urbanites to have anaemia was rejected in this study, there is the need to analyse data from future surveys in order to conclusively determine if place of residence is not a risk factor for anaemia in Ghana.

Women in all regions were less likely than women in the Western region to have severe anaemia. This was particularly significant for the Central ($p<0.01$), Greater Accra ($p<0.05$), Brong Ahafo ($p<0.05$), Northern ($p<0.05$) and Upper East ($p<0.01$) regions. Results of the regression also indicated that women in nine regions, excluding the Upper West region were significantly less likely ($p<0.01$) than women in the Western region to have moderate anaemia. Similarly, women in nine regions excluding the Central and Upper West regions were significantly less likely ($p<0.01$) than women in the Western region to have mild anaemia. The Central, Northern and Upper East regions are among the five poorest regions of the country. Thus it is possible that the low likelihood of anaemia in these regions could be the result of the implementation of diverse strategies that are carried out by IGOs and NGOs operating in these regions. For instance the WFP and UNICEF sought to reduce malnutrition in Northern Ghana through the implementation of a cereal flour fortification project (CSIR 2013). In addition, the Western region may also not have been a beneficiary of training and sensitization programmes aimed at anaemia control. For instance the Family Health Division of the Ghana Health Service training of over 100 private health practitioners on the control of anaemia in 2009 was limited to the three Northern regions, the Ashanti and Brong Ahafo Regions. For an explanation of why women in the Greater Accra region were less likely to have anaemia, it could be argued that women in this region receive better education and are more economically empowered than their counterparts in the western region, thus reducing their chances of developing anaemia. The poor performance of the Western region could also be due to minimal effort on the part of health authorities in the region to curb the anaemia problem. Considering that the Western region fares poorly when compared with other regions, interventions on prevention and treatment of anaemia should target women in this region.

Women with primary education were 2.736 more likely than women with no education to have severe anaemia ($p<0.01$). Women with Junior High School and higher education were 29 per cent ($p<0.05$) and 47 per cent ($p<0.05$) less likely than women with no education to have moderate anaemia. Women with higher education were also 40 per cent less likely than women with no education to have mild anaemia ($p<0.05$). Thus women with higher education were significantly less likely than women with no education to have moderate and mild anaemia. Results of the regression model also pointed out that women with higher education were less likely to have severe anaemia though this was not significant. Thus the hypothesis that women with no education were more likely to be anaemic than women with higher education was supported. This could possibly be the positive effects that maternal education has on the reduction of anaemia. For instance women who are educated earn better incomes, have knowledge about nutrition and seek early treatment for diseases, thereby reducing their chances of developing anaemia.

Women in the poorer to richest wealth quintiles were less likely to have severe anaemia compared to women in the poorest wealth quintile. Also, women in the middle to richest wealth quintiles were equally less likely to have mild anaemia. On the other hand, odds of being moderately anaemic increases with socioeconomic class, though none of these was significant. The only result that was significant was for mild anaemia where it was found that women in the richest wealth quintile were 40 per cent less likely than women in the poorest wealth quintile to have mild anaemia ($p<0.01$). Women in the richest wealth quintile are able to purchase and consume quality foods that contain the necessary nutrients which could prevent the depletion of iron stores. Bharati *et al.* (2008) using data collected from the Indian National Family Health Survey conducted in 1998/1999 also found that women with low household Standard of Living Index were more likely to suffer from anaemia.

Women in all the ethnic groups were less likely than Grussi women to have severe anaemia. The results were particularly significant for women in the Akan ($p<0.05$), Mole-Dagbani ($p<0.05$) and Gruma ($p<0.05$) ethnic groups. An explanation for this is that food taboos and customs that prevent the consumption of iron rich foods are probably less entrenched in Akan, Mole-Dagbani and Gruma women than in Grussi women. With the exception of women in the Guan ethnic group, women in the remaining ethnic groups were less likely than Grussi women to have moderate anaemia; however none of these results were significant. With respect to mild anaemia, it was found that Mole-Dagbani women were significantly less likely than Grussi women to have mild anaemia ($p<0.05$)

Women aged 20-24, 25-29 and 30-34 were less likely than women aged 15-19 to have severe anaemia, though not significant. However, women aged 35-39 and 40-44 were more likely than women aged 15-19 to have severe anaemia though not significant. Women aged 45-49 were 3. 051 as likely as women aged 15-19 to have severe anaemia ($p<0.01$). With respect to moderate anaemia, women in all age groups were less likely than women aged 15-19 to have moderate anaemia. This was particularly significant for women aged 30-34 ($p<0.01$) and 45-49 ($p<0.05$). Women in all age groups were also less likely than women aged 15-19 to have mild anaemia and this was significant for women aged 25-29 ($p<0.01$), 30-34 ($p<0.05$), 35-39 ($p<0.05$) and 45-49 (0.05). It can be observed that women aged 45-49 were significantly less likely to have mild and moderate anaemia compared to women aged 15-19; however they were 3. 051 more likely than women aged 15-19 to have severe anaemia ($p<0.01$). Women aged 45-49 are probably cushioned by certain socio-economic factors that reduce their chances of having mild and moderate anaemia compared to women aged 15-19. For instance they may be earning better incomes, may be well educated and have better nutrition than women aged 15-19. Also, women aged 15-19 may be adjusting to the monthly blood loss associated with menstruation.

The effect of this physiological change may thus be harder on women aged 15-19 than women aged 45-49. Intermittent supplementation of iron may also be higher among women aged 45-49. However severe anaemia may be greater among women aged 45-49 because anaemia at this stage may also be aggravated by certain biological factors. For instance production of red blood cells may be stalling and not as rapid as it is in women aged 15-19. Women aged 45-49 may also be exposed to greater number of pregnancies and haemorrhage associated with child birth. Similarly they would have breastfed more children than women aged 15-19.

Women who were not pregnant were 90 per cent less likely than pregnant women to have severe anaemia ($p<0.01$). Similarly non-pregnant women were 74 per cent less likely than pregnant women to have moderate anaemia ($p<0.01$). Non-pregnant women were also 12 per cent more likely than pregnant women to have mild anaemia; however this was not significant. Thus non-pregnant women were significantly less likely than pregnant women to have severe and moderate anaemia. This is probably because pregnant women were not making up for the rapid iron loss that is usually associated with gestation. The 2008 DHS report indicated that only 34 per cent of women took intestinal parasite drugs at the time of their pregnancy. Considering this low intake, the loss of blood due to helminthiasis could be a reason why pregnant women were more likely to have severe and moderate anaemia.

Women who were not lactating were 50 per cent less likely than lactating women to have severe anaemia ($p<0.05$). They were also 9 per cent less likely than lactating women to have moderate anaemia though this was not significant. Women who were not lactating were 22 per cent less likely to have mild anaemia ($p<0.01$). Post natal care may not be of primary concern once a safe delivery had taken place. Thus monitoring of haemoglobin levels may be non-existent in lactating women.

Also even though taking of pills for iron supplementation is recommended to continue three months after delivery, some mothers may have discontinued this after childbirth. They were also probably not consuming the adequate quantity of both heme and non-heme foods required for replacement of the depleted iron stores lost as a result of gestation or excessive blood loss during labour.

Women who used only treated bed nets were 62 per cent less likely than women who did not use any net to have severe anaemia ($p<0.01$). This is probably because women who slept in treated bed nets were not exposed to anopheles mosquitos that transmit malaria. Thus they were less likely to have malaria which leads to destruction of red blood cells and the excessive removal of non-infected RBCs and limits their production. Women who used only untreated bed nets were also less likely than women who did not use any net to have severe anaemia though this was not significant. Women who used treated and untreated bed nets were also less likely to have mild anaemia than women who did not use any net; however none of these were significant.

Table 6.3 Risk Factors of Severe, Moderate and Mild Anaemia.

		Severe						Moderate						Mild					
						95% CI for Exp (B)						95% CI for Exp (B)						95% CI for Exp (B)	
		B	Std. Error	Sig	Exp (B)	Lower Bound	Upper Bound	B	Std. Error	Sig	Exp (B)	Lower Bound	Upper Bound	B	Std. Error	Sig	Exp (B)	Lower Bound	Upper Bound
Intercept		1.907	.905	.035				1.997	.416	.000				1.319	.346	.000			
Place of Residence	Rural (R.C)																		
	Urban	-.263	.297	.376	.769	.429	1.377	-.176	.116	.129	.839	.669	1.052	-.160	.092	.082	.852	.712	1.021
Region	Western (R.C)																		
	Central	-1.636	.557	.003	.195	.065	.580	-.823	.206	.000	.439	.294	.657	-.154	.163	.345	.858	.624	1.179
	Greater A.	-1.099	.496	.027	.333	.126	.882	-1.242	.192	.000	.289	.198	.421	-.580	.154	.000	.560	.414	.757
	Volta	-.900	.546	.099	.407	.140	1.185	-.772	.234	.001	.462	.292	.731	-.475	.189	.012	.622	.429	.902
	Eastern	-.721	.446	.106	.486	.203	1.165	-.970	.203	.000	.379	.255	.564	-.415	.160	.010	.660	.482	.904
	Ashanti	-.564	.361	.118	.569	.280	1.154	-.540	.163	.001	.583	.424	.802	-.404	.140	.004	.667	.507	.878
	Brong A.	-.971	.490	.048	.379	.145	.990	-.517	.192	.007	.597	.409	.869	-.585	.166	.000	.557	.402	.771
	Northern	-1.621	.658	.014	.198	.054	.719	-.657	.231	.004	.518	.330	.815	-.558	.196	.005	.573	.390	.841

		Severe						Moderate						Mild					
						95% CI for Exp (B)						95% CI for Exp (B)						95% CI for Exp (B)	
		B	Std. Error	Sig	Exp (B)	Lower Bound	Upper Bound	B	Std. Error	Sig	Exp (B)	Lower Bound	Upper Bound	B	Std. Error	Sig	Exp (B)	Lower Bound	Upper Bound
	Upper E.	-2.169	.807	.007	.114	.024	.556	-1.722	.306	.000	.179	.098	.326	-.846	.228	.000	.429	.274	.671
	Upper W.	-.505	.720	.483	.604	.147	2.476	-.450	.327	.169	.638	.336	1.211	-.364	.280	.193	.695	.401	1.203
Education	No Education (R.C)																		
	Primary	1.006	.373	.007	2.736	1.317	5.682	.054	.141	.701	1.056	.800	1.393	.073	.114	.524	1.076	.860	1.346
	Middle/JHS	.537	.381	.159	1.711	.810	3.612	-.346	.138	.012	.708	.540	.927	-.036	.109	.740	.964	.779	1.194
	Secondary	.825	.547	.132	2.283	.781	6.675	-.196	.189	.298	.822	.568	1.189	-.149	.150	.322	.862	.642	1.157
	Higher	-.556	1.159	.632	.574	.059	5.562	-.645	.269	.017	.525	.310	.890	-.520	.211	.014	.595	.393	.899
Wealth	Poorest (R.C)																		
	Poorer	-.169	.361	.639	.844	.416	1.713	-.132	.159	.406	.876	.642	1.196	.073	.114	.524	1.076	.860	1.346
	Middle	-.411	.397	.301	.663	.304	1.445	.008	.167	.964	1.008	.726	1.398	-.036	.109	.740	.964	.779	1.194
	Richer	-.655	.452	.147	.519	.214	1.259	.103	.181	.570	1.108	.777	1.580	-.149	.150	.322	.862	.642	1.157
	Richest	-1.037	.556	.062	.354	.119	1.054	.146	.205	.477	1.157	.774	1.728	-.520	.211	.014	.595	.393	.899

			Severe							Moderate							Mild				
						95 CI for Exp (B)							95 CI for Exp (B)							95 CI for Exp (B)	
		B	Std. Error	Sig.	Exp (B)	Lower Bound	Upper Bound		B	Std. Error	Sig.	Exp (B)	Lower Bound	Upper Bound		B	Std. Error	Sig.	Exp (B)	Lower Bound	Upper Bound
Ethnicity	Grussi (R.C)																				
	Akan	-1.412	.640	.027	.244	.070	.854		-.414	.319	.194	.661	.354	1.234		-.449	.249	.071	.638	.392	1.040
	Ga/Dangme	-1.373	.785	.080	.253	.054	1.179		-.045	.359	.899	.956	.473	1.931		-.246	.277	.375	.782	.454	1.346
	Ewe	-1.272	.727	.080	.280	.067	1.165		-.417	.349	.232	.659	.333	1.305		-.511	.270	.059	.600	.353	1.019
	Guan	-.510	.835	.541	.600	.117	3.083		.021	.401	.959	1.021	.465	2.241		-.214	.323	.508	.807	.428	1.522
	Mole-Dagbani	-1.276	.616	.038	.279	.083	.934		-.351	.311	.259	.704	.383	1.295		-.524	.239	.028	.592	.371	.946
	Gruma	-2.271	1.022	.026	.103	.014	.765		-.684	.382	.074	.505	.239	1.068		-.469	.296	.113	.625	.350	1.118
	Other	-1.682	.968	.082	.186	.028	1.241		-.225	.363	.535	.798	.392	1.626		-.275	.283	.331	.759	.436	1.322

				Severe							Moderate							Mild			
						95 CI for Exp (B)							95 CI for Exp (B)							95 CI for Exp (B)	
		B	Std. Error	Sig.	Exp (B)	Lower Bound	Upper Bound		B	Std. Error	Sig.	Exp (B)	Lower Bound	Upper Bound		B	Std. Error	Sig.	Exp (B)	Lower Bound	Upper Bound
Age	15-19 (R.C)																				
	20-24	-.106	.368	.774	.900	.438	1.850		-.157	.142	.270	.855	.646	1.130		-.170	.110	.123	.843	.679	1.047
	25-29	-.828	.441	.060	.437	.184	1.037		-.247	.145	.089	.781	.588	1.038		-.400	.114	.000	.670	.536	.838
	30-34	-.691	.472	.144	.501	.199	1.265		-.413	.159	.009	.661	.484	.903		-.271	.120	.024	.763	.603	.965
	35-39	.057	.397	.886	1.059	.486	2.306		-.068	.151	.654	.935	.696	1.255		-.278	.120	.020	.757	.599	.958
	40-44	.549	.406	.176	1.731	.782	3.834		-.133	.171	.437	.876	.627	1.224		-.214	.132	.104	.807	.623	1.045
	45-49	1.115	.364	.002	3.051	1.496	6.223		-.368	.179	.040	.692	.487	.983		-.471	.138	.001	.624	.476	.818
Pregnancy Status	Pregnant (R.C)																				
	Not Pregnant	-2.270	.297	.000	.103	.058	.185		-1.342	.146	.000	.261	.196	.348		.115	.156	.461	1.122	.826	1.525

		Severe						Moderate						Mild			
						95 CI for Exp (B)						**95 CI for Exp (B)**					**95 CI for Exp (B)**	
		B	Std. Error	Sig.	Exp (B)	Lower Bound	Upper Bound	B	Std. Error	Sig.	Exp (B)	Lower Bound	Upper Bound	B	Std. Error	Sig.	Exp (B)	Lower Bound	Upper Bound
Lactating Status	Lactating (R.C)																		
	Not lactating	-.702	.318	.027	.495	.266	.924	-.096	.119	.417	.908	.720	1.146	-.250	.090	.005	.779	.653	.929
Mosquito bed net	No net (R.C)																		
	Only treated net	-.976	.353	.006	.377	.188	.753	.000	.116	.997	1.000	.797	1.254	-.014	.092	.875	.986	.823	1.180
	Only untreated net	-.588	.394	.135	.555	.257	1.202	-.244	.157	.121	.784	.576	1.066	-.071	.119	.549	.931	.738	1.176

CHAPTER SEVEN

SUMMARY OF FINDINGS, CONCLUSION AND RECOMMENDATIONS

7.1 Summary of findings

Women of reproductive age were subjects of the study and numbered 4,758. Out of this number, one-fifth were found in the 15-19 age group. The age groups with least representation were 40-44 and 45-49. Women from the Ashanti and Greater Accra regions jointly constituted 40 per cent of the subjects. Proportion of women from all other regions were below 10 per cent, with the lowest being the Upper West region (2.5 per cent).

Forty eight per cent of the women lived in rural areas whereas the remaining 51.8 per cent resided in urban areas. Majority of women for the study were Akan and formed about one-half of the total number of subjects. Women from other ethnic groups, namely the Mole-Dagbani, the Ewe, Ga/Dangme and Grussi also formed part of the sample.

Educational attainments of women were unsatisfactory; only 3.6 per cent of the subjects had been educated beyond the secondary school level. Also, over one – fifth of the subjects had no form of formal education. Forty five per cent as well as 10 per cent of the subjects had been educated to the junior high and senior high school respectively.

Distribution of women among the various wealth indexes was not very marked. Women who were located in the poorest wealth quintile formed 16 per cent of the subjects whilst those in the richest quintile formed 23 per cent. A preponderance of subjects for the study were not gravid. Similarly over three-fourths of the subjects were not breastfeeding at the time that haemoglobin tests were carried out.

Nulliparous women constituted 33.4 per cent of the subjects. Primiparous women and multiparous women also comprised 13.7 per cent and 34.3 per cent of the subjects respectively.

Over three fourths of the subjects relied on improved sources of drinking water whereas the remaining used water from unimproved sources. Similarly, majority of women used improved (69.5 per cent) than unimproved toilet facilities. Seventy two per cent of women interviewed did not sleep under any net a day before the interview was conducted. For those who did 18.7 per cent slept under treated nets whilst another 9.5 per cent did so under untreated nets.

Nearly half of the women who had given birth before had their first birth at ages 15 to 19. This was followed by women who had their first birth at ages 20 – 24 (36 per cent). Eighty four per cent of the women had their first birth before age 25.

At the bivariate level it was found that no anaemia was significantly lower among women who lived in rural areas than among women who lived in urban areas. No anaemia was also significantly lower among women who resided in the Western, Upper West and Central regions. It was however higher among women who lived in the Brong Ahafo, Greater Accra and Upper East regions.

No anaemia was significantly lower among women with primary and no education. It was however higher among women with higher and secondary school education. No anaemia increased with level of education and this pattern initiated from the primary school level.

The proportion of women with no anaemia was higher for Grussi and Guan women whereas it was lower for Mole-Dagbani and Ewe women. The association between ethnicity and anaemia status was however not significant.

No anaemia was significantly higher among women in the richer and richest quintiles whereas it was lower for women in the poorest and poorer wealth quintiles. With the exception of women aged 25-29, less than half of women in all other age groups did not have anaemia. The association between age of woman and anaemia status was statistically significant. No anaemia was significantly higher in non-pregnant women than in pregnant women. Similarly, it was significantly higher in women who were not breastfeeding than those who were not.

Source of drinking water, type of toilet facility and mosquito bed net slept under did not have a significant association with anaemia status. Other variables that did not have a significant association with anaemia status at the bivariate level were total children ever born, age at first birth and ethnicity.

At the multivariate level it was found that women who lived in the Central, Greater Accra, Brong Ahafo, Northern and Upper East regions were significantly less likely than women who lived in the Western region to have anaemia.

Women with primary education were significantly more likely than women with no education to have severe anaemia. It was also found that women with higher education were significantly less likely to have moderate and mild anaemia. Women in the richest wealth quintile were also significantly less likely than women in the poorest wealth quintile to have severe anaemia.

Women aged 45-49 were more likely than women aged 15-19 to have severe anaemia. Women aged 30-34 and 45-49 were significantly less likely to have moderate anaemia than women aged 15-19. Women in all age groups with the exception of those aged 20-24 were also significantly less likely than women aged 15-19 to have mild anaemia.

Non-pregnant women were significantly less likely than pregnant women to have severe and moderate anaemia. Non-lactating women were also significantly less likely than lactating women to have severe and mild anaemia.

Source of drinking water and type of toilet facility did not have a significant association with prevalence of anaemia. Women who slept in a treated bed net a night before the survey were significantly less likely than women who did not use any net to have severe anaemia.

7.2 Conclusion

This study showed that six out of ten Ghanaian women were anaemic. Women of different socio-demographic statuses were identified to be at risk of having the disease. The hypothesis that women with no education were more likely to be anaemic than women with higher education was supported. However, the hypothesis that women in rural areas were more likely to be anaemic than urban women was not supported. Similarly, the hypothesis that women in the lowest wealth quintile were more likely to have anaemia than women in the highest wealth quintile was rejected. The anaemia problem is a multifaceted one; thus reducing its prevalence and the mortality associated with it requires in-depth research into factors that account for the disease. Success in dealing with the problem also requires the implementation of a national multisectoral strategy complemented by a continuous monitoring and evaluation of the programme.

7.3 Recommendations

This study showed that close to 60 per cent of Ghanaian women were anaemic in 2008. The report of the Demographic and Health Survey also estimated anaemia among children under age 5 to be 78 per cent (GSS *et al.* 2009). These statistics are overwhelming; thus the implementation of a National Anaemia Prevention and Control Programme is considered key to reducing prevalence as well as anaemia related mortality among women and children. Though the DHS had reported high intake of iron pills and syrups at the time of pregnancy, there still remained some proportion of women (14 per cent) who for varied reasons did not take any pills of this kind. It is important to analyse the underlying factors that could have contributed to this in order to achieve maximum intake of iron pills. Helminthiasis constitutes a major cause of anaemia in women; thus there is also the need to increase intake of intestinal parasite drugs which was reported to be only 34 per cent among women who were interviewed in the 2008 survey.

In some instances anaemia that develops during gestation is carried beyond childbirth; in keeping with this, lactating women should be encouraged to continue intake of iron tabs and syrups. The WHO (2009) has advised that "women should receive supplementation with iron and folic acid during pregnancy and for three months postpartum". This should be monitored by health personnel who provide post-natal care at various health facilities in the country. Community health nurses should also advice post-partum women who do not seek care after childbirth to do so that their haemoglobin levels can be checked.

Intermittent or weekly iron supplementation by women of reproductive age represents an effective means to reducing anaemia prevalence. Evidence from the Micronutrients and Health (MICAH) programme implemented in 110 rural farming communities in the Eastern region between 1997 and 2004 had shown that intermittent supplementation reduced the risk of anaemia. The MICAH programme showed that weekly iron and folic acid supplementation to women of childbearing age, along with increased prevention of malaria, led to reduction in the prevalence of anaemia by 66 per cent (MacDonald 2007). A Cochrane review has also shown that intermittent iron reduces risk of anaemia by 27 per cent (Pasricha, 2013).

With regards to steps towards prevention and control of anaemia, some efforts which do not form part of a broader anaemia control strategy are noteworthy. For instance included in the National Health Insurance Strategy (NHIS) medicines list are drugs for iron supplementation as well as drugs for intestinal parasite infections. This means that women do not have to make out-of-pocket payments to access these essential drugs.

However the anaemia problem is fundamentally a nutrition problem and it appears that research on nutrition, nutrition practices and customs among different ethnic groups and regions is lacking. One of the outstanding strategies that are recommended for anaemia prevention is the "promotion of positive dietary change in women" through education. Thus it is necessary to undertake research into food consumption practices and behaviours among women of different regions and ethnic groups. This should also be complemented by research on the incidence of helminthiasis infections and their causative agents. As has been noted, aetiology of anaemia is complex and prevention and control of the disease would also depend on the sustainability of some programmes such as the National Malaria Prevention Programme and the Directly Observed Therapy (DOT) programme.

In industrialised and developing countries, consumption of iron fortified foods comprises one of the major strategies for anaemia control. According to the Global Alliance for Improved Nutrition (GAIN), the addition of essential nutrients to staple foods represents a feasible and sustainable means to dealing with the problem of micronutrient deficiency (GAIN 2012). The GAIN supported fortification of flour and vegetable oil in a project that ended in November 2012. The Ghana Foods and Drugs Board also achieved 95 per cent and 100 per cent success in the fortification of oil products and wheat flour respectively. However this project was implemented at the national level and targeted specific products that are probably not consumed by majority of Ghanaians, especially those residing in rural communities. Sub-national level fortification is crucial to reducing iron deficiency anaemia. For instance *Akple* and *Kenkey* are two Ghanaian staples prepared from maize and consumed in large quantities in Ewe and Ga communities. Reducing iron deficiency anaemia in communities that rely on these foods could thus be achieved through implementation of technologies that enable fortification of maize flour. It also appears that the fortification project of the Food and Drugs Board has ended; giving no guarantee that products in the future will be continuously fortified. It is important to keep fortification running and to ensure that medium to large scale bakery establishments in large towns are provided with fortified flour for preparation of bread.

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