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ANAEMIA IN PREGNANCY AND ASSOCIATED FACTORS: A CROSS-SECTIONAL STUDY OF ANTENATAL ATTENDANTS AT MAMOBI GENERAL HOSPITAL

BY

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THIS DISSERTATION IS SUBMITTED TO THE SCHOOL OF PUBLIC HEALTH, UNIVERSITY OF GHANA, LEGON, IN PARTIAL FULFILMENT OF THE REQUIREMENT FOR THE AWARD OF MASTER OF PUBLIC HEALTH IN EPIDEMIOLOGY AND DISEASE CONTROL

MAY, 2019

DECLARATION

I certify that this dissertation proposal has not been submitted for any academic award elsewhere. I also certify that the proposal has been written by me and any help received in writing this thesis and all resources used, have been duly acknowledged.

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ABSTRACT

Background: Anaemia is a health problem that is associated with a decrease in the volume of red blood cells as well as reduction in the mean haemoglobin concentration in the blood. Haemoglobin is responsible for carrying oxygen to tissues and organs in the body. Anaemia can be a particularly serious problem for pregnant women, leading to premature delivery and low birth weight. Iron deficiency anaemia is the most common micronutrient deficiency, and anaemia is often described as an indicator of both poor nutrition and poor health.

Aim: The aim of this study was to determine the prevalence and risk factors associated with anaemia among antenatal care attendants at the Mamobi General Hospital

Methods: This was a descriptive cross-sectional study that was conducted among pregnant women attending the Mamobi General Hospital. Structured questionnaire that was used in a similar study conducted by various authors was revised and adopted in this study. Results was analyzed using Stata version 15 and presented as mean, standard deviations, percentages, chi-square and logistic regression. The significance level was set at $p<0.05$.

Results: A total of 372 pregnant women were enrolled in the study with a mean age (±SD) 28.47 (±5.74) years. The prevalence of anaemia was 53.3% (62.7% mild, 35.9% moderate and 1.4% severe). Maternal anaemia was significantly associated with participant's religion ($p=0.032$) and folic acid consumption ($p=0.038$) after controlling for confounders.

Conclusion: The overall prevalence of anaemia in pregnancy was 53.3%. Folic acid tablet supplementation and religion were associated with anaemia. It was therefore recommended that health workers, particularly health promoters and midwives should intensify health promotion to help reduce anaemia among the pregnant women.

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CHAPTER ONE

INTRODUCTION

1.1 Background

Over the years Governments and Non-Governmental Organization (NGOs) have channeled their resources on health issues so as to minimize maternal morbidity and mortality. Anaemia in pregnancy is an important health issue resulting in high maternal morbidity and mortality. Anaemia is a global health issue that greatly affects both developed and the developing countries. According to a review of nationally representative survey data from 1993-2005, the World Health Organization (WHO) estimates that more than 1.62 billion people are affected by anaemia (WHO, 2012).

Anaemia is a health problem that is associated with a decrease in the volume of red blood cell as well as reduction in the mean haemoglobin concentration in the blood. Haemoglobin is responsible for carrying oxygen to tissues and organs in the body. Anaemia can be a particularly serious problem for pregnant women, leading to premature delivery and low birth weight. Iron deficiency anaemia is the most common micronutrient deficiency, and anaemia is often described as an indicator of both poor nutrition and poor health (GDHS, 2014).

The World Health Organization has estimated that about one-third of the world's population are anaemic, majority of which is due to iron deficiency. The second most affected group is pregnant women with a prevalence of 41.8% (Messenger, & Lim, 2016).

Anaemia remains a serious challenge globally especially among pregnant women. According to Kessebaum et al. (2014), pregnant women in the second trimester are the most vulnerable to the detrimental effects of anaemia. Anaemia among pregnant women is more prevalent in low and middle income countries compared to developed countries.

The prevalence of anaemia among pregnant women has been on the ascendency from 1990 to 2010. Southern Asia, Central and West Africa recorded the highest prevalence of anaemia in pregnant women. High-risk groups for anaemia and moderate-severe anaemia include the elderly, reproductive-age and pregnant women, Hispanics, and non-Hispanic blacks (Chi Huu Hong Le, 2016). Even though the causes of anaemia are variable, the major cause is iron deficiency. In some countries, considerable reductions in the prevalence of anaemia have been achieved; however, overall, progress has been insufficient. Further actions are required to reach the World Health Assembly target of a 50% reduction of anaemia in women of reproductive age by 2025 (WHO-Global target, 2017).

In Africa where poverty is high, anaemia has become a deadly disease. In the lower income and middle income belt anaemia is highly prevalent especially among the women and children under 5 years. Iron deficiency is the major cause of anaemia in pregnant women in Africa. Even though iron deficiency is the major cause of anaemia in Africa, there are other causes of anaemia such as deficiency in Vitamin B12 and deficiency in Folate. The prevalence of anaemia among pregnant women according to WHO from 1993 to 2008 was 57.6 percent. It means anaemia among pregnant women is very serious and should not be taken lightly by Governments and Non-Governmental Organizations. The trends and levels of anaemia varied across regions and geographical areas. In 1995 and 2011, Central and West Africa had the lowest mean concentrations of haemoglobin and the highest anaemia prevalence: East Africa had low haemoglobin concentrations for children and pregnant women. Children and pregnant women in these three regions in 1995 had an anaemia prevalence of at least 70%; prevalence of severe anaemia of at least 10% in west and central African regions (Gretchen et al., 2013).

In Ghana, anaemia is source of concern and an urgent public health problem (GHS DH Annual Report, 2016). Anaemia has a great negative implication on the health and

economic wellbeing of nations and communities (Xu et al., 2016). The prevalence of anaemia in women and children also remains high (Tunkyi & Moodley, 2018). In 2003, three quarters of pregnant women attending antenatal care in Ghana were estimated to have some level of anaemia (Ghana Health Service, 2017). Forty-five percent of women of child bearing age were anaemic (MoH, 2015). Micronutrient deficiencies, particularly of vitamin A, iodine, and iron, are of major concern and continue to undermine health and development across all age groups. Iron deficiency coupled with the high malaria burden contributes to very high prevalence of anaemia, especially among women and children (GHA, 2013). Anaemia in pregnant women is of particular interest since it had been reported to be a cause of mortality and morbidity among pregnant women. According to the Ghana health service annual report for 2016, anaemia was among the top ten causes of admissions in 2016 and among the top 10 causes of mortality of the admitted patients.

Out of the 1,149,391 people that were admitted at the various health facilities in Ghana, anaemia was the second highest after Malaria in 2016. In addition, 909 people died as a result of anaemia in 2015 and in 2016, 933 died (GHS annual report, 2016).

From the above figures, it is clear that Ghana needs to rise up to the task by formulating policies that could help to reduce the menace of anaemia. Even though the Ministry of Health and other non-governmental organizations are providing interventions to reduce anaemia the prevalence rate is still high.

1.2 Problem Statement

Anaemia in pregnancy is an issue of public health importance worldwide, but much of a concern in the developing countries of Sub-Saharan Africa and Southeast Asia (WHO, 2016). Sholeye, Animasahun and Shorunmu (2017), posits that anaemia in pregnancy is a major contributor to poor pregnancy outcomes, including maternal morbidity and mortality

in south Saharan countries. The WHO in 2013 reported over 2000 Ghanaian pregnant women to have died of pregnancy related anaemia. According to Kozuki et al. (2013), anaemia in pregnancy predisposes women to postpartum hemorrhage, pregnancy-induced hypertension, postnatal sepsis, a higher risk of preterm delivery, small-for-gestational age and low birth weight babies, stillbirth, and other negative perinatal outcomes.

In Ghana, a report by Family Health Division (FHD) of the Ghana health Service (GHS), revealed that anaemia among pregnant women at first ante-natal clinic visit marginally increased by 1% in the year 2015 as compared to the previous year. The FHD reported anaemia at the time of registration at ante-natal clinic and at 36 weeks in the region to be 45.5% and 31.8% respectively in 2014; 46.3% and 25.6% respectively in 2015; and 47.3% and 26.5% respectively in 2016 (FHD report, 2016). Anlaakuu and Anto (2017), studied factors associated with anaemia among pregnant women receiving antenatal care at the Sunyani Municipal Hospital in Ghana. They reported high prevalence of anaemia at the initial stage of antenatal care among a sample of 316 pregnant women.

They further reported associated risk factors to be malaria infection, frequency at which one consumed fish/snails and gestational age at first ANC visit. Owusu-Sarpong and Tetteh (2017) also reported high prevalence of anaemia among pregnant women in a cross sectional descriptive study conducted at the Yilo Krobo Municipality. The annual report from the Mamobi General Hospital showed the prevalence of Hb level less than 11g/dl (anaemia) at 36 weeks of gestation to be 55.5%, 73.7% and 30.2% in 2016, 2017 and 2018 respectively. Even though, the prevalence decreased in 2018 as compared to that in 2016 and 2017 (Mamobi General Hospital Annual Report, 2018). The risk factors associated with anaemia among ANC attendants at the Mamobi general hospital is not known. The prevalence obtained for 2018 is higher than the regional prevalence of 21.2% (FHD, 2016).

Despite the high prevalence of anaemia among pregnant women in Ghana, there are

differences in risk factors for anaemia. This study seeks to identify the risk factors associated with anaemia in pregnant women attending Mamobi General Hospital antenatal clinic.

1.3 Conceptual framework

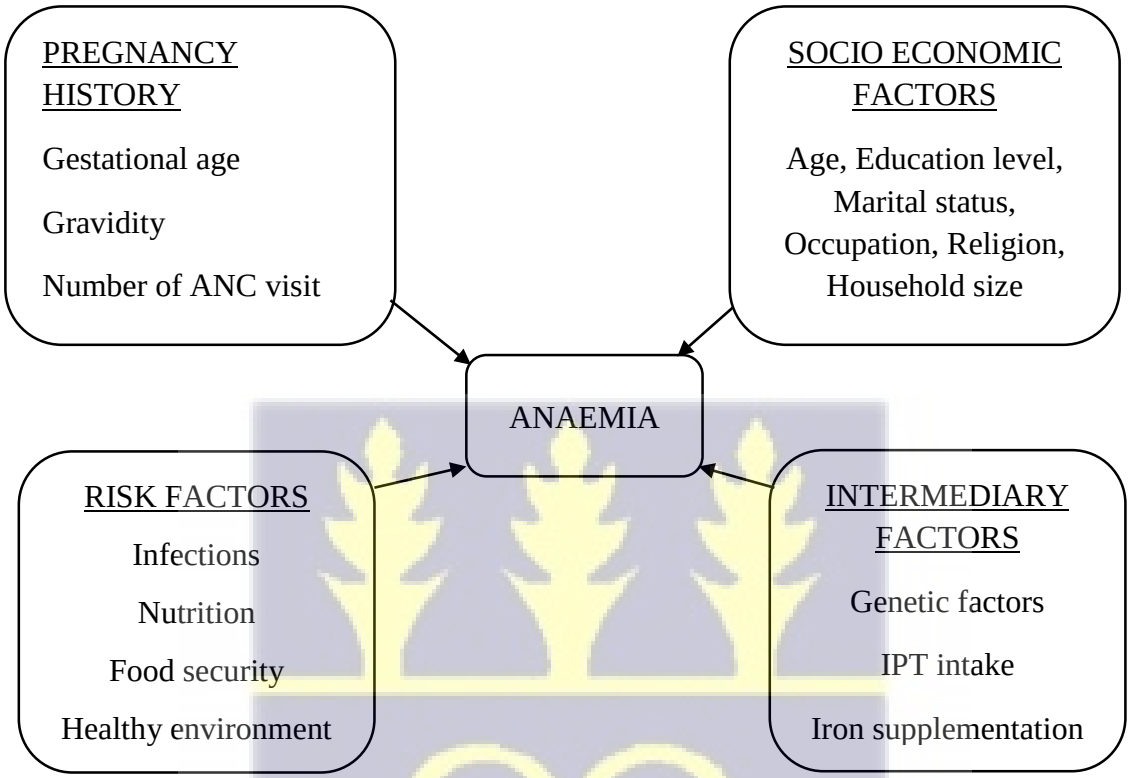

Figure 1.1: Conceptual Framework Of Factors Associated With Anaemia In Pregnancy

Narration of Conceptual Framework

Anaemia in pregnancy has basic, underlying and intermediate causes. Factors that constitute the basic causes are age, level of education, marital status, occupation and religion. These socio- demographic factors have a direct link with the underlying causes of anaemia in pregnancy. That is, they determine whether individuals are able to purchase food items and other consumables. For instance, women with tertiary education are likely to have a job that pays well, live in a healthy environment, and thus will not have problem with food security issues. If the underlying cause are not

addressed, it could lead to undernutrition which will subsequently cause anaemia the in pregnant women if not corrected.

1.4 Justification of the Study

Anaemia is part of the top ten diseases that was recorded in Ghana. It ranked second among the top ten admission list in 2016 in the Greater Accra region with total admission of 49391 patients. The prevalence of anaemia among antenatal care registrants and those at 36 weeks of gestation was 34% and 21% respectively (GHS DH Annual Report, 2016). The prevalence of anaemia among pregnant women who visit the Mamobi Polyclinic can only be reduced if the factors that cause it are determined. Findings from this study will be useful in providing appropriate preventive measures to reduce the maternal mortality of which anaemia is the leading cause in Ghana (Ghana Statistical Service, Ghana Health Service, & ICF, 2018).

1.5 Research Questions

In seeking to achieve the objectives of the study, the following research questions considered:

1. What is the prevalence of anaemia among pregnant women attending Mamobi General Hospital?
2. What are the factors associated with this anaemia among the pregnant women visiting the Mamobi General Hospital?

1.6 General Objective

To determine the prevalence and factors associated with anaemia among pregnant women attending Mamobi General Hospital in Greater Accra.

1.7 Specific Objectives

1. To determine the prevalence of anaemia among antenatal care attendants at Mamobi General Hospital
2. To determine factors associated with anaemia among antenatal care attendants at the Mamobi General Hospital

CHAPTER TWO

LITERATURE REVIEW

2.1 Anaemia

Anaemia is defined as a reduced amount of haemoglobin (Hb) in the blood. It is a deficiency in the size or number of red blood cells (RBCs) or the amount of Hb they contain (Mahan et al., 2012). As anaemia is so common during pregnancy, all women in the UK are screened for anaemia at their booking visit and at 28 weeks of pregnancy. As a global health problem, anaemia affects all age and sex groups in populations of developed and developing countries. Its repercussions spans across human health, social development and economic progress. Children and pregnant women are most vulnerable to anaemia. Anaemia in pregnancy is a global public health problem that affects pregnant women in both developing and developed countries, however, those most affected are pregnant women from developing countries. Globally, 41.8% of pregnant women are estimated to be anaemic. Anaemia in pregnancy is caused by a wide range of factors. Nonetheless, iron deficiency is the leading cause of anaemia in pregnancy. Approximately 50% of all cases of anaemia during pregnancy is iron deficiency related. Iron requirements increase significantly during pregnancy, this is because iron is required to expand plasma volume, increase red cell mass and for the development of the placenta and the fetus (Mahan & Raymond, 2017).

2.2 Prevalence

A study that was published by University Hospital of Zurich to establish the prevalence and risk factors of reduced iron stores and anaemia in early pregnancy showed that 50.2% of the participants were anaemic (Bencaiova, Burkhardt, & Breymann, 2012). There has been an increase in the prevalence of anaemia in Africa over the years. According to the world health organization (2011), 46.3% of pregnant women in Africa are anaemic. A

bout half of the Ghanaian female population are anaemic. The highest estimated prevalence of anaemia over the past sixteen years was 56.40% (Stevens et al., 2013). A study carried out by Acheampong and colleagues in selected private hospitals indicated the prevalence of anaemia (Hb<11.0 g/dl) among pregnant women attending ANC in the facilities to be 51% (Acheampong, Appiah, Baffour-Awuah, & Arhin, 2018). The Family Health Division reported anaemia at the time of registration at ante-natal clinic and at 36 weeks in the region to be 45.5% and 31.8% respectively in 2014; 46.3% and 25.6% respectively in 2015; and 47.3% and 26.5% respectively in 2016 (HFD, 2016). A cross-sectional study that was conducted among 384 pregnant women in Northwest Ethiopia in 2013 estimated the prevalence of anaemia to be 21.6% (Alem, Enawgaw, Gelaw, Kena, Seid, & Olkeba, 2013).

2.3 Signs and Symptoms

Anaemia among pregnant women is manifested through signs and symptoms. Some women may, however, present with asymptomatic anaemia. Among the signs and symptoms that pregnant women may present with at the health facility are shortness of breath, easy fatigability and palpitations (Health & Milman, 2015).

2.4 Risk Factors

There are numerous causes of anaemia among pregnant women. This could take the form of micronutrient deficiency (Example: folate, B_{12}, riboflavin and vitamin A), HIV, malaria and tuberculosis infections, and acquired or inherited disorders like sickle cell disease (Macdonald et al., 2010). The causes of anaemia can be grouped into three main categories: abnormal, poor or insufficient red blood cell production, accelerated destruction of red blood and excessive loss of red cell (Andrew et al., 2012). In some individuals, infections such as peptic ulcers may cause blood loss and anaemia. Iron deficiency is a common cause of anaemia in pregnant women. There is an increased demand for iron in pregnant women

compared to non-pregnant women (Al Hassan, 2015). Malaria and helminths infections lead to excessive red blood cell destruction and excessive red blood cell loss (Messina *et al.*, 2013). According to Ndukwu et al., (2012), pregnancy is the single most important factor that contributes to anaemia. The increase in demand for iron and other vitamins due to the physiological burden of pregnancy is what causes anaemia. Additionally, a woman loses about 500mg of iron with each pregnancy (Murphy, 2005). The increased iron requirement is because of increase in maternal blood volume for improved oxygen transport and iron transfer to the growing foetus, placental structure and as a reserve for lochia at parturition (Silva et al., 2015). Iron is also required for the production of haemoglobin during pregnancy, in both foetal and maternal red cells. The foetus stores most of its iron during the last trimester (Murthy et al., 2005). Species of hookworm parasites like Ancylostoma duodenale and Necator americanus reside in the duodenum of infected persons; they attach themselves to the villi and feed on the blood of the host. Hookworm infected pregnant women with inadequate dietary iron intake and high physiological demand can result in anaemia (Getachew et al., 2012). In Ethiopia a study conducted determined factors that are associated to anaemia in pregnant women attending ante-natal care to be low average monthly income, birth intervals less than two years, iron supplementation and large family size (Bekele, Tilahun, & Mekuria, 2016). In the year 2013, a cross sectional study by Alem et al. (2013) determined that pregnant women with age >34, rural residence, history of malaria attack, hookworm infection and absence of iron supplement are significantly associated with increased risk of anaemia. A cross-sectional study by Obse et al. (2013) also proposed that having 5 or more children, family sizes, third trimester, meat consumption, intake of vegetables and fruits less than one per day, intake of tea always after meal, recurrence of illness during pregnancy were risk factors associated with anaemia in pregnant women.

2.5 Effects of Anaemia

Easy fatigability and a decreased capability to work are some of the common symptoms of anaemia (Haas & Brown-lie, 2001). However, anaemia increases the risk of mortality and cognitive loss in survivors (Stoltzfus *et al.*, 2005). About 20% of maternal deaths are associated with anaemia in pregnancy (Black *et al*., 2008). It is also shown to cause increased in loss of blood at delivery and predispose women to postpartum haemorrhage (Kavle *et al*., 2008). Anaemic mothers are susceptible to delivering premature and low birth weight with an increased risk of mortality (Kozuki, 2012). Children below two years of age suffering from iron deficiency and malaria- induced severe anaemia are at higher risk of mortality. Mild anaemia in children, even if treated, may result in impaired memory and permanent cognitive damage by decreasing attention span (Brabin *et al*., 2001). The average intelligence quotient of anaemic children decreases by two points for every 1.0 g/L decrease in haemoglobin compared to other children (Black *et al*., 2008; Stoltzfus *et al*., 2004). School-age children in the U.S. perform poorly in math's test as a result of an iron deficiency (Halterman *et al*., 2001). Iron deficiency anaemia is defined by microcytic red cells and reduced circulating haemoglobin (Alemu *et al*., 2012). As the deficiency worsens, it results in the defects of the function and structure of epithelial cells; especially mouth, nails, stomach and tongue (Brown *et al*., 2008). There is a close link between the severity of anaemia in pregnancy that resulted from worm infestations and the outcome of pregnancy; preterm birth, low birth weight of the infant, perinatal mortality and infant survival are but to mention a few (Brooker *et al*., 2008).

2.6 Causes

A lot of factors contribute to anaemia in pregnancy. However, nutrition, infections and genetics are the most important factors that are linked with anaemia in pregnancy.

2.7 Infections

Malaria infection is the single most important cause of anaemia in the WHO African Region. Iron supplementation should be combined with prevention and treatment of malaria in malaria-endemic regions. This could lead to a beneficial synergistic effect on the levels of haemoglobin. Preventive measures, coupled with the use of insecticide-treated bed nets and intermittent preventive treatment, could also improve the concentrations of haemoglobin in the blood of pregnant women residing in malaria- endemic areas (WHO, 2015). Anaemia is strongly associated with maternal mortality. Severe anaemia also increases the risk of perinatal mortality. This association clearly needs a detailed study because anaemia in low and middle income countries (LMICs) is strengthened by malaria, parasitic infections such as bilharzia and hookworm (Tunkyi & Moodley, 2016).

2.8 Nutrition

Different researches have different definitions of nutritional anaemia. Iron deficiency is known to be the most common nutritional deficiency that is associated with morbidity and mortality that causes the majority of anaemia cases in developing countries (Lee et al., 2014). Nutritional iron deficiency occurs when physiological needs cannot be met by dietary iron absorption. Some consequences of iron deficiency in developing countries are related to health and economic costs. These include but not limited to decreased productivity, poor pregnancy outcome and impaired school performance. Fortification of foods with iron and elemental iron supplementation can control iron deficiency in populations. A lot of studies have proven that fortification with iron can be an effective approach against nutritional iron deficiency (Zimmermann & Hurrell, 2007).

2.9 Genetic Factors

Anaemia during pregnancy may also assume a genetic form. Usually iron deficiency is acquired, however, certain people are predisposed to it and a genetic form of iron-refractory

iron deficiency anaemia is recognized as a rare disease (Camaschella, 2017).

2.10 Prevention

Effective public health interventions that is used in controlling anaemia include de-worming, iron supplementation, and malaria control programs. Elemental iron tablet supplementation programs are useful in reducing anaemia, however, proof of their success is not definitive (Stoltzfus, 2001). Supplementing the diet of pregnant women with iron tablets during pregnancy reduces anaemia and improves infant outcomes. Studies that supplemented pregnant women iron tablets during pregnancy resulted in significant impacts – decreasing neonatal mortality by half in China (Zeng *et al*., 2008) and immensely reducing the risk of death in the first seven years of life (Christian *et al*., 2009). Mothers and their children benefit from an adequate intake of micronutrient. Breastfed babies benefit from supplementation micronutrient that their mothers receive particularly iron and vitamin A supplementation for pregnant women. Supplementation of iron tablets during pregnancy protect both mother and infant against anaemia, which is considered a key cause of maternal and perinatal mortality. Taking folic acid supplement is very important in early pregnancy; it helps protect against neural tube defects (Andrew et al., 2015). Low levels of folate in the circulating maternal blood results in a higher risk of neural tube defects (Messina et al., 2014). Women who are planning to get pregnant are encouraged to take 5 mg of folic acid daily. Some excellent dietary sources of folate include green leafy vegetables, meat, mushrooms, roots, etc. (Thomas & bishop, 2007). The dietary management of iron deficiency anaemia includes intake of first-class proteins like fish, meat, and poultry and reduction in the intake of coffee and tea (Zeng *et al.*, 2012).

CHAPTER THREE

METHODS

3.1 Study Design

This study was a hospital-based cross-sectional design that used quantitative data collection techniques. The study was carried out from May to June 2019.

3.2 Study Site

The Accra Metropolitan District is one of the 26 districts in the Greater Accra Region with a population of 1,665,086 as of 2010. As of March 2018, it spans an area of approximately 60 km^2 (23 sq mi) and encompasses the Ablekuma Central, Ablekuma South, Ashiedu Keteke, Ayawaso North, Okaikoi South, and Osu Klottey sub-metropolitan district councils.

The Ayawaso North Constituency falls within the Ayawaso Central sub-metropolitan district and includes five (5) electoral areas. These are: Mamobi West, Kwoatsuru, Mamobi East, Nima West and Kanda. The study site, Mamobi General Hospital, is located within Ayawaso North constituencey, and it was established in 1972. It occupies a unique status within the framework of Health Care Delivery in the country. The Hospital serves the population of Kotobabi, Nima, Mamobi, Pigfarm and its surrounding environs.

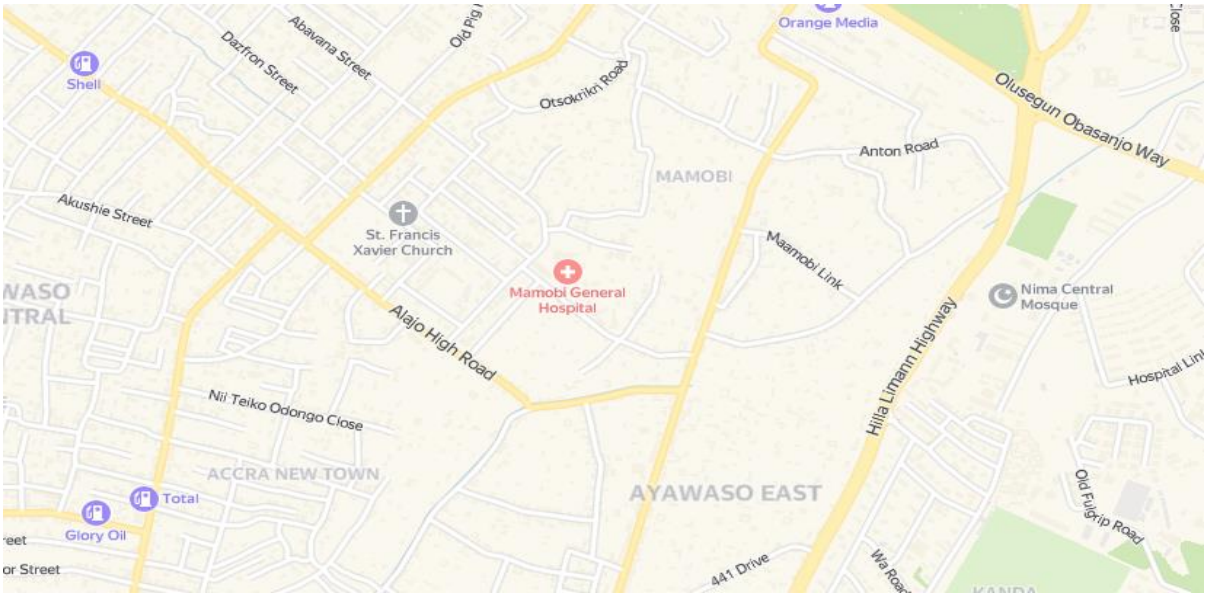

Figure 3.1: Map of Kintampo North District indicating the Study Area
Source: https://yandex.fr/maps/20803/accra/?ll=-0.196276%2C5.589482&z=15.46

3.3 Study Population

The study population were pregnant women who attended the antenatal clinic at the Mamobi General Hospital.

3.4 Sample Size and Sampling Method

The sample size was calculated using Cochran's (1977) equation for the sample size of proportion.

$$n = \frac{1-\alpha z^2 \quad P(1-P)}{\varepsilon^2}$$

n = sample size

z = the selected critical value of 1.96 at 95% confidence level,

p = the estimated prevalence of anaemia = 59.0% (Prevalence was obtained from the Mamobi annual report (2017) of pregnant women attending ANC)

ε = the level of precision of 5%

The total sample for the project was 372 based on the above formula. Therefore, the total sample size of 390was used with 5% account for non-response rate.

A quantitative method was used for this study, and thus participants were selected using convenient sampling approach. All pregnant women who met the inclusion criteria and agreed to participate in the study were interviewed when they come for their antennal visits. This was done daily over a period of four weeks.

3.5 Inclusion and Exclusion Criteria

3.5.1 Inclusion

All pregnant women from ages 18 to 49 years with checked Hb from the laboratory, attended antenatal at the Mamobi General Hospital and who consented to participate in the study.

3.5.2 Exclusion Criteria

Pregnant women who did not consent to participate in the study were excluded. All pregnant women who were severely sick in the past two weeks were excluded. All pregnant women who were transfused in the past two weeks were also excluded.

3.6 Study Tools and Technique

A structured questionnaire was used to collect data. The questionnaire had two main sections A and B. Section A provided information on the socio-demographic characteristics of study participants. Section B provided information on dietary intake and the risk factors associated with anaemia in pregnancy. A questionnaire that was used in a similar study by various authors was adopted and modified to suit objectives in this study (Appendix 2).

3.7 Quality Assurance and Data Processing

The questionnaire was pre-tested at the Mamobi General Hospital before data collection began. Two research assistants were trained to assist in the data collection. Questionnaires were given to selected participants.

3.8 Study Variables

The study variables are made of both dependent and independent variables. The dependent variable in this study is level of haemoglobin at current visit (checked at the laboratory). The independent variables are demographic variables such as age, marital status, occupation, gestational age, level of education, gravidity and parity. Nutritional factors like 24-hour recall and other key food items like meat, fish and eggs intake were also discussed as part of the independent variables.

Table 3.1: Table of dependent and independent variable

Variable	Operational definition	Scale of measurement
Age of participant	Age in years of the pregnant woman as reported during the interview	Continuous
Hb at current visit	Hb level of pregnant woman's at ANC visit during the time of interview	Continuous
Current gestational age	Gestational age in weeks at current visit	Categorical
Gravidity	Number of times study participant has been Pregnant	Categorical
Level of education	The educational status stated by pregnant woman during interview	Categorical
Marital status	Refers to the marital status of the pregnant Woman	Categorical
Parity	Number of children of a pregnant woman	Categorical
Occupation	The work of the pregnant woman	Categorical
Residence	Where participants live at the time of interview	Categorical
Religion	Religious affiliation of pregnant women	Categorical
Tribe	Tribe of pregnant women	Categorical

3.9 Data Analysis

Stata version 15 was used to analysed the data. Univariate analysis was used performed on socio- demographic characteristics and risk factors of anaemia in pregnancy, Chi-squared test was used to assess associations and logistic regression analysis were used to test the strength of associations.

3.10 Ethical Considerations

The ethical considerations of this study includes the study approval, informed consent, privacy and confidentiality, voluntary participation and withdrawal, risks and benefits, and results dissemination and they have been explained below

Study Approval

Approval for the study was sought from the Ethical Review Committee of GHS, Research and Development Division in Accra. Formal permission was also sought from the medical director of Mamobi General Hospital. An introductory letter was written by the head of department of Epidemiology and Disease Control to the hospital that was presented to the medical director of Mamobi General Hospital.

Informed consent

The informed consent contains purpose of the study, the various procedures involved, potential risks and benefits of participating in the study and other important things were adequately discussed with participants in a language they better understood. Participants received detailed explanation of the study, assured of anonymity and all questions and sentiments pertaining to the study were answered and addressed appropriately to participants' satisfaction before they were allowed to participate in the interview. Participants who agreed to participate in the study were given written informed consent and allowed to read and sign before they were interviewed.

Participation was voluntary and respondents were reminded of their liberty of refusal to answer any question when they feel uncomfortable as well as total withdrawal from the study at any time if they wished.

Before the interview commenced, participants were assured of confidentiality. Names of participants were not requested. Each participant was given an identification code for easy

identification during data entry. Collected data were stored on the computer of the researcher with restricted access. Participants were assured that the information given would be used solely for academic purposes and their information was not shared with anyone. The results were presented and discussed without revealing the identities of the respondents and their responses.

Potential Benefits and Risk

There was minimal risk involved in the study and this usually came as taking few minutes of participants' time to answer the questions, which was a form of distress to the participants. Results of the study could contribute to a robust policy that would ensure that the necessary services needed to for pregnant women.

Dissemination of Results

The findings of this study was presented in a report and made available to the School of Public Health in the University of Ghana, School of Graduate Studies, Maamobi General Hospital.

Compensation

The participants were informed that there will be no compensation given in this study.

Conflict of interest

There is no conflict of interest to disclose.

Funding information

The researcher bore the total cost of the funding for the research without support from any third party.

CHAPTER FOUR

RESULTS

4.1 Background characteristics of study participants

This study involved four hundred and six pregnant women attending ANC clinic at the Mamobi General Hospital. The average age of the women was 28.47 ± 5.74 years with most (84.7%, 343/406) of them between the ages of 20 to 35 years. Majority (75.1%, 305/406) of the women were married with only one divorced. Junior high school (39.4%, 160/406) and Senior high school (34.5%,140/406) leavers dominated the study participants. Averagely, the number of household members was 3.43 ± 1.47 with majority (48.5%, 197/406) of them having 3 to 4 members. Hausa was the most predominant tribe. The average number of pregnancies experienced by each participant was 2.33 ± 1.27 with about one-third (33.6%, 136/406) of them having their first pregnancy. Folic acid supplement was accessed by more than two-thirds (88.9.%, 361/406) of the participants. Heavy menstruation was not an issue among about two-thirds of the women (61.8%, 251/405). Twenty-one (5.1%) women had experienced at least an episode of malaria during their pregnancy. About six in every ten selected participants owned a bed net (62.6%, 254/406). Sulphadoxine Pyrimethamine was received by 54.4% (221/406). Majority (92.7%, 377/406) of them had electricity in their house while the least (1.7%, 7/406) used candles. Toilet facility was not a problem as most of the women (78.1%, 314/402) had their own water closet with the majority (86.4%, 349/404) having their own pipe borne water. Details of background characteristics of study participants can be found in Table 4.1

Table 4.1: Background characteristics of study participants

Variables	Frequency	Percent
Age: Mean ± SD	28.47 ± 5.74	
15-19	20	4.94
20-25	113	27.9
26-30	131	32.35
31-35	99	24.44
36-40	34	8.4
41-45	8	1.98
Marital status		
Never Married	100	24.63
Married	305	75.12
Divorced	1	0.25
Educational Level		
None	23	5.67
Primary	29	7.14
JHS	160	39.41
SHS	140	34.48
Tertiary	54	13.3
Religion		
Christianity	270	66.5
Islam	135	33.25
Traditionalist	1	0.25
Household size		
Mean ± SD	3.43 ± 1.47	
1 – 2	125	30.79
3 – 4	197	48.52
5 – 6	71	17.49
7 – 9	13	3.2
Tribe		
Ewe	81	19.95
Guan	2	0.49
Akan	112	27.59
Ga	41	10.1
Hausa	170	41.87
Gravida		
Mean ± SD	2.33 ± 1.27	
One	136	33.58
Two	99	24.44
Three	101	24.94
>=4	69	17.04

Table 4.1: Background characteristics of study participants (cont'd)

Variables	Frequency	Percent
Parity		
Mean ± SD	1.35 ± 1.28	
None	135	33.33
One	99	24.44
Two	101	24.94
Three	45	11.11
>=4	25	6.17
Wealth quintile		
< GHC 300	81	20
GHS 301 – GHS 500	85	20.99
GHS 501 – GHS 1000	79	19.51
GHS 1001 – GHS 1500	88	21.73
> GHS 1500	72	17.78
G6PD		
No defect	316	82.29
Full defect	28	7.29
Partial defect	40	10.42
Folic acid supplementation		
No	45	11.08
Yes	361	88.92
Heavy menstrual flow before pregnancy		
No	251	61.82
Sometimes	152	37.44
Always	2	0.49
Malaria infection		
No	385	94.83
Yes	21	5.17
Bed Net Ownership		
No	152	37.44
Yes	254	62.56
Bed Net Use		
No	271	66.75
Yes	135	33.25
Sulphadoxine Pyrimethamine (SP)		
No	185	45.57
Yes	221	54.44

Table 4.1: Background characteristics of study participants (cont'd)

Variables	Frequency	Percent
Lighting system		
Electricity	377	92.7
Lantern	22	5.4
Candle	7	1.7
Toilet facility		
Own WC	314	78.1
Own KVIP	40	10.0
Public WC	35	8.7
Public KVIP	13	3.2
Water facility		
Own pipe borne water	349	86.4
Public pipe born water	23	5.7
Own well	19	4.7
Public well	11	2.7
Own borehole	2	0.5

*Own WC: Own water closet, Own KVIP: Own Kumasi ventilated improved pit, Public WC: Public water closet, Public KVIP: Public Kumasi ventilated improved pit.

4.2 Prevalence of Anaemia

In assessing the patients' anaemia status 209 of the 406 among the pregnant women were anaemic. The prevalence of anaemia was 53.3% (95% CI: 48.2 – 58.3%). This is shown in figure 4.1. About two-third (62.7%, 131/209) of the pregnant women were mildly anaemic while three participants had severe cases of anaemia. Details of the Intensity of Anaemia status among anaemic pregnant women attending ANC at Mamobi General Hospital are shown in Figure 4.2.

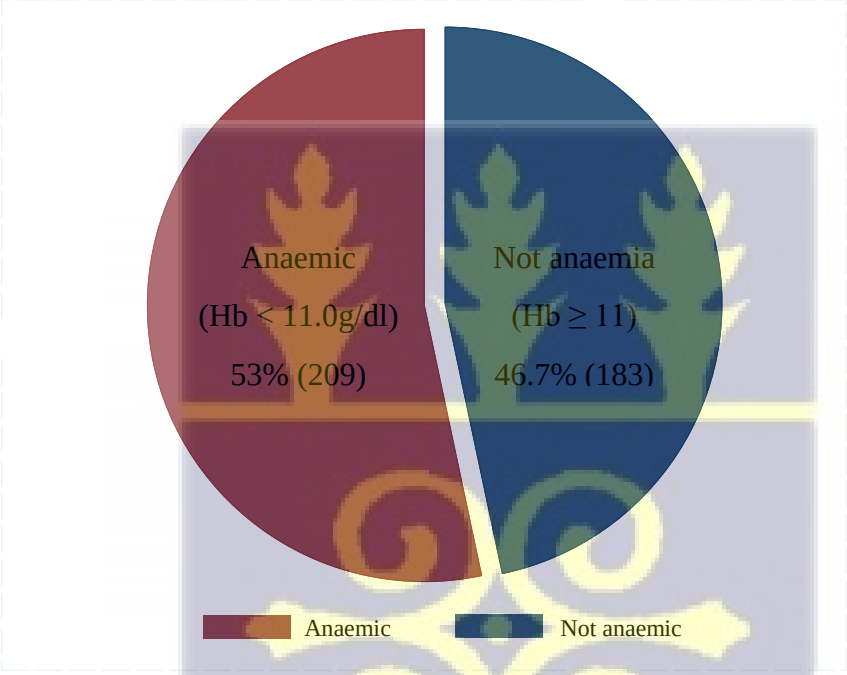

Figure 4.1: Anaemia status among pregnant women attending ANC at Mamobi General Hospital.

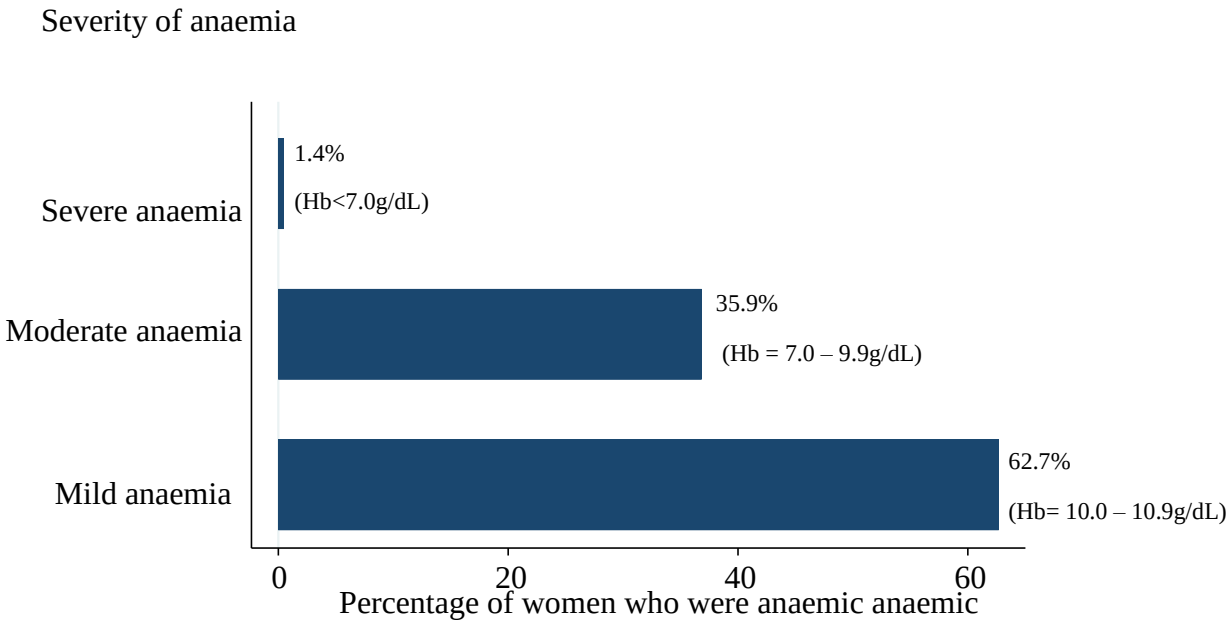

Figure 4.2: Severity of Anaemia status among anaemic pregnant women attending ANC at Mamobi General Hospital.

4.3 Association between background characteristics and anaemia status of pregnant women

Table 4.2 presents the test of association between background characteristics and (209/406) anaemia status of the 406 participants. From the chi-square tests, none of the background characteristics was significantly associated with anaemia status ($p>0.05$). The prevalence of anaemia among women who received folic acid supplement was relatively high than those who did not receive the supplement. However, this difference was not statistically significant (53.5% vs 4.5.5%, p=0.267). Regarding body size, the prevalence of anaemia reduced with bigger body size (pre-obesity and obesity) but this difference was not statistically identified to be significant ($p>0.05$). Anaemia was more prevalent among women who had experienced an episode of malaria during their pregnancy compared to those who did not have any malaria episode. However, the difference in the proportions was not statistically significant (71.4% vs 52.3%, p=0.087). Again segregation of the

severity of anaemia revealed that of the 209 participants that were anaemic, 1.4%(1/209) were severely anaemic (Hb<7g/dl) with most of them being mildly anaemic (Hb=10.0 - 10.9g/dl). Though there are several types of anaemias as thoroughly discussed in the literature review, iron deficiency anaemia was found to be the most prevalent (virtually all the women) among the pregnant women that presented with anaemia. Table 4.2a, 4.2b and 4.2c present the test of association between background characteristics and participants' anaemia status.

Table 4.2a: Association between background characteristics and participants' anaemia status.

	Anaemia			
(Age)	**No, n (%)**	**Yes, n (%)**	**chi-square**	**p-value**
Age			3.8811	0.567
15-19	6(31.58)	13(68.42)		
20-25	49(44.14)	62(55.86)		
26-30	64(50.39)	63(49.61)		
31-35	45(48.39)	48(51.61)		
36-40	14(42.42)	19(57.58)		
41-45	5(62.5)	3(37.5)		
Marital status				
Never Married	39(40.63)	57(59.38)		
Married	143(48.47)	152(51.53)		
Divorced	1(100)	0(0)		
Educational Level			2.9526	0.566
None	11(50)	11(50)		
Primary	10(35.71)	18(64.29)		
JHS	67(43.79)	86(56.21)		
SHS	68(50)	68(50)		
Tertiary	27(50.94)	26(49.06)		
Religion			1.156	0.561
Christianity	121(46.36)	140(53.64)		
Islam	61(46.92)	69(53.08)		
Traditionalist	1(100)	0(0)		
Tribe			2.1983	0.699
Ewe	39(50.65)	38(49.35)		
Guan	1(50)	1(50)		
Akan	55(50.46)	54(49.54)		
Ga	17(44.74)	21(55.26)		
Other	71(42.77)	95(57.23)		

Gravida			2.6455	0.45
One	57(43.18)	75(56.82)		
Two	51(53.68)	44(46.32)		
Three	44(44.9)	54(55.1)		
>=4	31(46.97)	35(53.03)		
Parity			3.4654	0.483
None	56(42.75)	75(57.25)		
One	52(54.74)	43(45.26)		
Two	44(44.9)	54(55.1)		
Three	19(45.24)	23(54.76)		
>=4	12(48)	13(52)		

Table 4.2b: Association between background characteristics and participants' anaemia status.

	Anaemia		chi-square	p-value
	No, n (%)	Yes, n (%)		
Body Size (BMI)			2.3309	0.312
Normal	27(37.5)	45(62.5)		
Pre-obesity	53(46.49)	61(53.51)		
Obese	83(47.98)	90(52.02)		
G6PD			0.1911	0.909
No defect	147(47.73)	161(52.27)		
Full defect	12(44.44)	15(55.56)		
Partial defect	18(50)	18(50)		
Folic acid supplementation			1.2308	0.267
No	24(54.55)	20(45.45)		
Yes	159(45.69)	189(54.31)		
Heavy menstrual flow			1.7745	0.412
No	116(47.15)	130(52.85)		
Sometimes	67(46.53)	77(53.47)		
Always	0(0)	2(100)		
Malaria infection			2.9245	0.087
No	177(47.71)	194(52.29)		
Yes	6(28.57)	15(71.43)		
Bed Net Use			0.0219	0.882
No	123(46.95)	139(53.05)		
Yes	60(46.15)	70(53.85)		
Sulphadoxine Pyrimethamine (SP)			0.0038	0.951
No	82(46.86)	93(53.14)		
Yes	101(46.54)	116(53.46)		

Table 4.2c: Association between background characteristics and participants' anaemia status.

	Anaemia			
	No, n (%)	**Yes, n (%)**	**chi-square**	**p-value**
Lighting system			0.6570	0.657
Electricity	171(47.0)	193(53.0)		
Lantern	8(38.1)	13(61.9)		
Candle	4(57.1)	3(42.9)		
Toilet facility			0.1911	0.909
Own WC	136(44.9)	167(55.1)		
Own KVIP	19(50.0)	19(50.0)		
Public WC	17(50.0)	17(50.0)		
Public KVIP	8(61.5)	5(38.5)		
Water facility			1.3080	0.874
Own pipe borne water	155(46.3)	180(53.7)		
Public pipe born water	11(47.8)	12(52.2)		
Own well	9(47.4)	10(52.6)		
Public well	7(63.6)	4(36.4)		
Own borehole	1(50.0)	1(50.0)		

4.4 Effect of background characteristics on anaemia status

Tables 4.3a and 4.3b shows the effects of background characteristics of study participants on anaemia status. A simple (unadjusted) and multiple (adjusted) binary logistic regression model were fitted. From the unadjusted regression model, none of the background

characteristics was individually significantly predictive of participants' anaemia status (p>0.050). However, after adjusting for other confounders (background characteristics), religion and receiving of folic acid supplement were significantly predictive of anaemia status. The odds being anaemic among women who received Folic acid supplementation was about 2.3 times higher compared to those who did not receive Folic acid supplementation (aOR: 2.31, 95% CI: 1.05 - 5.12). For religion, Muslims had 61% reduced odds of being anaemic compared to Christians (aOR: 0.39, 95% CI: 0.17 – 0.92).

Table 4.3a: Effect background characteristics on anaemia status

	Unadjusted			Adjusted		
	UOR	**95% CI**	**P-value**	**aOR**	**95% CI**	**P-value**
Age			0.580			0.839
15-19	1.00			1.00		
20-25	0.58	0.21 - 1.65		1.00	0.3 - 3.29	
26-30	0.45	0.16 - 1.27		0.71	0.21 - 2.45	
31-35	0.49	0.17 - 1.41		0.92	0.24 - 3.47	
36-40	0.63	0.19 - 2.06		1.04	0.23 - 4.77	
41-45	0.28	0.05 - 1.56		0.46	0.06 - 3.79	
Marital status						0.321
Never Married	1.00			1.00		
Married	0.73	0.46 - 1.16	0.181	0.71	0.37 - 1.39	
Divorced	1.00			1.00		
Educational Level			0.57			0.322
None	1.00			1.00		
Primary	1.80	0.58 - 5.62		1.99	0.5 - 7.83	
JHS	1.28	0.52 - 3.14		1.21	0.39 - 3.79	
SHS	1.00	0.41 - 2.46		0.75	0.24 - 2.4	
Tertiary	0.96	0.36 - 2.6		0.92	0.25 - 3.31	
Parity			0.487			0.571
None	1.00			1.00		
One	0.62	0.36 - 1.05		0.91	0.4 - 2.08	
Two	0.92	0.54 - 1.55		1.65	0.68 - 3.96	
Three	0.90	0.45 - 1.82		1.23	0.37 - 4.1	

>=4	0.81	0.34 - 1.91		1.29	0.33 - 5.04	
house_size			0.445			0.249
1-2	1.00			1.00		
3-4	0.70	0.44 - 1.12		0.49	0.23 - 1.05	
5-6	0.75	0.41 - 1.36		0.48	0.18 - 1.24	
7-9	1.13	0.35 - 3.65		1.00	0.22 - 4.46	
Body Size (BMI)			0.314			0.485
Normal	1.00			1.00		
Pre-obesity	0.69	0.38 - 1.26		0.65	0.33 - 1.31	
Obese	0.65	0.37 - 1.14		0.73	0.36 - 1.46	
Religion						0.032
Christianity	1.00			1.00		
Islam	0.98	0.64 - 1.49	0.916	0.39	0.17 - 0.92	
Traditionalist	1.00			1.00		

Table 4.3b: Effect background characteristics on anaemia status

	Unadjusted			Adjusted		
	UOR	**95% CI**	**P-value**	**aOR**	**95% CI**	**P-value**
Tribe			0.7			0.203
Ewe	1.00			1.00		
Guan	1.03	0.06 - 17.01		1.00		
Akan	1.01	0.56 - 1.81		1.11	0.57 - 2.17	
Ga	1.27	0.58 - 2.77		1.24	0.5 - 3.03	
Hausa	1.37	0.8 - 2.36		2.58	1.03 - 6.44	
G6PD			0.909			0.771
No defect	1.00			1.00		
Full defect	1.14	0.52 - 2.52		1.41	0.55 - 3.63	
Partial defect	0.91	0.46 - 1.82		1.02	0.43 - 2.43	
Folic acid supplementation			0.269			0.038
No	1.00			1.00		
Yes	1.43	0.76 - 2.68		2.31	1.05 - 5.12	
Heavy menstrual flow			0.905			0.431
No	1.00			1.00		
Sometimes	1.03	0.68 - 1.55		0.80	0.46 - 1.39	
Always	1.00			1.00		
Malaria infection			0.095			0.116
No	1.00			1.00		
Yes	2.28	0.87 - 6.01		2.49	0.8 - 7.79	
Bed Net Use			0.882			0.828
No	1.00			1.00		

Yes	1.03	0.68 - 1.57		1.06	0.64 - 1.76	
Sulphadoxine Pyrimethamine (SP)			0.951			0.891
No	1.00			1.00		
Yes	1.01	0.68 - 1.51		1.04	0.58 - 1.87	

Table 4.3c: Effect background characteristics on anaemia status

	Unadjusted			Adjusted		
	UOR	**95% CI**	**P-value**	**aOR**	**95% CI**	**P-value**
Lighting system			0.622			0.899
Electricity	1.00			1.00		
Lantern	1.44	0.58 - 3.56		1.56	0.61 - 4.00	
Candle	0.66	0.17 - 3.01		0.64	0.14 - 2.32	
Toilet facility			0.603			0.899
Own WC	1.00			1.00		
Own KVIP	0.81	0.41 - 1.60		0.91	0.44 - 1.90	
Public WC	0.81	0.40 - 1.66		0.82	0.38 - 1.74	
Public KVIP	0.51	0.16 - 1.59		0.47	0.14 - 1.60	
Water facility			0.859			0.899
Own pipe borne water	1.00			1.00		
Public pipe born water	0.94	0.40 - 2.19		0.97	0.40 - 2.40	
Own well	0.96	0. 38 - 2.41		1.22	0.44 - 3.41	
Public well	0.49	0. 14 - 1.71		0.51	0.14 - 1.89	
Own borehole	0. .86	0.05 - 13.88		0.70	0.04 - 12.15	

CHAPTER FIVE

DISCUSSION

This study was undertaken to determine the prevalence of anaemia and its associated factors among pregnant women attending ANC at the Mamobi General Hospital in Accra.. Anaemia among pregnant women is one of the widespread public health problems in lower and middle income countries across the globe. Maternal death is increased by up to 5-folds when complicated with anaemia in pregnancy (Gedefaw, Ayele, Asres, & Mossie, 2015). The effects of maternal anaemia can be detrimental to both the mother and the foetus (both born and unborn) (Sharma et al., 2016). These are but some few reasons why this study investigated the prevalence and factors that are associated with anaemia among pregnant women.

The prevalence of anaemia in this study was 53.3% as shown by figure 4.1. This figure reflects the national prevalence of anaemia that is consistently high. This high prevalence is not different from those that were established by multiple studies conducted in various countries (Bencaiova, Burkhardt, & Breymann, 2012; Klemm et al., 2011; Van Den Broek et al., 2000). Certain authors, however, found a lower prevalence of anaemia compared to the one in this study (Lebso, Anato, & Loha, 2017; Stephen et al., 2018).

Of the 53.3% pregnant women that were anaemic, 62.7% presented with mild anaemia, 35.9% presented with moderate anaemia and 1.4% were severely anaemic as shown in figure 4.2 above. A similar investigation in Addis Ababa, Ethiopia, carried out by Gebreweld, Bekele, & Tsegaye, (2018) revealed similar patterns of the severity of anaemia among pregnant women. However, a study by Tomar, Singhal, & Shukla, (2017) found moderate anaemia among the pregnant women to be quiet high (50.4%), which contradicts the current finding.

None of the predictors was individually associated with anaemia among pregnant women.

According to Kassa et at., (2017), anaemia in pregnancy is linked with several negative outcomes that may include: increased maternal morbidity and mortality, increased perinatal morbidity and mortality, increased obstetric complications and maternal physical and psychological comorbidity.

The chi-square test of association between the background characteristics of participants and anaemia did not yield any significant association, $p<0.05$. Olatunbosun et al., (2014) conducted a similar study in Oyo state, Nigeria and they also concluded on similar results.

The prevalence of anaemia among women who received folic acid supplement was relatively high compared to those who did not receive the supplement. However, this difference was not statistically significant (53.5% vs 4.5.5%, $p=0.267$). This could be attributed to malabsorption or their excess consumption of tea and coffee. It is also possible that those who received the folic acid did not really consume it as some of them complain of nausea after taking folic acid.

Participants with higher BMIs were less anaemic as compared to those with lower BMIs even though this identified difference was not statistically significant ($p>0.05$). This maybe be attributed to participants with higher BMIs, consuming less of iron containing foods. A study that was conducted in a similar setting in Wolayita Sodo Town, Ethiopia, showed a statistically significant association between low BMI and anaemia status of pregnant women (Alemayehu, Gedefaw, Yemane, & Asres, 2016).

Participants who had experienced an episode of malaria during their pregnancy were more prone to be anaemic compared to those who did not have any malaria episode. The difference in the proportions, however, was not statistically significant (71.4% vs 52.3%, $p=0.087$). Malaria is known to cause the breakdown of the RBCs, which in turn leads to haemolytic anaemia. This finding contradicts a study that was conducted in Madang, Papua

New Guinea, where malaria was found to be significantly associated with maternal anaemia (Andrew, Pell, Angwin, Auwun, & Daniels, 2015).

Only religion and receiving of folic acid supplement were significantly associated with anaemia status after adjusting for confounders in multiple logistic regression. Other studies across the globe have also established significant relationship between the religion of pregnant women and folic acid tablet supplementation with anaemia (Kozuma, 2009; Rehab, Ruqaya, Shayma, Azhar, & Faisal, 2014; Sato, Fujimori, Szarfarc, Borges, & Tsunechiro, 2010). Others however, did not find a statistically significant association religion of study participants and their anaemia status (Kavle & Landry, 2018; Lin et al., 2018; Polin et al., 2013).

5.1 Limitations of this study

1- The research was conducted at the Mamobi General Hospital. This constitutes selection bias simply because the pregnant women that visit the ANC are different from those who do not visit the Mamobi General Hospital.

2- The questionnaire was full of structured questions which made it impossible for respondents to freely express themselves.

3- The study was designed such that, women who were visiting the ANC for the first time with substantially higher anaemia were excluded.

4- Findings cannot be used to generalize for the regional population because the study was carried out in only one health facility

CHAPTER SIX

CONCLUSION AND RECOMMENDATIONS

6.1 Conclusion

The overall prevalence of anaemia (Hb < 11.0g/dl) among pregnant women attending ante natal care (ANC) at the Mamobi General Hospital was determined to be 53.3%. The severity of anaemia among the pregnant women were as follows: 62.7% were mildly anaemic, 35.9% were moderately anaemic while 1.4% were severely anaemic.

Religion and folic acid tablet supplementation were the only factors that were significantly associated with anaemia during pregnancy in this study after adjusting for confounders. All other demographic characteristics of participants, their socio economic status and clinical data were not significantly associated with maternal anaemia.

6.2 Recommendations

Women should be encouraged by health professionals including midwives, nurses, and health promotion officers to consume the folic acid tablets being given to them to help reduce maternal anaemia in the metropolis and the country at large.

Management of the hospital in collaboration of health professionals, particularly midwives and health promoters should put measures in place to encourage and intensify health promotion that is specifically targeted at lowering the prevalence of anaemia among pregnant women. This when executed well, will help to reduce the prevalence of anaemia among the pregnant women.

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APPENDICES

Appendix 1: Participants Information Sheet

The Information Sheet provides information about the research for participants to make an informed decision of whether to participate in the study or not. It outlines the nature of the research, what the research involves, risks, benefits, compensation (if there is none, this should be stated).

Title of Study

ANAEMIA IN PREGNANCY AND ASSOCIATED RISK FACTORS: A CROSS-SECTIONAL STUDY OF ANTENATAL ATTENDANTS AT MAMOBI GENERAL HOSPITAL

Introduction: I am Fatouma Ousman a postgraduate student of the school of public health, University of Ghana Legon and the principal investigator of the research, I am in the department of Epidemiology and Diesease Control. My Email address is fatimaho561@gmail.com and my phone number is : 05411729241

Background and Purpose of research: Anaemia is a health problem that is associated with a decrease in the volume of red blood cell as well as reduction in the mean hemoglobin concentration in the blood. Hemoglobin is responsible for carrying oxygen to tissues and organs in the body. Anaemia in children in impairs their mental and physical growth and increases morbidity and mortality. Anaemia can be a particularly serious problem for pregnant women, leading to premature delivery and low birth weight. Iron deficiency anaemia is the most common micronutrient deficiency, and anaemia is often described as an indicator of both poor nutrition and poor health (GDHS, 2014).

Anaemia is part of the top ten diseases that was recorded in Ghana. It ranked second among the top ten admission list in 2016 in the Greater Accra region with total admission of 49391

patients. The prevalence of anaemia among antenatal care registrants and those at 36 weeks of gestation is 34% and 21% respective (GHS DH Annual Report, 2016). The prevalence of anaemia among pregnant women who visit the Mamobi Polyclinic can only be reduced if the factors that cause it are determined. Findings from this study will be useful in providing appropriate preventive measures to reduce the maternal mortality of which anaemia is the leading cause in Ghana (Ghana Statistical Service, Ghana Health Service, & ICF, 2018).

Nature of research: This is a cross-sectional study that seeks to estimate the prevalence of anaemia in pregnant women and its associated risk factors. The number of participant is 372 people, participants would be required to answer a structured questionnaire that is made of socioeconomic, socio-demographic and dietary intake. Their ANC booklets will also be checked for Hb level and other important information.

Participants involvement:

Duration Taking part in this study will take about 20 minutes of your time and we expect your honest response in answering of the questions.

Potential Risks: There is minimal risk involved in the study and may usually come as taking few minutes of participants' time to answer the questions, which might be a form of distress to you.

Benefits: participants will not benefit in kind or cash, but findings would be made available to the hospital which can be used improve treatment and care of pregnant women.

Costs: There will be no personal cost incurred by you for taking part in this research except for your time to respond to questions should you agree to participate in the study.

Compensation: You will be given a token of soap for your time to participate in this study.

Confidentiality: Your responses will be confidential and your identity will not be known to anyone. This will be ensured by assigning codes to you. Completed questionnaire will be

kept in a locked cabinet after data analysis and can be accessed by only the Principal Investigator and will be destroyed when it is no longer relevant to the research – after five years. Information from this research will be used solely for this study and any publications that may result from this study.

Voluntary participation/withdrawal: participation is voluntary and participants have the right to decline to participate and also withdraw from the study at any time without penalty and without having to give any reasons.

Outcome and Feedback: The findings of this study will be presented in a report and made available to the School of Public Health in the University of Ghana, the Health directorate, the health facility, among the pregnant women, various stakeholders and policy makers in the country's health sector and the ethics committee. Presentations will also be held to present the findings of the study to the drug users. The researcher also intends to use the findings to write manuscripts for publications in academic journals.

Feedback to participant: a copy of the final work will be made available to the ANC so that the findings may be communicated to the pregnant women.

Funding information: The researcher will bear the total cost of the funding for the research without support from any third party.

Sharing of participants Information/Data: The data collected will be used solely for academic purpose. It will not be shared with any organization or individuals.

Provision of Information and Consent for participants

You will be given signed or thumb-printed informed consent form and information sheet to keep.

Who to Contact for Further Clarification/Questions:

This research has been reviewed and approved by the Ghana Health Service Ethic Review Committee. For questions and enquires about this study, you may contact the principal investigator or her supervisor through the following addresses:

1.Name: FATOUMA OUSMAN,

UNIVERSITY OF GHANA SCHOOL OF PUBLIC HEALTH

Tel: 0541729241

Fatimaho561@gmail.com

2. DR: PRISCILIIA AWO NORTEY

Tel:0208181120

panortey@gmail.com

If you have any question(s) or further clarification concerning ethical issues and rights as participants , please do not hesitate to contact ;

Ms.Hannah Frimpong,

Administrator

Ghana Health Service Ethical Review Committee Secretariat, Accra

Tel:(+233) 50 704 1223 /243235225

Email: Hannah.Frimpong@gmail.org

Appendix 2: Participants' Informed Consent Form

I acknowledge that I have read or have had the purpose and contents of the Participants' Information Sheet read and satisfactorily explained to me in a language I understand (English □/Twi □/ Hausa □). I fully understand the contents and any potential implications as well as my right to change my mind (ie withdraw from the research) even after I have signed this form.

I voluntarily agree to be part of this research.

Name or Initials of Participant…….. ID Code ……..

Participants' Signature ……OR Thumb Print…… OR Mark (Please specify)…….

Date:…….

INTERPRETERS' STATEMENT (where applicable)

I interpreted the purpose and contents of the Participants' Information Sheet to the afore named participant to the best of my ability in the (English □/Twi □/ Hausa □) language to his proper understanding.

All questions, appropriate clarifications sort by the participant and answers were also duly interpreted to his/her satisfaction.

Name of Interpreter……

Signature of Interpreter…….. Date:……

Contact Details

STATEMENT OF WITNESS (where applicable)

I was present when the purpose and contents of the Participant Information Sheet was read and explained satisfactorily to the participant in the language he/she understood (English □/Twi □/ Hausa □).

I confirm that he/she was given the opportunity to ask questions/seek clarifications and same were duly answered to his/her satisfaction before voluntarily agreeing to be part of the research.

Name:……

Signature……. OR Thumb Print ……..... OR Mark (please specify)……..

Date:……

INVESTIGATOR STATEMENT AND SIGNATURE

I certify that the participant has been given ample time to read and learn about the study. All questions and clarifications raised by the participant have been addressed.

Researcher's name…….

Signature …….

Date…….

Appendix 3: Questionnaire

This research is being conducted by a student from School of Public Health, University Of Ghana. The purpose of the study is to **determine the prevalence of anaemia among women attending Ante-natal clinics in the Mamobi General Hospital**. Confidentiality of responds will be ensured and names of respondents will not be included in reports.

Participant code ☐ ☐ ☐ Date: ……..

Facility name: ……

Section A: Demographic Characteristics of Respondent

Serial no.	**Field name**	**Questions**	**Coding**	
100	Age	How old are you? (in completed years)	…….	
102	MarSta	What is your marital status?	1. Never Married 2. Married 3. Divorced 4. widowed	[ ]
103	EduLvl	What is your educational level?	1. No formal education 2. Primary 3, Junior High School 4. Secondary 5. Tertiary	[ ]
104	Residence	Where do you live?	…….	
105	Occu	What is your occupation?	…….	

106	Rel	What is your religion?	1. Christianity 2. Islam 3. Traditionalist	[ ]
107	Tribe	What is your tribe?	1. Ewe 2. Guan 3. Akan 4. Ga 5. other (Specify)……	[ ]
108	Par	What is your parity?	……	
109	Gra	What is your gravida?		

Section B: Clinical Data

Serial no.	Field name	Clinical variable	Coding
201	Hb	Haemoglobin level	_____g/dl

Section C: Health of Mothers attending ANC

Serial no.	Field name	Health status question	Coding	
301	PstIrn	Has respondent ever take iron and Folic acid supplementation during pregnancy?	1. Yes 2. No	[ ]

302	HvyFlw	Did respondent experience heavy menstrual flow when not pregnant?	1. No 2. Sometimes 3. Always	[ ]
303	Mal	Have you had malaria infection During this pregnancy	1. No 2. Yes	[ ]
304	Net	Do you have a treated mosquito net?	1. No 2. Yes	[ ]
305	Nig	Did you sleep under mosquito net last night? 1. No 2. Yes	1. No 2. Yes	[ ]
306	Sp	Have you taken Sulphadoxine Pyrimethamine (SP) during this pregnancy?	1. No 2. Yes	[ ]
		If Yes, how many times?	……..	

Section D: Socio economic status of respondents

Serial no.	**Field name**	**Health status question**	**Coding**	
401	FAS	What is your Family size?	…….	
402	RSTY	Residence type	1=Own house 2= Shared ownership 3= Rented apartment 4= Government estate 5=Other.....	[ ]
403	BMT	What building material is your house made of?	1= Cement 2= Bricks 3= Laterite 4= Mud	[ ]

404	RAV	How many rooms are available to you in the house?	1= >5 2= 3-5 3= 1-2	[ ]
405	LITY	What lighting system do you have?	1= Electricity 2= Lantern 3= Candle 4= Other (specify).....	[ ]
406	TOI	What toilet facility is available to you?	1= Own WC 2= Own KVIP 3= Public WC 4= Public KVIP	[ ]
407	WTR F	What water facility do you use?	1= Own pipe borne water 2= Public pipe borne 3= Own well 4= Public well 5= Own borehole 6= Public borehole 7= River/stream	[ ]
408	 SSA SSB SSC SSD SSE	Do you have any of the following items in your home? Television Radio Refrigerator Fan Blender	 1= Yes 2= No 1= Yes 2= No 1= Yes 2= No 1= Yes 2= No 1= Yes 2= No	[ ]

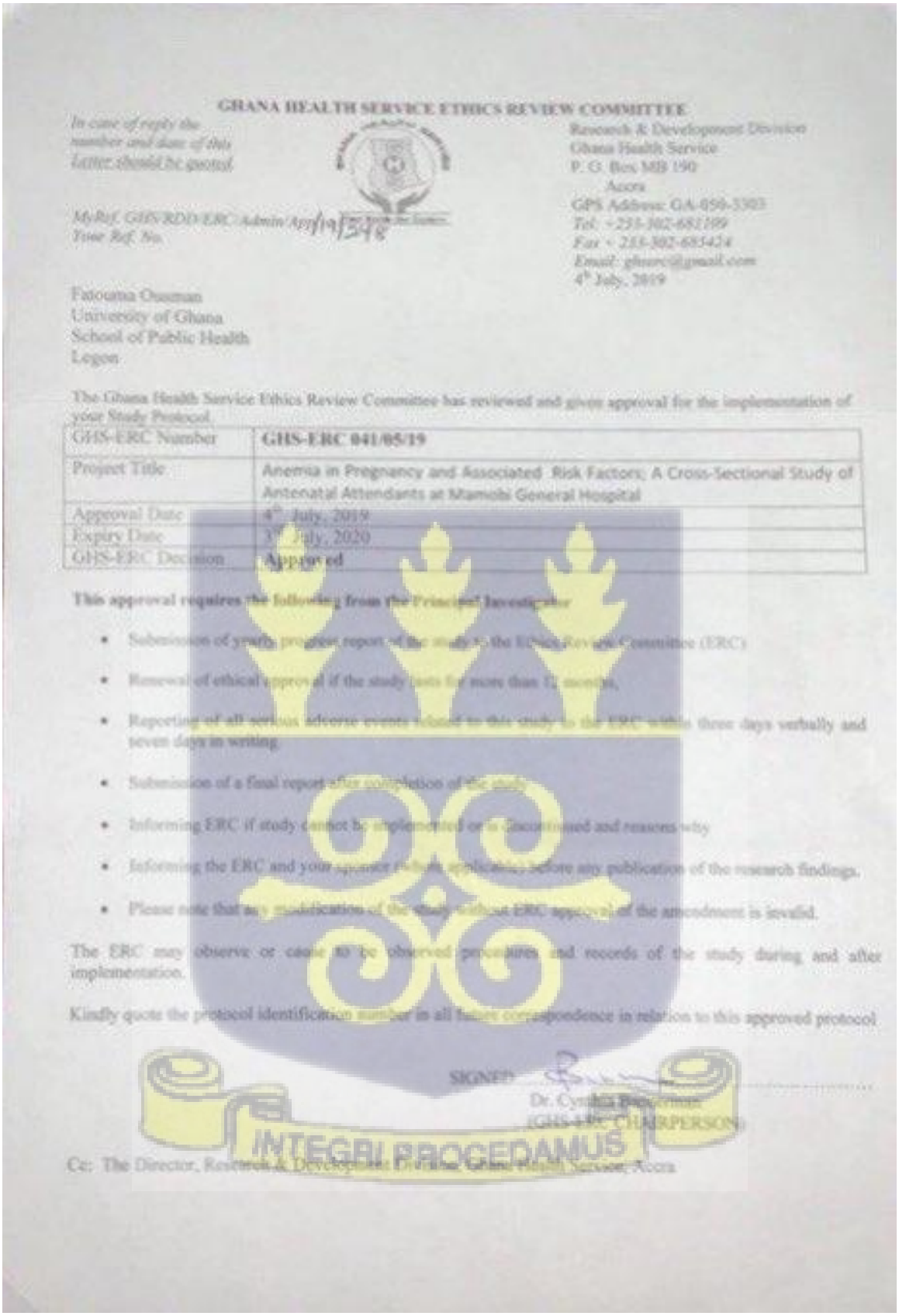
Section E: Dietary diversity of respondents (The respondent is to list the food eaten the previous day)

DIETARY DIVERSITY (24 HOUR RECALL)					
BREAKFAST	SNACK	LUNCH	SNACK	SUPPER	SNACK

Name of interviewer ……

THANK YOU FOR YOUR TIME

Appendix 4: Ethical Clearance



GHANA HEALTH SERVICE ETHICS REVIEW COMMITTEE

In case of reply the number and date of this letter should be quoted.

My Ref: GHS/RDD/ERC/Admin/Appl/19/1348
Your Ref. No.

Research & Development Division
Ghana Health Service
P. O. Box MB 190
Accra
GPS Address: GA-050-5303
Tel: +233-302-681109
Fax + 233-302-685424
Email: ghsrrc@gmail.com
4th July, 2019

Fatouma Ousman
University of Ghana
School of Public Health
Legon

The Ghana Health Service Ethics Review Committee has reviewed and given approval for the implementation of your Study Protocol.

GHS-ERC Number	**GHS-ERC 041/05/19**
Project Title	Anemia in Pregnancy and Associated Risk Factors; A Cross-Sectional Study of Antenatal Attendants at Mamobi General Hospital
Approval Date	4th July, 2019
Expiry Date	3rd July, 2020
GHS-ERC Decision	Approved

This approval requires the following from the Principal Investigator

- Submission of yearly progress report of the study to the Ethics Review Committee (ERC)
- Renewal of ethical approval if the study lasts for more than 12 months.
- Reporting of all serious adverse events related to this study to the ERC within three days verbally and seven days in writing.
- Submission of a final report after completion of the study.
- Informing ERC if study cannot be implemented or is discontinued and reasons why.
- Informing the ERC and your sponsor of any amendments before any publication of the research findings.
- Please note that any modification of the study without ERC approval of the amendment is invalid.

The ERC may observe or cause to be observed procedures and records of the study during and after implementation.

Kindly quote the protocol identification number in all future correspondence in relation to this approved protocol.

SIGNED: .....
Dr. Cynthia Boakye
(GHS-ERC CHAIRPERSON)

Cc: The Director, Research & Development Division, Ghana Health Service, Accra