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SCHOOL OF PUBLIC HEALTH

COLLEGE OF HEALTH SCIENCES

UNIVERSITY OF GHANA, LEGON

ANAEMIA IN PREGNANCY AMONG ANTENATAL ATTENDANTS AT THE SUNYANI MUNICIPAL HOSPITAL.

BY

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Declaration

I Anlaakuu Peter hereby declare that apart from references to other people's work, which have been duly acknowledged, this dissertation is as a result of my own fieldwork which was carried out under supervision. I further declare that this work has never been submitted in part or whole for the award of any degree in any institution.

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Dedication

I dedicate this work to the Almighty God who gave me the grace to complete this work successfully.

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Acknowledgement

To God be the highest glory, for his unmerited love, guidance and mercies for me throughout my study period. To the Anlaakuu's family for their prayers, unwavering and unending moral and financial support throughout my study in school. To my academic supervisor, Dr. Francis Anto I am most grateful. I could not have finished this work without you. I want to specially thank the head of department of Epidemiology and Disease Control Dr. Patricia Akweongo for her encouragement, to Prof. George Armah the head department electron microscopy (Noguchi memorial institute of medical research university of Ghana, legon.) Dr. Seth Owusu-Adjei the Director, Kintampo Health Research Center and the entire faculty of Epidemiology and Disease Control.

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Abstract

Anaemia in pregnancy is an important public health problem especially in developing countries. It is a major cause of maternal morbidity and mortality, and also has a significant impact on the health of the foetus. The purpose of the current study was to determine the prevalence and risk factors associated with anaemia among pregnant women receiving antenatal care at the Sunyani Municipal Hospital. A cross-sectional study was conducted from May to June, 2015, on 316 pregnant women who attended antenatal care (ANC) at the Sunyani Municipal Hospital. Data on socio demographic and, obstetric characteristics, medical intervention and malaria infection, consumption of iron and iron containing foods of participants were collected using checklist and a structured questionnaire. Also data on haemoglobin level at first and current pregnancy was collected. Data was analyzed descriptively and factors associated with anaemia were assessed. Out of the 316 pregnant women studied, 131(41.5%) were found to be anaemic (Hb<11 g/dl) at the period of interview; with a mean of 11.24g/dl and range from 8.10g/dl to 14.5g/dl. One hundred and sixteen (80.9%) were mildly anaemic (Hb: 9.0—10.9g/dl), 25(19.1%) were moderately anaemic (Hb: 7.0 – 8.9g/dl). The prevalence of anaemia was (44.30%) in pregnant women who made the recommended four antenatal visits. Age of pregnant woman COR 0.26(0.10 – 0.70) p=0.007, gestational age at first visit AOR 1.92 (1.14 – 3.23) P =0.014, malaria infection AOR 0.47 (0.25 – 0.90) P =0.021, consumption of fish and snails COR 0.30 (0.11 – 0.820) p =0.02, occupation COR 3.0 (1.07 – 8.40) p = 0.037 and number of ANC visit COR 0.04 (0.27 – 0.96) P=0.04 were significants determinant of anaemia in pregnancy.

The prevalence of anaemia in antenatal care attendees of Sunyani Municipal Hospital is high. Educating women on early antenatal booking, age of pregnancy, occupation, prevention and treatment of malaria infection and dietary advice should be emphasized more strongly in the antenatal care unit

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LIST OF ACRONYMS

AIDS	Acquired Immunodeficiency Syndrome
ANC	Antenatal Clinic
AOR	Adjusted Odds Ratio
APGAR	Appearance, Pulse, Grimace, Activity and Respiration
BARD	Brong Ahafo Regional Health Directorate
COR	Crude Odds Ratio
C L	Confidence Interval
GDHS	Ghana Demographic Health Survey
GHS	Ghana Health Service
WHO	World Health Organization
Hb	Haemoglobin
HIV	Human Immunodeficiency Virus
IPT	Intermittent Preventive Treatment
MCH	Maternal and Child Health
RBC	Red Blood Cell
SDA	Seventh Day Adventist
SP	Sulphadoxine pyrimethanine
SMH	Sunyani Municipal Hospital
OPD	Outpatient Department
PHC	Primary Health Care
ZDV	Zidovudine

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CHAPTER ONE

Introduction

1.1 Background Information

Pregnancy is not just a matter of waiting to give birth but a joyful and a fulfilling period in a woman's life. It can also be one of the experiences of misery and suffering when complication and adverse circumstances compromise the pregnancy, causing ill health or even death (Patil, 2013). Reduction of haemoglobin is usually accompanied by a decrease in red blood cell count and packed cell volume (PCV, haematocrit) (WHO, 2001). For an individual of a certain sex, age and place of residence, the blood haemoglobin value must be below a reference value for the condition to be described as anaemic. Anaemia itself is not a disease but it is an indication of an underlying illness or morbid condition (Okoro, 2005).

Anaemia is a major public health problem throughout the world, particularly for women of reproductive age in developing countries. In most countries in the world, about 56million pregnant women are estimated to be anaemic. The global prevalence of anaemia in pregnancy is estimated to be approximately 41.8% varying from a low of 5.7% in the USA to a high of 75% in Gambia (Chathuranga, Balasuriya, & Perera, 2014). In USA, anaemia in pregnancy was estimated to increase from 1.8% to 27.4% in the first and third trimester respectively. Some women are anaemic prior to the index pregnancy and others become progressively anaemic during pregnancy (Goonewardene, Shehata, & Hamad, 2012).

Anaemia in pregnancy is 61% in developing countries (WHO/FHE/MSM/93.5) with a high incidence and severity occurring among pregnant women living in malaria endemic areas and Africa account for about 20% of maternal death due to anaemia in pregnancy with fetuses at high risk of preterm deliveries, low birth weight and perinatal mortality as a result of impairment of

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oxygen to the placenta (Idowu, Mafiana, & Dapo, 2005). Women often become anaemic during pregnancy because of high demand for iron and other vitamins due to physiological burden of the pregnancy. The inability to meet the required level for these substances either as a result of dietary deficiencies or infections gives rise to anaemia (Van den Brock, 1996).

Anaemia ranges from mild, moderate to severe and the WHO pegs the haemoglobin level for each of these types of anaemia in pregnancy at 10.0-10.9g/dl (mild anaemia), 7-9.9gldl (moderate anaemia), and <7g/dl (severe anaemia) (WHO,2001).

1.2 Causes of Anaemia

Anaemia in pregnancy is mainly caused by iron deficiency, genetic, parasite infection and worm infestation. It is estimated that about 44million pregnant women are infected with worms globally (WHO, 2010). In sub-Saharan Africa, worms, schistosomiasis and malaria infection contribute to 25% of anaemia in pregnant women (Rush, 2000). A study in coastal Kenya reported that about 32% of pregnant women were infested with worms, 31% with urogenital schistosomiasis and almost 43% with malaria *(Plasmodium falciparum),* while more than 46% of the pregnant women were co-infected with two or more of these parasites (McClure et al., 2014).

Pregnant women living in endemic areas are at higher risk of acquiring malaria than non pregnant women due to the reduction of immune response to the malaria parasite (Clerk, Bruce, Greenwood, & Chandramohan, 2009).

1.3 Dietary Deficiencies

Iron deficiency is the most wide spread nutritional deficiency in the world, and pregnant women are at higher risk of developing iron deficiency anaemia (Ramakrishnan, 2002). Although such deficiency is a problem mainly in developing countries, it also affects 10% - 30% of pregnant

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women in the industrialized world (Hereberg at el; 2001). The effect can be more severe in women with more than one child because during pregnancy iron demand is augmented to increase the red cell mass, the expansion of the plasma volume allows for the growth of the foetus (Rodriguez Bernal, Rebagliato, 2012). Study on iron digestion is based on the important role of both gastric hydrochloric and ascorbic acid that reduces ferric iron to ferrous iron and the process is dependent on an acidic PH. The formation of soluble monomeric chelates with ferric iron, reducing its polymerization, these chelates need an intragastric acidic PH to be formed. Gastric acid secretion is considered the most important factor for the availability of non-haem iron (Annibale, Capurso, & Fave, 2003).

At the antenatal clinics, even though iron supplement is given to the pregnant women to improve their haemoglobin level; most pregnant women do not respond adequately to oral iron therapy due to problems associated with ingestion of the tablets and their side effects, thereby resulting in low compliance (Khalafallah et al., 2010).

1.4 Effects of Anaemia in Pregnant Women

Anaemia is an important risk factor in pregnancy and it is associated with an increase incidence of both maternal and foetal morbidity and mortality. Maternal anaemia also contributes to an increase in perinatal mortality, low birth weight, low APGAR score, still birth and foetalwastage. Each year more than half a million women die from pregnancy related causes and about 85% are found in developing countries (WHO/MCH/MSM/91.6). In pregnancy, insufficient blood circulation has a significant effect on the placenta. The ability of the foetus to grow in the uterus is presumed to be the function of the placenta which is responsible for the exchange of respiratory gases and nutrients (Mahamuda, Feroza, & Shamim, 2011). Anaemia in pregnancy reduces tolerance to blood loss and leads to impaired function and cardiac failure (Bondevik et

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al., 2000). In India anaemia is directly responsible with obstetric haemorrhage, and is estimated to account for over 45% of cases of maternal death (Kalaivani, 2009).

1.5 Haemoglobinopathies and G6PD Deficiency

G6PD deficiency affects about 30% of pregnant women in Ghana (GHS, 2010), and is the commonest red blood cell enzyme which shortens red blood cell lifespan which is associated with certain medications. Haemolytic anaemia induced by infection may be a more common cause of clinically significant haemolysis in patients with G6PD deficiency (Bendzrah at al., 2008).

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1.6 Problem Statement

Anaemia during pregnancy is a frequent finding in Ghana and can increase morbidity and mortality in both mother and child and hinder the attainment of Millennium Development Goal five (MDG5). In the year 2003, it was estimated that 200 women die during pregnancy and childbirth as a result of complications related to anaemia (GHS, 2003 annual report). To help address this situation, the Ghana Health Service instituted a policy aimed at improving haemoglobin levels during pregnancy by giving iron supplementation, health education on nutrition, ensuring quality of care, prevention of malaria infection through the administration of Intermittent Preventive Treatment and prevention of helminthes infestation through the administration of albendazole in the year 2003.

In-spite of this intervention, anaemia in pregnancy is still a major problem in some health service delivery centers in the country. In 2010, the Ghana Health Service ranked anaemia in pregnancy sixth among the top ten diseases in the country (GHS, 2010 annual report). In 2013, whiles anaemia was found in 29.0% (24,771/85,429) of pregnant women screened at the various antenatal clinics in the Brong Ahafo Region, the situation was more serious among those who were screened at the Sunyani Municipal Hospital. At the Sunyani Municipal Hospital, 37.5% (538/1434) of pregnant women who were screened were found to be anaemic (BAHD, 2013 annual report). The purpose of the current study therefore is to identify factors associated with anaemia in pregnancy among antenatal attendants at the Sunyani Municipal Hospital.

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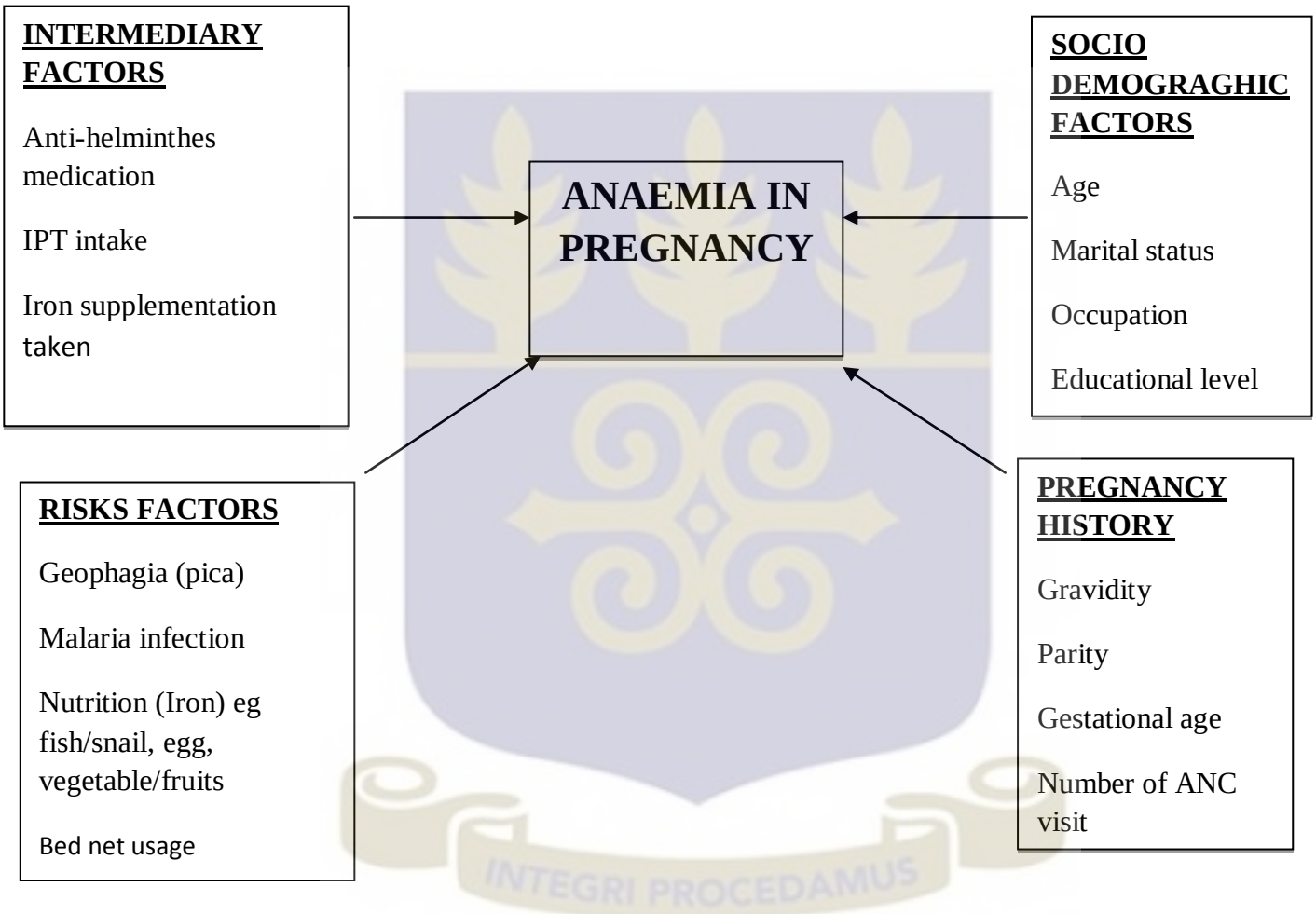
1.7 Conceptual Framework

Figure 1: shows the relationship between the dependent variable (Anaemia in pregnancy) and the independent variables. These variables have a direct effect on anaemia in pregnancy.



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1.8 Justification for the Study

In Sunyani Municipality a population of about 123,224 (Census, 2010); a high prevalence of anaemia in antenatal attendants happen to be one of the major problems facing the municipality presently, with high attendance of antenatal clinic (1817 expectant mothers SMH annual report 2013). The situation may even be more severe in the coming years. Determining factors associated with anaemia in pregnancy will help stakeholders to institute timely intervention to avert this problem. This timely intervention may be the areas of proper maternal education, adequate iron and multivitamin supplementation and ensuring quality of care of the pregnant women. The objective is to achieve a high quality of care and a reduction in maternal and infant mortality and low birth weight.

Objective

General Objective

To determine factors associated with anaemia in pregnancy among antenatal attendants at the Sunyani Municipal Hospital.

Specific Objectves

1. To determine the prevalence of anaemia (Hb <11.0g/dl) in pregnancy among ANC attendants at the Sunyani Municipal Hospital.

2. To determine factors associated with anaemia in pregnancy among antenatal attendants at the Sunyani Municipal Hospital.

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CHAPTER TWO

Literature Review

2.1 Introduction to Anaemia

Anaemia is defined as a decrease in the ability of blood to carry oxygen due to a decrease in the total number of erythrocytes (each having a normal quantity of haemoglobin). A haemoglobin concentration below 11.0g/dl or packed cell volume (PCV) of less than 33.0% is regarded as anaemia in pregnancy by the World Health Organization (WHO 2001)

Anaemia in pregnancy is a major public health issue because of its significant effect on maternal and infant mortality. In Africa, anaemia affects 65% of pre-school children, 57% of pregnant women and 48% of non-pregnant women with young children and pregnant women at higher risk (van Hensbroek, Jonker, & Bates, 2011).

The importance of good haemoglobin concentration during pregnancy for both the woman and the growing foetus cannot be overemphasized being a driving force for oxygen for the mother and foetus, a reduction below acceptable levels can be detrimental to both. Anaemia itself is not a disease but is an indication of underlying illness or morbid condition (McLean, Cogswell, Egli, Wojdyla, & de Benoist, 2009).

2.2 Classification of Anaemia

Anaemia in pregnancy may be classified by two main methods: the morphological and etiological classification.

2.2.1 Classification by Morphology

This type of classification is the most common form of anaemia which includes cell size (cytic), color (chromic), and shape of the RBCs. Measurements of hemoglobin, haematocrit, and red cell

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indices provide information about the appearance of the RBC, which aids in the classification. Red cell indices include the mean corpuscular volume, mean hemoglobin, mean corpuscular hemoglobin concentration and red blood cell distribution width. In addition, serum ferritin concentration is used to measure iron storage. Measuring ferritin concentration is important in obtaining the diagnosis of iron deficiency anemia. Transferrin saturation also measures dietary iron absorption and transport. Transferrin is the protein to which iron is bound for transport from within the body (Goonewardene et al., 2012).

2.2.2 Classification by Etiology

Anemia can be caused by impaired cell production, blood loss, and increased rate of destruction of the red cell. Blood loss occurs during acute conditions such as trauma, or chronic diseases and gastrointestinal bleeding. Increased rate of destruction of red cells occurs in haemolytic anemia resulting from conditions inside and outside the cell. Abnormalities within the red cell can result from hereditary or acquired disease. Sperocytosis and elliptocytosis are hereditary conditions causing anemia due to a disorder in the red cell membrane. Disorders in enzymes within the red cell, such as glucose-6-phosphate dehydrogenase and pyruvate synthesis diseases, also can cause anemia. Sickle cell anemia and thalessemia are genetically determined diseases in which RBCs have structural abnormalities (Kumar, Goldman, Oncology, & Children, 2002). The following are types classified under etiology:

2.2.2.1 Microcytic Anaemia

Iron deficiencies is the most common cause of this type of anaemia and it occurs in 4% to 8% of children aged 12 to 36 mouth, Other causes are anaemia of chronic diseases such as endocarditis and tuberculosis. Iron deficiency anaemia develops when there is insufficient iron for hemoglobin synthesis (Mekky, Jasuja, & Parkin, 2009).

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Lead poisoning may also lead to microcytic anaemia by inhibiting hemoglobin production, abnormal globin synthesis has been found in the presence of increase lead levels that result in shortening red cell survival. Patients with chronic inflammatory disease such as rheumatoid arthritis and systemic lupus erythematosis, and patients with malignant disease also have a predisposition to microcytic anaemia (Gulen, Hanimeli, Karaca, & Taneli, 2012).

2.2.2.2 Normocytic Anaemia

This is normally seen in anaemia of chronic diseases such as chronic renal failure, chronic infection, neoplastic disease and connective tissue disease. It could also be due to iron, vitamin B_{12} or folate deficiency (Wilkinson & Warren, 2003). In addition, acute normocytic anaemia occurs following blood loss before iron stores are depleted.

2.2.2.3 Macrocytic Anaemia

It can be divided into two groups depending on bone marrow findings. These groups are megaloblastic and non megaloblastic or macrocytosis

2.2.2.3.1 Megaloblastic Anaemia

This form of anaemia is characterize by peripheral blood cytopenia resulting in ineffective haematopoisis in the bone marrow (Manuel & Padhi, 2013). They are cause by nutritional deficiencies such as vitamin B12 or folate and inherited disorders of DNA synthesis or following certain drug therapy. Diagnosis of megaloblastic anaemia requires complete blood count, peripheral smear and bone marrow aspiration. This type of anaemia occurs when there is ineffective erythropoiesis and premature death of cells which decrease the output of cells from the bone marrow (Dharmarajan, Adiga, & Norkus, 2003; Mansen & McCance, 2006).

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2.2.2.3.2 Macrocytosis

This is a form of megaloblasticanaemia which occurs in normoblasticanaemia. Common causes of this form of anaemia include pregnancy, excess alcohol consumption and haematological disorders such as sideroblasticanaemia (Glover-Amengor et al., 2000). In terms of the etiology of macrocytic anemias, both folic acid and vitamin B_{12} are needed for normal hematopoiesis and maturation of all cells. Hence, vitamin B_{12} deficiencies, folate deficiencies, inborn errors of metabolism that inhibit folate absorption, and poor nutritional intake can cause malabsorption syndromes leading to macrocytic anemia (Wood & Elwood, 2014).

2.2.2.4 Aplastic Anemia

Aplastic anemia, also known as hypoplastic anemia, results when there is a decline in blood cell production due to bone marrow depression. The rate of decline in the bone marrow production of blood cells is slower for red cells than other types of cells, so the appearance of this aneamia in adults is similar to a chronic anemia pattern. Aplastic anemsia occurs rarely, but it is increasing in developing countries (Kumar et al., 2002). The most common hereditary form of aplastic anemia is called Fanconi anemia. It results from defects in DNA repair, acquired aplastic anemia also occurs secondary to another disease, such as reactions to benzene, arsenic, chloramphenicol, Dilantin, and antimetabolite chemotherapeutic drugs. Ionizing radiation can also cause secondary aplastic anemia (Weeks &Gaspard, 2005& Young et al., 2006).

2.2.2.5 Haemolytic Anaemia

Haemolytic anemia involves the destruction of erythrocytes and the subsequent acceleration of erythropoiesis. The average circulating red cell life span is 115 days, but this may be shortened due to a large number of physical and immune- mediated causes. Hemolytic anemia may be inherited or acquired. The inherited form occurs from cellular abnormalities in the membrane or

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the enzymes that influence the production of hemoglobin. Acquired hemolytic anemia occurs as a result of infection, chemical agents, and abnormal immune response. Haemolytic anemia produces haemolyis within the blood vessels or lymphoid tissue that filters blood (Nadarajan, 2014).

2.2.2.6 Pregnancy related Anaemia

Pregnancy is accompanied by several changes, including physical changes, physiological changes and behavioral changes. In the maternal haematology system, plasma volume increase progressively reaching a peak above 45% in non-pregnant volume in the last trimester. The changes are greater in multiple pregnancies, with increase red cell mass, but a lesser proportion, resulting in haemodilution leading to a decrease in haemoglobin concentrations, packed cell volume and red cell count. The early stages of anaemia in pregnancy are usually without symptoms. As the haemoglobin falls, however, oxygen supply to the vital organs decrease and the women begin to complain of general weakness, dizziness, tiredness and headaches (Wood & Elwood, 2014). If the haemoglobin level falls to 4g/dl, most tissue of the body becomes starved of oxygen and the effect is most marked on the heart muscles. Death from anaemia is the result of heart failure, shock or infection that is aggravated by the impaired resistance of the patient to disease (Kalsoom, Tarar, 2013).

2.2.3 Causes of Anaemia in Pregnancy

Anaemia in pregnancy may be attributed to three main factors. These are nutritional factors, infections and genetic factors.

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2.2.3.1 Nutritional Anaemia

This result from the deficiency of any of the nutrients necessary for the maintenance of a normal haemoglobin level. The WHO defined nutritional anaemia as a condition in which the haemoglobin content of blood is lower than normal as a result of a deficiency of one or more essential nutritions, regardless of causes of such deficiency (Goonewardene et al., 2012). Nutritional anaemia is the most common type of anaemia in the world and mainly includes iron, folate and B12 deficiency. These make up approximately 75% of all anaemia in pregnancy (Imdad & Bhutta, 2012)

The high prevalence of anaemia among women is because about half of their iron requirement is needed to replace iron losses during menstruation, consequently most of these women enter pregnancy with depleted iron stores especially in developing countries. The high requirement for maternal tissue synthesis and for transfer to the foetus exacerbate their iron deficiency.(Gillespie & Allen, 2002).

In pregnancy, the reduced bioavailability of iron is unavoidable due to increase in demand for iron by the foetus during pregnancy compared to 45% in excess of blood produced in non pregnant state is necessary for oxygen and nourishment requirement of the foetus which is received through the placenta. Iron deficiencies result in serious type of anaemia which is characterize not only by low haemoglobin and haematocrit level but also by a reduction or depletion of iron stores by reduce serum iron level and decrease transferrin saturation (Reveiz, Gml, & Lg, 2010).

Maternal nutrition has a critical role in foetal development and it is estimated that foetal growth is much affected by maternal dietary deficiencies of nutrition during early pregnancy. Iron is

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present in diet such as red meat, snails, fish, eggs and green vegetables and its absorption depends largely on its balance in the body (De Andrade, Silva, Bustani, & Marques, 2014).

2.2.3.2 Geophagia (pica) as a cause of Anaemia in Pregnancy.

Geophagia is the ingestion of clay or soil during pregnancy. Geophagia was related to more than two fold increase risk of anaemia. The ingestion of clay or soil impairs the absorption of iron and other nutrients, resulting in anaemia. A study in Sudan have shown that ingestion of clay was a risk factor for maternal anaemia (Adam, Khamis, & Elbashir, 2005). Similarly report from Kenya have found that 56% of women attending antenatal clinic reported eating soil or clay regularly (Geisel et al., 1998). There is little research on geophagia in developing countries although there is likely to be important public health implication given its high prevalence and the possible effect of eating soil on the nutritional status and parasitic infection.

2.2.3.3 Genetic Factors

Certain factors can cause haemolysis of the red cells, resulting in such disease as thalassemia and sickle cell anaemia, which is found frequently in the black African population. In Ghana unlike thalassemia, sickle cell anaemia is the most prevalent of anaemia though in- depth studies is yet to be carried out basically on sickle- cell and anaemia in other to buttress or refute this claim. In resent time Ghana Health Service has been placing much focus on sickle cell in all districts in Ghana, it is possible that the anaemia resulting from it will not be overlooked (GHS, 2010).

Women who have sickle cell disease (SCD) and become pregnant face the increased difficulty of managing the effects of their disorder. The haemodynamic changes that occur in pregnancy cause an increase in painful crisis (Roberts, 2012). The impact of crisis on the woman's pregnancy is numerous as the resulting vasoocclusion resulting in multi-organ complications. The risk of poor pregnancy outcomes such as spontaneous miscarriages, intrauterine deaths and

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stillbirths are increased (Berzolla et al, 2011). Due to vaso-occlusion thromboembolic events, pre-eclampsia and intrauterine growth restriction are other potential problems of SCD (Sharma, 2012). Hyposplenism increases the likelihood of the woman acquiring a urinary tract or chest infection (Chase et al, 2010). In addition, there is an increased risk of pre-term delivery and delivery by caesarean section either due to infection or maternal and fetal indications (Chakravarty et al, 2008; Sickle Cell Society, 2008; Berzolla et al, 2011; WHO, 2012). The potential physical effects of sickle cell disease disease (SCD) on pregnancy can vary from woman to woman but it is recognized that these complications can lead to increased maternal and fetal morbidity and mortality (Sickle Cell Society, 2008; Al Jama et al, 2009; Ngô et al, 2010; Chase et al, 2010; Lewis, 2011). Apart from the physical effects of SCD on pregnancy, the woman also has to cope with the psychological and social stresses of living with a chronic lifelong illness.

2.2.3.4 Infections

(a) Worm infestation; Worm infestation infestation during pregnancy can result in severe anaemia. The presence of hookworm in the small intestine when they invaginate a piece of mucosa and extract blood and nutrients can result to loss of so much blood in a pregnant woman. The degree of anaemia produced depends on the worm load and it is estimated that 60 – 120 worm will cause slight anaemia whilst over 300 worms will produce severe anaemia (Webber, 1996)

(b) Malaria; In endermic regions, malaria infection is the most implicated cause of parasitic infection. Malaria causes varying degree of anaemia ranging from life threating level of less than 5g/dl to slightly below 11g/dl. This is due to diminished resistance to malaria infection during pregnancy. WHO estimates that malaria accounts for 10% of Africa's disease burden (Desai et

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al., 2007). Primigravid women stand the highest risk of developing malaria in pregnancy, and its subsequent morbidity patterns. The risk decrease with increased number of the etiologic factors responsible for anaemia are multiple and their relative contributions can be expected to vary by geographic areas and by season especially. The observation that severe anaemia is greatly reduced in patients who have received regular malaria prophylaxis during pregnancy indicates that it is related to chronic infection with *Plasmodium falciparum* malaria (Verhoeff et al., 1999).

(c) HIV/AIDS; Anaemia is a common clinical finding in HIV infected women and has been associated with adverse maternal and fetal outcomes in pregnancy (Belperio, 2004; Lundgren, 2003; Srasuebkul, et al. 2009). In 2012, the Saving Mothers Report in South Africa concluded that HIV infection (70%) and anaemia (30%) were the commonest conditions among women who died during pregnancy or in the puerperium (Department of Health, South Africa2012). Studies have shown that, the use of antiretroviral drugs such as Zidovudine (ZDV)for prevention of mother to child transmission (MTCT) of HIV or used in combination with other antiretrovirals have been implicated in the development or increased severity of anaemia (Spiga, et at.1999). A recent clinical trial across three sub-Saharan African countries demonstrated that women randomized to short or longer ZDV containing regimens were at similar risk of severe anaemia and the longer the duration of a triple antiretroviral (ARV) regimen the greater the reduction in the incidence of anaemia(Sartorius, Chersich, et al.2013). These findings are inconsistent with studies conducted in South Africa, Malawi and Mozambique that implicated ZDV containing regimens as risk for anaemia (Marazzi MC, Palombi L, et al. 2011). Zidovudine containing regimens as prophylaxis for PMTCT remains the most affordable and cost-effective option in most Sub- Saharan African countries with a high HIV disease burden. Yet, not many studies have sought to confirm if anaemia, a potential side effect of Zidovudine use, could be attributed

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to the HIV disease stage itself and could be avoided if pregnant women in the advanced stage of disease are treated with a triple antiretroviral regimen (Nandlal et al., 2014).

Reports from Nigeria on anaemia have shown to be the most commonest manifestation of HIV infection, occurring in approximately 30 % of patients with asymptomatic infections and in about 70 % of those with AIDS (Moyle,2002; Omeregie, at el. 2009). Therefore, it may imply that the presence of HIV is an added risk to anaemia in pregnancy (Mocroft, Kirk, at el. 1999). Voluntary counselling and testing of pregnant women for HIV is therefore indicated at primary care level to detect asymptomatic anaemia in pregnancy that may be due to HIV infection (Dairo, Lawoyin, et al. 2005). Studies have reported that the prevalence and severity of anaemia is more frequent in HIV positive than in HIV negative women (Dim, Onah, 2007; Uneke, at el 2007). Anaemia therefore, in maternal HIV infection may be associated with an increased risk of anaemia-related maternal deaths (Ezechi et al., 2013).

2.2.4 Other Factors that Contribute to Anaemia in Pregnancy

2.2.4.1 Parity, Birth Interval and Age of the Woman.

Multi- parity, short birth interval (child spacing) and adolescent pregnancy can also affect anaemia adversely. Women require a high iron store in order to replace the iron loss during menstruation but most of them enter pregnancy with depleted stores of iron. Consequently when faced with pregnancy condition associated with high iron requirement for maternal tissue synthesis and for the transfer to their foetus plus blood losses at delivery which exacerbates their iron deficiency (Gillespie & Allen, 2002). Adolescent girls are more prone to anaemia due to poor nutrition and demand of growth, menstruation and pregnancy therefore compound the already existing anaemia status of the adolescent (Annibale et al., 2003).

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Parity; Study done in Nigeria revealed that anaemia was more prevalent among multigravidae as compared to pimigravidae it is on record that prevalence of anaemia tends to fall with increase parity being 44.8% in primigravidae and 55.2% in multigradae which shown a significant association between anemia and parity. In contrast, prevalence of iron deficiency increased with parity, being 4% and 11.9% respectively in primigravidae and multigravidae (Kalsoom S, Tarar SH, 2013).

2.2.4.2 Socio – Cultural Beliefs

Socio cultural belief of the people can also affect anaemia in pregnancy adversely. It is important to understand that the pregnant woman exist and belong to communities in which several beliefs and cultural practices already exist. Consequently these socio – cultural belief affect the women perspective of viewing and understanding things including pregnancy, health and health care. Although iron and folic acid supplementation are generally recommended, there are numerous economic, cultural and social obstacles to this simple prevention measures (Clerk et al., 2009)

According to (Wall, 1998) in the rural setting, gender disparity has been observed with women generally receiving less attention than men. Poorer access to medical services is compounded by social, cultural and economic factors including gender inequality in access to food, by burden of work and by special dietary requirements such as iron supplements. This is why many women and particularly rural women are often trapped in a cycle of ill-health exacerbated by child bearing and hard physical labour. Seclusion for example was found to have a compounding effect on the high maternal mortality of 1000 deaths per 100,000 live births among Hausa women in Northern Nigeria.

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2.2.5 Global Burden of Anaemia in Pregnancy

Only few countries have collected data on the prevalence of anaemia, basically because much of the information is from clinic records, or small surveys resulting in national and regional estimates of anaemia not very precise (McLean et al., 2009). The prevalence of anaemia in developing countries is about four time that of developed countries (Chathuranga et al., 2014). A study from Malawi showed that 60% of iron deficient women had other deficiency as well and may have signs of inflammation (van den Brock & Letsky, 2000).study conducted in Ethiopia identified age of mother, marital status, educational status and occupation as well as socio demographic characteristics that influence a pregnant woman developing anaemia (Alene & Dohe, 2014).

2.2.6 Prevalence of Anaemia in Ghana

According to the baseline study on the prevalence of anaemia in Ghana and etiology of anaemia which was conducted in 2005 (GHS, 2005; cited in GDHS, 2008) about 65% of pregnant women were found to be anaemic. The most common causes of anaemia in Ghana are inadequate dietary intake of iron, malaria, intestinal and worm infestation (GHS, 2005 cited in GDHS, 2008). Iron and folic acid supplementation and anti-malarial prophylaxis for the pregnant women, promotion of the use of insecticide treated bed net by pregnant women are some of the measures being pursued by the Ghana Health Service to reduce anaemia prevalence among vulnerable groups (GDHS, 2008). In Ghana, anaemia in pregnancy is currently measured at a cut point of 11.0g/dl which is the recommended cut of limit according to WHO (WHO, 2001).

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2.2.7 Symptoms of Anaemia

Mild or moderate anaemia in pregnancy does not pose any elevated risk but when severe it is associated with high risk mortality in pregnant women (Nidus information services, 2001). Mild anaemia may only present as tiredness while symptoms of severe anaemia are as follows. (a) Pallor (b) Tiredness and weaknes (c) Palpitation (d) Tendency to pick up infection easy (e) Dizziness and seeing black spots (f) Fainting or fainting tendency (Kalaivani, 2009).

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CHAPTER THREE

3.0 Methodology

3.1 Type of Study

A hospital based cross sectional study was conducted at the Sunyani Municipal Hospital from May to June 2015. All pregnant women aged 15 years and above who visited the antenatal clinic of the hospital were eligible to participate in the study.

3.2 Study Location

Sunyani Municipality is one of the twenty-two administrative districts in the Brong Ahafo Region of Ghana. It lies between latitudes 70 20'N and 70 05'N and longitudes 20 30'W and 20 10'W and shares boundaries with Sunyani West District to the North, Dormaa Municipality to the West, Asutifi District to the South and Tano North District to the East (GDHS, 2008).

Sunyani also serves as the Regional Capital for Brong Ahafo with a total land area of 829.3 Square Kilometres. The municipality falls within the wet Semi-Equatorial Climatic Zone of Ghana with monthly temperatures varying between 23ºC and 33ºC with the lowest around August and the highest being observed around March and April. The municipality experiences double rainfall pattern, the main rainy season is between March and September with the minor between Octobers to December. This offers two farming seasons in a year which supports high agricultural production. However, the rainfall pattern of the municipality is decreasing over the years as a result of deforestation and depletion of water bodies resulting from human activities.

The municipality has diverse ethnic background because its serves as the administrative capital for the region and as such offers certain services which does not exist in most districts. There are nine main identifiable ethnic groups in the municipality. Akan is the majority and constitutes 71.1%, Ga Dangme represents 2.1%, Ewe constitutes 3.2% while the Northern tribes (Guan,

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Gurma, Mole-Dagbani, Grusi, Mande) in the municipality constitute 19.3% (GSS, PHC, 2010). The main religious groups in the municipality are predominantly Christians, Islam, and Traditional groups with 81% being Christians, 11.3 % being Islam, and again 0.9% being traditional believers whereas 6.2% belong to no religious group (GSS, PHC, 2010).

The Sunyani Municipal Hospital (SMH) was established in 1948 as a referral hospital and was later closed down following the establishment of a new regional hospital (Hospital of Excellence) and became a level c facility in 2004 (GHS, 2010). Services provided by the facility are OPD, inpatient service, ANC, pharmacy, X ray, laboratory, mortuary, maternity and theatre. According to the hospital records in 2013, the top-ten diseases were malaria, pregnancy related diseases, diarrhea diseases, hypertension, diabetics mellitus, anaemia, HIV, upper respiratory tract infection and urinary tract infection (SMH Annual report, 2013). The hospital has 63 bed capacity, with an average outpatient case of 300 per day with 120 professional nurses, and 5 doctors and 4 physician assistants. There are 8 Midwives and two community health nurses. Services provided included administration of IPT and education, palpation to check fetal heart beat. They also check for pre eclampsia sign, immunization and monitoring of haemoglobin level.

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3.3 Variables

Variables	Operational definition	Type of variables	Scale of measurement
Hb at current visit	Hb level of pregnant woman's at ANC visit during the time of interview	Dependant	Continuous
Hb at first visit	First ANC visit of pregnant woman Hb level	Independents	Continuous
Age of Participant	Age in years of the pregnant woman as reported during the interview.	Independent	Continuous
Gestational age at first visit	Gestational age in weeks of first ANC visit	Independent	Categorical
Gestational age at current visit	Gestational age in weeks of pregnancy during the time of interview	Independent	Categorical
Gravidity	The number of time a woman has been pregnant	Independent	Categorical
Geophagia (Pica)	Whether a pregnant woman consumed clay or sand	Independent	Categorical
Educational level	The educational status mention by the pregnant woman during interview	Independent	Categorical
Marital status	Refers to the marital status of the pregnant woman	Independent	Categorical
Parity	Number of children of a pregnant woman	Independent	Categorical
Occupation	The work of the pregnant woman	Independent	Categorical
Variables	**Operational definition**	**Type of**	**Scale of**

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		variables	measurement
Iron supplementation	How often the pregnant woman takes iron containing food per week.	Independent	Categorical
Malaria Prophylaxis	Refers to whether a pregnant woman was administered S P	Independent	Categorical
Bed net usage	Refers to whether a pregnant woman sleep under a treated bed net	Independent	Categorical
Number of ANC visit	The number of times the pregnant woman has visited the ANC clinic	Independent	Categorical
Ant- helminthes medication	whether the pregnant woman was administered deworming medication	Independent	Categorical
Birth spacing	The birth interval between the last and current pregnancy.	Independent	Categorical
Malaria infection	Whether the pregnant woman has been treated of malaria infection during current pregnancy.	Independent	Categorical

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3.4 Study Population

All antenatal attendants between the aged of 15 years to 45 years during the period of 12th May to 15th June.

Inclusion and Exclusion Criteria

Inclusion Criteria

1. All pregnant women aged 15 years and above with at least two antenatal visits and record of Hb at first and current visit.

Exclusion criteria

1. Pregnant women who are coming for ANC for the first time
2. Pregnant women who have history of recent blood transfusion (within the previous two weeks).

3.5 Sampling

3.5.1 Sample Size Calculation

The current study of anaemia among pregnant women appears to be the first study in the Sunyani Municipal Hospital. The sample size was therefore calculated based on anaemia in pregnancy in whole of the Brong Ahafo Region of 29.0% prevalence (BAHD annual report 2013).

The sample size was calculated using the Cochran formula $n= (Z^2pq)/d^2$ n= sample size (Cochran, 2007).

Where:

Z is the z-score that corresponds with 95% confidence interval which is 1.96

P= Proportion of anaemia in pregnancy which is 29.0% which is equals to 0.29

q= Proportion of antenatal attendants who are not anaemic which is equal to 1-0.29% = 0.71

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d= Margin of error set at 5% (0.05)

$1.96^2 *(0.29*0.71)/0.05^2$

(3.8416*0.2059)/0.0025

0.79099/0.0025

n = 316.396

n= 316

3.5.2 Sampling Procedure

Data were collected from 316 participants during the period of May to June 2015. Thirteen participants were selected every day from an average of 60 antenatal attendants in a day with a sampling interval of 5. The first participant was randomly selected among the first 5 on each day by cutting pieces of papers into five in a bowl and someone was asked to pick one paper from the bowl. A request was made to the nurses to direct every 5^{th} attendant who came from the laboratory with Hb test results to a screened place which was not too far away from point of care. Participants who did not consent to participate in the study were replaced with the next participant following her. This was repeated until the required sample was obtained.

3.6 Data Collection Technique and Tools

The study employed two main approaches for data collection. These were data extraction from participants' ANC Booklet and administration of a structured questionnaire. Data were collected from the pregnant women after they had given written informed consent and received ANC services for the day. Relevant data were extracted from the ANC booklet of the pregnant women and recorded on a case report form specifically designed for this study (appendix 1). Data on

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number of ANC visits, Gravidity, Parity, Hb level at first and current visits, Gestational age at first and current ANC visit, administration of anti-helminthes during pregnancy were collected. Also, data on malaria infection during pregnancy, administration of iron supplementation and gestational age at which IPT was administered were extracted from the ANC booklet.

A structured questionnaire was used to collect data on age of participants, occupation of pregnant woman, level of education, marital status, , 'pica'(clay) consumption, frequency of consumption of iron containing foods, birth spacing/interval between pregnancies, and bed net usage.

3.7 Quality Control

Research assistants were recruited and trained on the purpose of the study, how to collect the data, and the communication skills used in data collection. At the end of each day of the study, data collected were assessed to ensure that adequate information were collected. Double data entry was done afterward. The two data were compared and inconsistencies resolved by cross checking with the questionnaire to minimize errors. All data were backed up with external storage device.

3.9 Pre-Testing

The questionnaires were tested at SDA hospital, a health facility located in the Sunyani Municipality. Questionnaires were pre-tested to identify any potential problems in the questions. After the pre- testing exercise all necessary corrections were made before proceeding to the actual field for data collection.

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3.8 Data Processing and Analysis

Data were entered into Epi Data version 3.1 and exported to Stata version 12 for analysis. Categorical variables were summarized into frequencies and proportion. Continuous variables were summarized into means and ranges. Continuous variables such as age were re categorized into Age groups, Hb at first visit was re categorised into mild anaemia (Hb 10 – 10.9g/dl), moderate anaemia (7 – 9.9g/dl) and severe anaemia (Hb< 7g/dl) (WHO, 2001). Hb at current visit were categorized into anaemia (Hb<11.0g/dl) and no anaemia (Hb ≥ 11.0g/dl) (WHO, 2001) and anaemia at current visit was used as the main outcome variable. Biverate analysis was done using pearson Chi square to assess significant difference between anaemia and categorical variables. Binary logistic regression was used to assess for factors associated with anaemia. Factors with P - value<0.05 at 95% Cl were considered statistically significant and therefore included in the multiple logistic regression model.

3.10 Ethical Consideration

Ethical approval for this study was obtained from the Ghana Health Service Ethical Review Committee (Number; GHS-ERC: 08/02/15). Permission was also sought from the management of the Sunyani Municipal Hospital before commencement of the study.

Privacy and confidentiality was maintained during data collection and the interviews conducted one-on one at a place quite away from where care was being provided to the other clients. No personal identifiers like names of patients were recorded. A written informed consent was obtained from the individual respondents before interviewing them. The participants were assured of confidentiality regarding the information collected and had the option to opt out of the study at any time. Data access was limited to the principal investigator, research assistants and supervisor of the study only. All data collected were stored under lock and key and would be destroyed after ten years.

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CHAPTER FOUR

4.0 Results

4.1 Socio-Demographic Characteristics of Study Participants

A total of three hundred and sixteen (316) pregnant women aged 15 – 45years (mean 28.42 years and SD ± 5.6 years) who accessed Antenatal Care services at the Sunyani Municipal Hospital participated in the study. Most, 113(35.7%) of them were aged 25 - 29 years. Majority, 163(51.6%) of the women had at least basic level education, 83(26.3%) had secondary education and 48(15.2%) had tertiary level education. Only 22(7%) of the women had no formal education. Out of all the 316 women 218(69%) were self employed, 44(13.9%) were employed in the formal sector. A total of 183(57.9%) of the women were married. (Table 1).

Table 1: Socio-demographic characteristics of study participants.

Variables	Frequency (N=316)	Percentage
Age category (years)		
15 - 19	21	6.7
20 – 24	61	19.3
25 – 29	113	35.7
30 – 34	78	24.7
35 and above	43	13.6
Highest educational level		
No formal education	22	7.0
Primary	163	51.6
Secondary	83	26.3
Tertiary	48	15.2
Occupation of participants		
Government worker	44	13.9
Self employed	218	69.0
Unemployed	30	9.5
Other (students)	24	7.6
Marital status		
Single	50	15.8
Married	183	57.9
Cohabitation	79	25.0
Divorced/separation/widowed	4	1.3

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4.2 Obstetric characteristics of study participants

Up to 46.8% (148/316) of the women made the recommended minimum of four ANC visits, 89(28.2%) made three ANC visits and 79(25%) made two ANC visits. 137(43.4%) were women with more than one child, 94(29.8%) were women with no child (pregnant for the first time) while 85(26.9%) were women with only one child. Majority of the women 99(31.3%) were carrying their third pregnancy. Most of the women 199(63.0%) made their first ANC visit in the first trimester, 115(36.4%) in the second trimester and only 2(0.6%) in the third trimester. Almost half, 157(49.7%) of the women were currently in their third trimester of pregnancy, 141(44.6%) were in their second trimester and 18(5.7%) were in their first trimester of the current pregnancy. Majority 217(83.1%) of the women had time interval between the current and last delivery of 12 months and more, 5(1.58%) had time interval of less than 12 month while 94(29.75%) of the women were pregnant for the first time. 80.5% of the women who were in their third trimester of pregnancy had made the recommended minimum of four ANC visit and 19.5% of the women had not made these recommended minimum of four ANC visit. 15.4% of pregnant women in their third trimester of pregnancy had made only two ANC visit (Table 2).

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Table 2: Obstetric characteristics of study participants of Sunyani Municipal Hospital May – June 2015.

Variables	Frequencies (N=316)	Percentage
Number of ANC visit		
Two visit	79	25.0
Three visit	89	28.2
Four or more visit	148	46.8
Parity		
Para zero	94	29.8
One child	85	26.9
Two or more children	137	43.4
Gravidity		
First pregnancy	55	17.41
Second pregnancy	70	22.15
Third pregnancy	99	31.33
Four or more pregnancy	92	29.11
Gestational age at first visit		
First trimester	199	63
Second trimester	115	36.4
Third trimester	2	0.6
Gestational age at current visit		
First trimester	18	5.7
Second trimester	141	44.6
Third trimester	157	49.7
Birth spacing/interval between pregnancy		
First pregnancy (No birth space)	94	29.75
Less than 12 month	5	1.58
12 month or more	217	68.7

Number of ANC visit and Gestational age at current visit

	1st trimester N (%)	2nd trimester N (%)	3rd trimester N (%)
Two ANC visit	15(19.2)	51(65.4)	12(15.4)
Three ANC visit	3(3.4)	61(68.5)	25(28.1)
Four or more ANC visit	0(0)	29(19.5)	120(80.5)

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4.3 Prevalence of anaemia among antenatal attendants

Out of the 316 participants, 129(40.8%) had Hb<11.0g/dl at their first ANC visit, with a mean of 11.21g/dl and range 6.8g/dl to 15.1g/dl. Seventy nine (61.2%) of them had mild anemia Hb< 7 g/dl), 48 (37.2%) had moderate anemia (Hb 7 – 9.9 g/dl) whilst 2 (1.6%) had severe anemia (Hb 10 – 10.9 g/dl). Out of 316 participants 131(41.5%) pregnant women were found to have Hb< 11.0g/dl based on Hb estimated at their current ANC visit, (mean was 11.24g/dl and range from 8.10g/dl to 14.5g/dl). One hundred and sixteen (80.9%) had mild anaemia, 25(19.1%) had moderate anemia with no body having severe anaemia (Fig. 2).

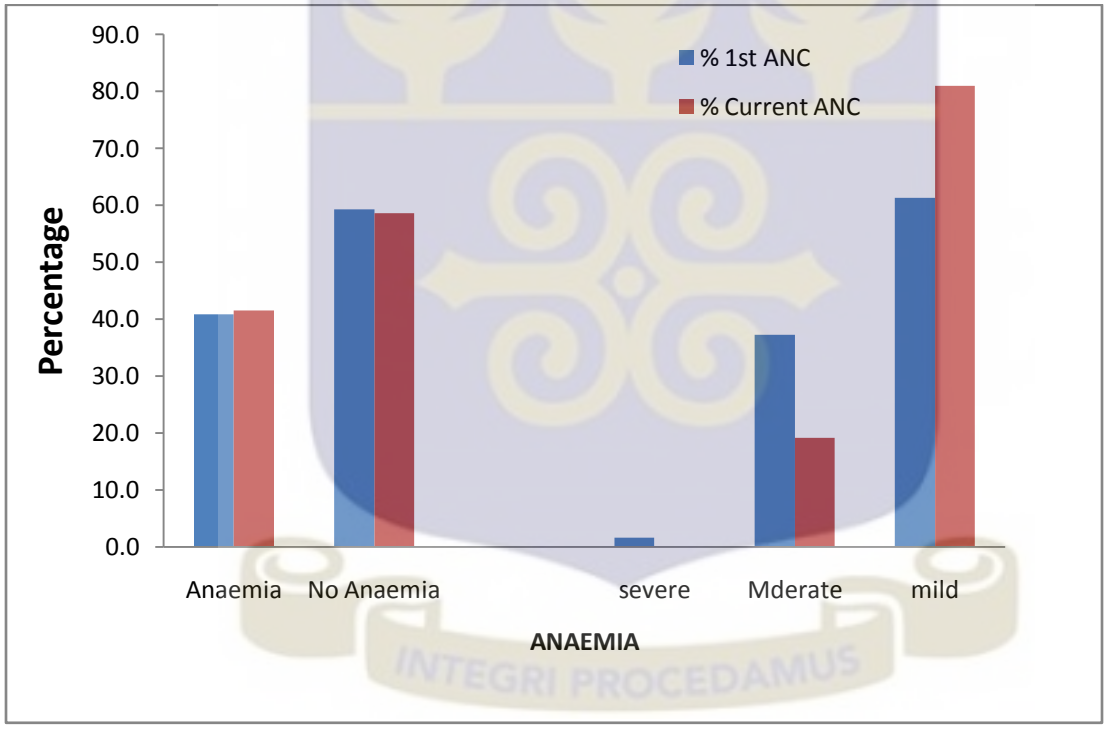

Figure 2: Prevalence of anaemia among pregnant women at Sunyani Municipal Hospital, May-June

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4.4 Medical interventions and malaria infections during pregnancy

One hundred and ninety two (60.8%) of the pregnant women slept under bed net the night before data collection interview while 278(88.0%) own a bed net.76 (24.1%) received IPT during the first trimester. More than half, 177(56.0%) received IPT in the second trimester, and 63 (19.9%) received IPT in the third trimester. Out of the 316 women, only 76(24.1%) had received anti-helminthes medication. Only 74(23.4%) were given malaria prophylaxis and 19.6% were infected with malaria (Table 3)

Table 3 Medical interventions and malaria infections during pregnancy

Factors	**Frequency N = 316**	**Percentages**
Bed net ownership		
Own a bed net	278	88.0
Does not own a bed net	38	12.0
Bed nets use		
Slept under bed net the previous night.	192	60.8
Did not sleep under bed net last night	124	39.2
Gestational age at which IPT was taken		
First trimester	76	24.1
Second trimester	177	56.0
Third trimester	63	19.9
Use of anti- helminthes medicine		
No dewormer medicine received	240	75.9
At least one dose of dewormer medicine received	76	24.1
Malaria prophylaxis		
Malaria prophylaxis taken	74	23.4
Malaria prophylaxis not taken	242	76.6
Malaria infection during pregnancy		
Been infected	62	19.6
Not been infected	254	80.4
Gestational age malaria infection occurred		
First trimester	8	12.90
Second trimester	41	66.13
Third trimester	13	20.97

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4.5 Consumption of iron and iron containing foods

Table 4 below displays consumption of iron and iron containing foods. Women who received iron supplements were 305(96.5%), and 260(85.25%) took it always. 49(15.5%) consumed clay, women who never took eggs during their pregnancy were 20(6.3%), 19(6.0%) never consumed fish or snails and 14(4.4%) never consumed vegetables.

Table 4: Consumption of iron and iron containing foods

Factors	Frequencies N=316	Percentage
Iron supplementation taken during current pregnancy		
Taken iron supplementation	305	96.5
Received no iron supplementation	11	3.5
How many times iron supplementation taken		
Once	22	7.21
Always	260	85.25
Sometimes	23	7.54
Pica (clay) consumption during current pregnancy		
Takes during current pregnancy	49	15.5
Has not taken pica during current pregnancy	267	84.5
Frequency of consuming egg		
Never	20	6.3
Once a week	113	35.8
Twice per week	119	37.7
Three or more per week	64	20.3
Frequency of consuming fish/snail		
Never	19	6.0
Once a week	30	9.5
Twice per week	115	36.4
Three or more per week	152	48.1
Frequency of consuming green vegetables/fruits		
Never	14	4.4
Once a week	17	5.4
Twice per week	80	25.3
Three or more per week	205	64.9

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4.6: Bivariate analysis of anaemia status among pregnant women

Table 5 below displays the Bivariate analysis of anaemia status among pregnant women. There was significant difference between women in their age groups in terms of being anaemic (Chi 12.1167, P= 0.017). Thirty four of the women (43.6%) were between 30 – 34 years, followed by 34(30.1%) between 25 – 29 years, 31(50.8%) were between 20 – 24 years, 19(44.2%) were 35 and above and 13(61.9%) were between 15 - 20 years

There was significant difference in gestational age at first visit and anaemia (Chi 8.222, P=0.016). Most of the women 72(36.2%) who were anaemic visited the ANC in the 1st trimester, 57(49.6%) were in their 2nd trimester and 2(100%) were in their 3rd trimester of gestational age at first visit (Table 6).

There were also significant difference among women infected with malaria and those without malaria (Chi 7.15, P=0.008). Thirty five (56.5%) malaria infected women were anaemic as against 27 (43.5%) who were not anaemic (Table 7).

There was a significant difference in consumption of fish or snails and anaemia (Chi 8.55, P=0.04). Fifty two (34.2%) of the women who consumed fish/snails three times (always) per week were anaemic as against 100(65.8%) who were not anaemic. (Table 8).

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Table 5: Bivariate analysis on socio demographic of factors associated with anaemia

Factors	Anaemia N (%)	Not Anaemic N (%)	χ^2	P value
Age category (years)				
15 – 19	13(61.9)	8(38.1)	**12.1167**	**0.017***
20 – 24	31(50.8)	30(49.2)		
25 – 29	34(30.09)	79(69.91)		
30 – 34	34(43.6)	44(56.4)		
35 and above	19(44.2)	24(55.8)		
Occupation of participants				
Government worker	14(31.8)	30(68.2)	4.87	0.18
Self employed	89(40.8)	129(59.2)		
Unemployed	14(46.7)	16(53.3)		
Others(students)	14(58.3)	10(41.7)		
Highest educational level			4.91	0.18
No formal education	7(31.8)	15(68.2)		
Primary/JHS	73(44.8)	90(55.2)		
Secondary	37(44.6)	46(55.4)		
Tertiary	14(29.2)	34(70.8)		
Marital status				
Single	25(50.0)	25(50.0)	4.52	0.21
Married	73(39.9)	110(60.1)		
Cohabitation	33(41.8)	46(58.2)		
Divorced/separation/widowed	0(0)	4(100)		

Note: pearson chi square test used to determine significant difference between the various categories, P-value <0.05 are significant.

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Table 6: Bivariate analysis of obstetric characteristics associated with anaemia

Factors	Anaemia N (%)	Not Anaemic N (%)	χ^2	P value
Number of ANC visits				
Two visit	37(47.4)	41(52.6)	5.31	0.07
Three visit	28(31.6)	61(68.4)		
Four or more visit	66(44.3)	83(55.7)		
Parity				
Para zero	45(47.9)	49(52.1)	2.943	0.230
Premigravidae	30(35.3)	55(64.7)		
Multigravidae	56(40.9)	81(59.1)		
Gravidity				
First pregnancy	26(47.3)	29(52.7)	1.48	0.69
Second pregnancy	29(41.4)	41(58.6)		
Third pregnancy	37(37.4)	62(62.6)		
Fourth or more pregnancy	39(42.4)	53(57.6)		
Birth space/birth interval				
First pregnancy	45(47.9)	49(52.1)	2.27	0.32
Less than 12 month	2(40.0)	3(60.0)		
24 month and more	84(38.7)	133(61.3)		
Gestational age at first visit				
First trimester	72(36.2)	127(63.8)	**8.222***	**0.016***
Second trimester	57(49.6)	58(50.4)		
Third trimester	2(100)	0(0)		

Note: pearson chi square test used to determine significant difference between the various categories, P-value <0.05 are significant.

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Table 7: Bivariate analysis of medical interventions and infections associated with anaemia

Factors	Anaemia N (%)	Not Anaemic N (%)	χ^2	P value
Use of anti- helminthes medicine				
No dewormer medicine received	97(40.4)	143(59.6)	0.44	0.51
At least one dose of dewormer received	34(44.7)	42(55.3)		
Anti- malaria prophylaxis during pregnancy				
No anti malaria taken	37(50.0)	37(50.0)	2.91	0.09
At least one dose of anti-malaria taken	94(38.8)	148(61.2)		
Gestational age at which IPT taken				
First trimester	33(43.4)	43(56.6)	4.85	0.09
Second trimester	65(36.7)	112(63.3)		
Third trimester	33(52.4)	30(47.6)		
Bed net ownership				
Own a bed net	110(39.6)	168(90.8)	3.39	0.07
Does not own a bed net	21(55.3)	17(44.7)		
Bed net use				
Slept under bed net the previous night.	74(38.5)	118(61.5)	1.71	0.19
Did not sleep under bed net last night	57(46.0)	67(54.0)		
Malaria infection during pregnancy				
Been infected	35(56.5)	27(43.5)	**7.15***	**0.008***
Not been infected	96(37.8)	158(62.2)		

Note: pearson chi square test used to determine significant difference between the various categories, P-value <0.05 are significant.

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Table 8: Bivariate analysis of consumption of iron and iron containing foods associated with anaemia.

Factors	Anaemia N (%)	Not Anaemic N (%)	χ^2	P value
Iron supplementation taken during current pregnancy				
Received iron supplementation	127(41.6)	178(58.4)	0.12	0.73
Received no iron supplementation	4(36.4)	79(63.6)		
Pica (clay) consumption during current pregnancy				
Takes during current pregnancy	19(38.8)	30(61.2)	0.17	0.68
Has not taken pica during current pregnancy	112(41.9)	155(58.1)		
Frequency of consuming egg			4.32	0.23
Never	9(45.0)	11(55.0)		
Once a week	55(48.7)	58(51.3)		
Twice per week	44(34.0)	75(63.0)		
Three or more per week	23(35.9)	41(64.1)		
Frequency of consuming fish/snail				
Never	12(63.2)	7(36.8)	**8.55***	**0.04***
Once a week	15(50.0)	15(50.0)		
Twice per week	52(45.2)	63(54.8)		
Three or more per week	52(34.2)	100(65.8)		
Frequency of consuming green vegetables/fruits				
Never	9(64.3)	5(35.7)	3.16	0.37
Once a week	7(41.2)	10(58.8)		
Twice per week	32(40.0)	48(60.0)		
Three or more per week	83(40.5)	122(59.5)		

Note: pearson chi square test used to determine significant difference between the various categories, P-value <0.05 are significant.

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4.7: Binary logistics analysis of factors associated with anaemia among pregnant women

4.7 .1 Association of demographic factors and anaemia

Table 9 summarizes binary logistic analysis of factors associated with anaemia. Age was significantly associated with anaemia. The odds of pregnant women between 25 – 29 years becoming anaenic is reduced by 74% as compared to pregnant women aged 15 – 19 years. COR 0.26 (0.10 – 0.70) P =0.007.

Occupation was also significantly associated with anaemia, the odds of a pregnant student becoming anaemic is increase 3 times compared to pregnant women who is a government worker COR 3.0 (1.07 – 8.40) P= 0.037.

No association was found between anaemia and Level of education and marital status.

Table 9 Shows association of demographic factors and anaemia

Variables	COR	95% CL	P value	AOR	95% CL	P value
Age of participant						
15 – 19	1.0			1.0		
20 – 24	0.64	0.23 – 1.75	0.382	0.99	0.29 – 3.40	0.99
25 – 29	0.26	0.10 – 0.70	**0.007***	0.45	0.13 – 1.53	0.19
30 – 34	0.48	0.18 – 1.28	0.138	0.87	0.24 – 3.13	0.83
35 and above	0.49	0.17 – 1.42	0.187	0.84	0.22 – 3.23	0.80
Highest educational level						
No formal education	1.0					
Primary/JHS	1.74	0.67 – 4.49	0.25			
Secondary	1.72	0.64 – 4.67	0.28			
Tertiary	0.88	0.29 – 2.6	0.82			
Occupation of participants						
Government worker	1.0			1.0		
Self employed	1.48	0.74 – 2.95	0.27	0.63	0.19 – 2.09	0.45
Unemployed	1.88	0.72 – 4.88	0.20	0.71	0.18 – 2.84	0.63
Others (Students)	3	1.07 – 8.40	**0.037***	1.40	0.34 – 5.73	0.64
Marital status						
Single	1.0					
Married	0.67	0.35 – 1.24	0.20			
Cohabitation	0.72	0.35 – 1.46	0.36			
Divorced/separation/Widow	1	-	-			

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4.7.2 Obstetric determinants associated with Anaemia

Table 10 below shows the binary logistic analysis of obstetric factors associated with anaemia. Parity, birth spacing and gravidity, were all not associated with anaemia in both univerate and multivariate analysis. Gestational age at first visit was associated with anaemia. The odds of pregnant women making their first ANC visit in the second trimester of pregnancy (gestational age), getting anemia was increased by 1.92 times compared to those in their first trimester.

AOR 1.92(1.14 – 3.23) P= 0.014.

The odds of pregnant women with three ANC visit getting anaemia was reduced by 96% compared to those who had two ANC visit. COR 0.04 (0.27 – 0.96) P=0.04.

Table 10 Association of obstetric factors and anaemia

Variables	COR	95% CL	P value	AOR	95% CL	P value
Parity						
Para zero	1.0					
Primegravidae	0.59	0.32 – 1.09	0.09			
Multigravidae	0.75	0.44 – 1.28	0.29			
Gravidity						
Four or more pregnancies	1.0					
First pregnancy	0.79	0.39 – 1.61	0.51			
Second pregnancy	0.67	0.34 – 1.30	0.23			
Third trimester	0.82	0.42 – 1.61	0.56			
Birth space/birth interval						
First pregnancy	1.0					
Less than 12 month	0.92	0.12 – 4.54	0.92			
12 month and more	0.69	0.42 – 1.12	0.69			
Gestational age at first visit						
First trimester	1.0			1.0		
Second trimester	1.73	1.09 – 2.76	**0.021***	1.92	1.14 – 3.23	**0.014**
Third trimester	-	-	-	-	-	-
Number of ANC visit						
Two visit	1.0			1.0		
Three visit	0.04	0.27 – 0.96	**0.04***	0.65	0.32 – 1.32	0.24
Four or more visit	0.51	0.51 – 1.53	0.65	0.89	0.48 – 1.61	0.70

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4.7.3 Interventions and infections associated with anaemia

Malaria prophylaxics, anti-helminthes medicine, gestational age at which IPT was received and bed nets use were not associated with anaemia in both univariate and multivariate analysis. Malaria infections during pregnancy was however significantly associated with anaemia.

The odds of pregnant women who were not infected with malaria parasite, becoming anaemic was reduced by 53% compared with pregnant women who were infected with malaria. [AOR 0.47 (0.25 – 0.89)] P= 0.021 (Table 11)

Table 11 Interventions and infections associated with anaemia

Variables	COR	95% CL	P value	AOR	95% CL	P value
Anti-malaria prophylactics during pregnancy						
l No anti – malaria drug taken	1.0					
At least one dose of anti-malaria drug taken	0.64	0.38 – 1.07	0.09			
Use of anti- helminthes drug						
No dewormer received during pregnancy	1.0					
At least one dose of dewormer received	1.2	0.71 – 2.01	0.51			
Gestational age at which IPT taken						
Third trimester	1.0					
First trimester	0.76	0.43 – 1.31	0.32			
Second trimester	1.43	0.73 – 2.80	0.29			
Malaria infection during pregnancy						
Been infected	1.0			1.0		
Not been infected	0.47	0.27 – 0.82	**0.008***	0.47	0.25 – 0.90	**0.021***

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4.7.4 Consumption of iron and iron containing foods

Table 12 below summarizes the association of consumption of iron and iron containing foods with anaemia. Iron supplementation, clay consumption, egg consumption and green vegetables and fruits were not significantly associated with anaemia in both univariate and multivariate analysis.

The odds of a pregnant woman who consumed fish or snails three or more times per week, becoming anaemic was reduced by 70% compared to those who never consumed fish or snails COR 0.30 (0.11 – 0.82) P=0.02.

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Table 12: Association of Consumption of iron and iron containing foods with anaemia

Variables	COR	95% CL	P value	AOR	95% CL	P value
Iron supplementation taken during pregnancy						
Received iron supplementation	1.0					
Received no iron supplementation	0.8	0.23 – 2.79	0.73			
Pica consumption						
Takes during current pregnancy	1.0					
Has not taken pica during current pregnancy	1.14	0.61 - 2.12	0.68			
Consumption of egg per week						
Never	1.0					
Once a week	1.16	0.45 – 3.01	0.76			
Twice per week	0.72	0.28 – 1.87	0.50			
Three or more per week	0.68	0.25 – 1.90	0.47			
Consumption of green vegetables/fruits						
Never	1.0					
Once a week	0.39	0.09 – 1.67	0.20			
Twice per week	0.09	0.11 – 1.21	0.09			
Three or more per week	0.09	0.12 – 1.17	0.09			
Frequency of consuming meat, fish/snail						
Never	1.0			1.0		
Once a week	0.58	0.18 – 1.89	0.37	1.03	0.42 – 2.54	0.95
Twice per week	0.48	0.18 – 1.31	0.15	0.70	0.29 – 1.69	0.43
Three or more per week	0.30	0.11- 0.82	**0.02***	2.15	0.58 – 7.98	0.25

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CHAPTER FIVE

Discussion

Anemia in pregnancy is one of the most widespread public health problems especially in developing countries because of its importance in health, social and economic consequences. Anemia poses a 5-fold increase in overall risk of maternal death. Non-fatal risk factors in anaemia resulting in complications during antenatal period include poor weight gain, preterm labors and miscarriage. On the fetus, complications include prematurity, low birth weight, low APGAR scores and cognitive impairment.

The prevalence of anaemia in this study was found to be 41.5%. The study also found that age, gestational age at first visit, malaria infection, consumption of fish and snails, occupation and number of antenatal clinic visits were all significantly association with anaemia in pregnancy. However level of education was control for in the adjusted models

Prevalence of Anaemia at Sunyani Municipal Hospital

The prevalence of anaemia among pregnant women attending antenatal clinic at the Sunyani Municipal Hospital was slightly over 40%. This was higher than what was reported by the Brong Ahafo Regional Health Directorate (BAHD) in 2013, which pegged the prevalence of anaemia among pregnant women at about 30.0%. The level of anaemia was however mild with no severe anaemia cases detected.

Similarly, about 40% of pregnant women are reported in Northwest Ethiopia experienced anaemia (Melku, Addis, Alem, & Enawgaw, 2014). Other findings from Africa have much higher prevalence report of anaemia in pregnancy (66% in Burkina Faso, Tanzania at 95%; South Africa at 57.3%) (Meda*et al*.1999).

Globally,the prevalence of anaemia in pregnancy ranges from 41.8% – 43.8% (Chrispinus, 2014). The variations may be attributed to different causes of anemia, dietary differences,

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population differences, study design and difference in methodology used in determining hemoglobin levels. From these findings, it is evident that the prevalence of anaemia is still high in Sunyani Municipality despite the various interventions including health education during antenatal care.

Age and anaemia

The prevalence of anaemia was higher among pregnant women aged between 25 – 29 years compared to women age between 15 – 19 years. this was significant at crude however after adjustment it lost its significant. Similar studies have also shown a significant association between age groups and anaemia (Patil, 2013) . In a report by (Chrispinus, 2014) from Kenya women aged between 21- 25 had the highest (43.3%) prevalence of anaemia. Other studies however could not detect any difference between the levels of anaemia and age groups (Melku et al., 2014). The reason could be due to the fact that pregnant women who are younger probably have a better immunity and ability for blood cell production.

ANC visit and anaemia

The results from this study suggest that women who had at least three ANC visits were less likely to be anaemic compared to women who had less than two ANC visit during pregnancy. The odds of a woman with three ANC visits becoming anemic was reduced by over 90% compared to those with two or less ANC visits but this was significant at crude but lost its significant after adjustment. This could be due to the fact that women who attend ANC receive education on how to prevent anaemia through good eating habits. They also receive interventions such as iron supplementation, anti helminthes and IPT for malaria.

Iron supplementation and anaemia

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Over 90 % of the pregnant women who were selected for the study received iron supplement at ANC with less than 4% of them not receiving iron supplementation.

The study revealed that, iron supplementation did not improve the haemoglobin level of the pregnant women. This confirmed reports by Melku et al., 2014 from Ethiopia who found no improvement in the haemoglobin levels of pregnant women who received iron at ANC clinic compared with women who did not receive any iron supplement. rather had 20% reduced chance of getting anaemia compared to those who received iron supplement during their current pregnancy. However the finding was in contradiction with other studies (A. Brian.et al., 2008, Zhang, Li., 2009 and Khan.,et al 2010).

The reason that could account for the finding could be, because pregnant women are not directly observed to take iron at ANC clinic, it is also possible that the pregnant women received the iron tablets but do not swallow them.

Frequency of consuming meat, fish/snail anaemia

Eating meat, fish or snails regularly during pregnancy reduced a pregnant woman's chances of becoming anaemic. Pregnant women who consumed fish or snails always are 70% less likely of becoming anaemic compared to pregnant women who never consumed fish or snails but this was significant at crude but lost its significant after adjustment.

An increase in the frequency of consumption of fish meat or snail result in low anaemia status because of the high level of iron and protein which most women should be educated to increase its consumption to improved their haemoglobin level.

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Malaria infection and anaemia

Malaria prevalence among the pregnant women who were anaemic was almost 27%. Malaria infection during pregnancy was found to be significantly associated with anaemia among the pregnant women. Women who had malaria during pregnancy were almost five times more likely to be anaemic. Similarly other studies have found almost the same association, which suggest that women who were anaemic during pregnancy were 3 times more likely to be anaemic (Monif et al., 2004 and WHO 2006). This can be controlled by providing pregnant women with insecticide- treated bed nets (ITN) and intermittent preventive treatment (IPT) with anti -malarial medication.

Gestational age at first visit

It was observed in this study that majority (63%) of pregnant women visit ANC during their first trimester of pregnancy. However almost 2% of pregnant women made their first visit very late in their third trimester of their pregnancy. Visiting ANC early in pregnancy reduced the likelihood of anaemia in pregnant women .Women who visited ANC during their first trimester of pregnancy had an increased odds of anaemia compared to those who visited ANC in the first trimester. The finding is similar to that reported from Gujrat, Pakistan by Kalsoom, Tarar H, 2013 who also found a strong association between gestational age at first ANC visit and anaemia but contradicted the findings of Melku et al., (2014) from Gondar, Northwest Ethiopia who found no association between anaemia and gestational age at first visit.

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Occupation and anaemia

The study revealed that, more than half 67.9% of the participants who were anaemic were self employed while more than 10% of the anaemic women are students. Pregnant women who were students were 3 times more likely of getting anaemia than government workers. This implies that pregnant women who are student are 3 times more likely to develop anaemia than pregnant women who were government workers but this was significant at crude but lost its significant after adjustment. This could be due the fact that student are probably more likely to be unemployed and lack the financial capacity to provide themselves with good food and access quality health services.

Limitations of the Study.

The study was limited to a single health facility and the finding can therefore not be generalized to the whole Region.

The other limitation is that this study was conducted at tertiary care hospital located at Sunyani town and majority of the study participants were urban residents. But many of the pregnant women in that municipality were living in rural areas where access to antenatal facilities is limited, so the prevalence of anemia would have been even more if the study was done in the general population.

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CHAPTER SIX

6.0 Conclusion and Recommendation

6.1 Conclusions.

The prevalence of anaemia among pregnant women in the Sunyani Municipality was high even though there is ongoing administration of iron supplementation, anti-helminthes and IPT to the pregnant women. The study also revealed that, age of pregnant woman, gestational age at first visit, malaria infection, consumption of fish/snails, occupation of the pregnant woman and number of antenatal visit were significantly associated with anaemia in pregnancy.

6.2 Recommendation

Based on the findings of this present study, the following recommendations have been made;

1. On prevalence of anaemia;

The Regional Health Directorate should intensify health education on the need for balanced diet and compliance to iron supplements and anti-helminthes at ANC. Education on anaemia should not be attached as an addendum to other health education but should be similar to education on Ebola and HIV/AIDS.

2. Iron supplementation and anaemia

The pregnant woman should be directly observed to take the iron supplements at the ANC clinic. It is also important for the Midwives to invite a member of the pregnant women's family at least once at the ANC where they will listen to the benefit of iron supplementation to the pregnant woman and the fetus. Through this, the family member will constantly remind the pregnant woman to take her iron supplements always.

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3. Malaria infection and anaemia

The Regional Health Director should ensure steady supply of the Sulphadoxine pyrimethanine (S P) drugs and bed nets. The Midvives should ensure that the drug is taken under strict observation at the ANC.

4. Occupation and anaemia

Given that women who got pregnant while they were students were more likely to be anaemic, young ladies (students) should be educated on the need to prepare themselves adequately before getting pregnant.

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INTEGRI PROCEDAMUS

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7.0 APPENDICES

7.1 APPENDIX 1

QUESTIONAIRE FOR THE FACTORS ASSOCIATED WITH ANAEMIA IN PREGNANT WOMEN ATTENDING ANTENATAL CLINIC IN SUNYANI MUNICIPAL HOSPITAL

FORM NO [ ][ ][ ]

DATE OF INTERVIEW [ ][ ][ ][ ][ ][ ][ ][ ]

	INFORMATION FROM ANC BOOKLET		CODE
1	No. of ANC visit		
2	Hb at first visit		g/dl
3	Hb at current visit		g/dl
4	Age of participant		Years
5	Gestational age at first visit		
6	Gestational age at current visit		
7	Use of anti- helminthes medicine	No deworming medicine received during current pregnancy [ ] At least one dose of deworming medicine received during current pregnancy [ ]	
8	Anti-malaria prophylaxis during current pregnancy	No anti- malaria drug taken [ ] At least one dose of anti-malaria drug taken [ ]	
9	Gestational age at which IPT was administered during current pregnancy	[ ]	Weeks
10	Parity (Number of Children)		
11	Gravidity (Number of Pregnancy)	[ ]	
	QUESTION FORM INTERVIEW		
13	Occupation of participant	Government worker [ ] Self-employed [ ] Unemployed [ ] Others [ ]	

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14	Highest level of education	No Formal Education [ ] Primary [ ] Secondary [ ] Tertiary [ ]	
15	Marital status	Single [ ] Married [ ] Cohabitation [ ] Divorced/separation/widow [ ]	
16	Have you taken your iron supplementation during this current pregnancy?	Yes No	
17	If yes how many times?	Once [ ] Always [ ] Sometimes [ ]	
18	Pica consumption during this current pregnancy	Yes No	
19	Frequency of consumption of the following foodsduring current pregnancy in a week		
	14.1 Egg	Never [ ] Once a week [ ] Twice per week [ ] Three or more per week [ ]	
	Meat/ Fish/Snails	Never [ ] Once a week [ ] Twice per week [ ] Three or more per week [ ]	
	Green vegetables/fruits	Never [ ] Once a week [ ] Twice per week [ ] Three or more per week [ ]	
20	Birth spacing/ interval between pregnancies	☐	Years
21	Malaria infection during current pregnancy	Yes No	
22	If yes Gestational age at which infection occurred?	☐	Weeks
23	Do you have bed net?	Yes No	

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24	Did you sleep under it last night?	Yes No	

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7.0 CONSENT FORM

TITLE: Anaemia in pregnancy among antenatal attendants at the Sunyani Municipal Hospital

PRINCIPAL INVESTIGATOR: Anlaakuu Peter

QUALIFICATION: Masters in Clinical Trials

A PILOT STUDY TO DETERMINE ANAEMIA IN PREGNANCY AMONG ANTENATAL ATTENDANTS AT THE SUNYANI MUNICIPAL HOSPITAL.

CONSENT FORM: PREGNANT WOMEN RECEIVING ANTENATAL CARE

You are invited to participate in a research being conducted on anaemia in pregnancy by Mr. Anlaakuu Peter, a Student at the Department of Epidemiology and Disease Control of the School of Public Health, University of Ghana. For this project, the study will employ two main approaches for data collection. These will be data extraction from participant ANC Booklet using a checklist and administration of a structured questionnaire.

The purpose of this research is to determine the prevalence of anaemia (HB <11.0g/dl) among ANC attendants at the Sunyani Municipal Hospital and possible risks factors associated with anaemia in pregnant women

The information generated will be used for academic research or publication and to help advance knowledge about the current trends for policy makers. All information obtained will be encrypted, secured and confidential.

For this research, you will answer questions in a survey. You are free to withdraw your participation at any time should you become uncomfortable with the study. If you have any questions or concerns, feel free to contact me on my cell phone 0208536249, or by email at anlaakuupeter20@yahoo.com. I hope you will enjoy this opportunity to share your experiences and viewpoints. Thank you very much for your help.

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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.

_____ _____

Signature of Researcher Date

I certify that I voluntarily agree to answer the survey questions, that the survey has been explained to me. All my questions have been answered satisfactorily to my understanding and I am free to discontinue participation at any time if I so choose.

_____ _____

Signature or Thumbprint of Participant Date

_____ _____

Signature or Thumbprint of Witness Date

For questions or problems about your rights please call Ms. Hannah Frimpong on 0243235225 or write to The Ethical Review Committee, Ghana Health Service at Hannah.frimpong@ghsmail.com