**AKENTEN APPIAH-MENKA UNIVERSITY OF SKILLS TRAINING AND ENTREPRENEURIAL DEVELOPMENT**

**ASANTE MAMPONG**

# PREVALENCE AND FACTORS ASSOCIATED WITH ANAEMIA IN PREGNANCY AMONG ANTENATAL ATTENDANTS AT THE MAMPONG MUNICIPAL HOSPITAL

**SANDRA GYANEA AGYEMANG**

**MASTER OF PUBLIC HEALTH (MPH)**

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A thesis submitted to the Department of Public Health Education of the Faculty of Environment and Health Education, Akenten Appiah-Menka University of Skills Training and Entrepreneurial Development in partial fulfilment of the requirements for the award of a Master of Public Health (MPH)

**MARCH, 2025**

## DECLARATION

**Candidate's Declaration**

I hereby declare that this dissertation is the result of my own original work and that no part of it has been presented for another degree at this university or elsewhere.

**Sandra Gyanea Agyemang**

Signature: …… Date: ……..

**Supervisors' Declaration**

I hereby declare that the preparation and presentation of this dissertationwere supervised in accordance with guidelines on supervision of dissertation laid down by the Akenten Appiah-Menka University of Skills Training and Entrepreneurial Development.

**Dr. Joana Apenkwa**

Signature: …….. Date: ……

**Dr. Justice Ofori Amoah**

Signature: …… Date: ……..

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## DEDICATION

I dedicate this work to my family for their unwavering support, guidance, and encouragement throughout my education and research journey. Additionally, I extend this dedication to all my loved ones who have contributed in various ways to the success of this study.

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| | | |
|---|---|---|
| **ANC** | – | Antenatal Care |
| **APGAR** | – | Appearance, Pulse, Grimace, Activity, Respiration (newborn assessment) |
| **BMI** | – | Body Mass Index |
| **CHRPE** | – | Committee on Human Research, Publications and Ethics |
| **CI** | – | Confidence Interval |
| **DHD** | – | District Health Directorate |
| **DHS** | – | Demographic and Health Survey |
| **EDD** | – | Estimated Date of Delivery |
| **EMR** | – | Electronic Medical Records |
| **FAO** | – | Food and Agriculture Organization |
| **FBC** | – | Full Blood Count |
| **GDHS** | – | Ghana Demographic and Health Survey |
| **GHS** | – | Ghana Health Service |
| **Hb / HB** | – | Haemoglobin |
| **HIV** | – | Human Immunodeficiency Virus |
| **IPTp** | – | Intermittent Preventive Treatment for Malaria in Pregnancy |
| **IUGR** | – | Intrauterine Growth Restriction |
| **LBW** | – | Low Birth Weight |
| **MDDW** | – | Minimum Dietary Diversity for Women |
| **MMH** | – | Mampong Municipal Hospital |
| **MOH** | – | Ministry of Health |

| | | |
|---|---|---|
| **MTCT** | – | Mother-to-Child Transmission |
| **ORS** | – | Oral Rehydration Solution |
| **PLWD** | – | People Living With Disability |
| **RBC** | – | Red Blood Cell |
| **RR** | – | Relative Risk |
| **SD** | – | Standard Deviation |
| **SES** | – | Socioeconomic Status |
| **SP** | – | Sulfadoxine-Pyrimethamine (drug used for IPTp) |
| **SPSS** | – | Statistical Package for Social Sciences |
| **UNICEF** | – | United Nations Children's Fund |
| **WHO** | – | World Health Organization |

## ABSTRACT

Anaemia in pregnancy remains a major public health concern, particularly in resource-limited settings. This study assessed the prevalence and associated factors of anaemia among pregnant women attending antenatal care at the Mampong Municipal Hospital. A cross-sectional study design was employed, involving 381 participants. A structured questionnaire was designed to collect data from pregnant women. The findings revealed a high prevalence of anaemia (60.6%), with severe anaemia (23.6%) being the most common form. The study identified significant associations between anaemia and socio demographic factors, including age, educational level, occupation, and income. Women aged 35–44 years had the highest prevalence (77.5%), and those with no formal education were at greater risk (85.5%). Also, unemployed women (93.5%) and those earning below 500 GHS per month (93.3%) were disproportionately affected. Advanced statistical analysis, including logistic regression, revealed that women with no formal education had 3.25 times higher odds of anaemia ($p=0.006$), and unemployed women had 7.12 times higher odds ($p=0.001$) compared to those employed. Household income was a key determinant, with women earning less than 500 GHS having 5.88 times higher odds of anaemia ($p<0.001$). Furthermore, nutritional factors significantly influenced anaemia risk, with regular iron-rich food intake showing a protective effect ($r = -0.22$, $p = 0.001$) and daily iron supplementation reducing anaemia risk ($r = -0.30$, $p = 0.0005$).Antenatal education and healthcare practices also played a role, as women who did not receive iron supplements during ANC visits had nearly twice the odds of anaemia (OR = 1.90, $p < 0.001$). Lack of adherence to iron supplementation increased the risk significantly (OR = 1.72, $p < 0$.The study indicates the need for comprehensive interventions, including improved nutrition education, enhanced antenatal care services, and socioeconomic support programmes to mitigate anaemia among pregnant women.

# CHAPTER ONE

## 1.0 INTRODUCTION

### 1.1 Background of the Study

Anaemia in pregnancy is a major global public health problem that affects both maternal and fetal health. It is defined by the World Health Organization (WHO) as a haemoglobin concentration of less than 11.0 g/dL in pregnant women(Rohith, 2021). Anaemia occurs when the oxygen-carrying capacity of the blood is reduced due to a deficiency in the number of red blood cells or in the haemoglobin content of these cells(Fite *et al.*,2021). The condition may result from a variety of causes, including iron deficiency, folate and vitamin B12 deficiency, chronic infections (such as malaria and HIV)(Karami *et al.*,2022). Genetic disorders which include sickle cell disease and thalassemia, or physiological changes associated with pregnancy, particularly increased plasma volume and iron demands(Dorsamy *et al.*,2022).

Globally, anaemia affects approximately 1.6 billion people, representing about 25% of the world's population (Karami *et al.*,2022). It disproportionately impacts women of reproductive age, especially those who are pregnant. The WHO estimates suggest that 41.8% of pregnant women worldwide are anaemic, with a higher burden in developing countries (approximately 51%) compared to developed nations (Tandoh *et al.*,2021a). Regional variations are remarkable, with South Asia and sub-Saharan Africa showing the highest prevalence rates. In countries such as India, prevalence rates have been reported as high as 65–75%, highlighting the scope of the problem in low-resource settings(Geta *et al.*,2022).

During pregnancy, the demand for iron and other nutrients increases significantly to support fetal development and expand maternal blood volume(Karami *et al.*,2022). A physiological

expansion in plasma volume by up to 50% during the second trimester results in haemodilution, a natural process that can lead to what is termed "physiological anaemia of pregnancy" (Sharma *et al.*,2021). However, when iron intake or absorption does not meet these heightened demands, iron-deficiency anaemia which isby far the most common form of anaemia in pregnancy can occur(Dorsamy *et al.*,2022).

Anaemia during pregnancy is associated with serious health risks. Maternal complications include fatigue, increased risk of infections, postpartum haemorrhage, and even maternal death(Rahman *et al.*,2022). For the fetus, the consequences are equally severe, ranging from intrauterine growth restriction (IUGR) and low birth weight to preterm birth and increased perinatal mortality. According to Pobee et al.(2021), maternal haemoglobin levels below 8.0 g/dL are linked to a two- to three-fold increase in perinatal mortality, while levels below 5.0 g/dL may result in an 8–10-fold increase(Karami *et al.*,2022). Furthermore, iron-deficiency anaemia has been implicated in impaired cognitive and physical development in infants, highlighting its long-term implications beyond childbirth(Ogunbode & Ogunbode, 2021).

In Ghana, anaemia remains a persistent issue in maternal health. According to the 2022 Ghana Demographic and Health Survey (GDHS), the prevalence of anaemia among pregnant women stands at 51%, compared to 40% in non-pregnant women (GDHS, 2020). This trend mirrors broader global patterns, but also reflects specific local challenges. Anaemia prevalence is influenced by multiple socio-demographic factors, including educational level, income, household food security, access to antenatal care, and cultural dietary practices. Studies by Ogundele et al. (2021), found that low maternal education and poor socioeconomic status were strong predictors of anaemia in pregnancy. These factors often translate into limited access to nutrient-rich foods, low health literacy, and reduced use

of preventive health services such as iron supplementation and deworming(Adamu *et al.*,2017).

A study by Nuamah et al. (2019), emphasized that anaemia in pregnancy continues to pose a challenge in rural areas of Ghana, where healthcare infrastructure is often inadequate. In such settings, antenatal clinics may be understaffed and under-equipped, contributing to poor screening and late diagnosis of anaemia. Infections such as malaria and intestinal parasites, which are endemic in many parts of Ghana(Akowuah *et al.*,2022), further increase the risk of anaemia by contributing to blood loss and destruction of red blood cells.The Mampong Municipality in the Ashanti Region of Ghana is no exception. Anaemia in pregnancy is one of the leading health conditions affecting women attending antenatal care in this area. The high prevalence is attributed to factors such as limited healthcare personnel, inadequate labour atory facilities for regular screening, poor dietary habits, low utilization of iron-folic acid supplementation, and a lack of comprehensive nutrition and health education(Adu-Amankwaah *et al.*,2018a). Persistent infections, such as malaria, and a lack of family planning services also contribute to the rising cases of anaemia(Kinyoki *et al.*,2021a).

Despite numerous government and donor-funded interventions aimed at reducing maternal anaemia such as the provision of free iron supplements during ANC visits, intermittent preventive treatment for malaria in pregnancy (IPTp), and health promotion activities the condition remains stubbornly high(Li *et al.*,2020). This suggests a need for more localized, data-driven approaches. However, there lack of data on the current prevalence and associated risk factors for anaemia in pregnancy within the Mampong Municipal Hospital catchment area.Therefore, this study aimed to assess the current prevalence and the socio-demographic,

dietary, and health-related factors associated with anaemia among pregnant women attending antenatal care in Mampong Municipal Hospital.

### 1.2 Problem Statement

Anaemia in pregnancy remains a major public health challenge worldwide, particularly in low- and middle-income countries, where it contributes significantly to maternal and perinatal morbidity and mortality(Goicoechea *et al.*,2022). Despite global and national efforts to address maternal health through improved antenatal care services, the prevalence of anaemia among pregnant women remains alarmingly high. According to the World Health Organization, approximately 41.8% of pregnant women globally are anaemic, with the burden disproportionately higher in developing countries (WHO, 2021). In Ghana, recent data from the 2022 Ghana Demographic and Health Survey (GDHS) report a prevalence of 51% among pregnant women, indicating that over half of expectant mothers are affected(Adu-Amankwaah *et al.*,2018a).

Anaemia during pregnancy, particularly iron-deficiency anaemia, is associated with serious complications including preterm delivery, low birth weight, intrauterine growth restriction, increased risk of infections, and elevated maternal and perinatal mortality(Basaaking, 2016). While several studies have identified key factors contributing to anaemia in pregnancy such as inadequate dietary intake, low socio-economic status, infections (malaria, helminths), poor health-seekingbehaviour" s, and limited access to quality antenatal services these factors are often context-specific and vary widely across different regions(Abd Rahman *et al.*,2022).

In the Mampong municipality of Ghana, anecdotal evidence and facility-based reports suggest that anaemia in pregnancy is prevalent and represents one of the leading conditions encountered in antenatal clinics. However, there is a lack of recent, comprehensive data on the actual prevalence and the specific socio-demographic, nutritional, and health-related factors contributing to the condition within this locality. The absence of such data limits the ability of healthcare providers and policymakers to design targeted, evidence-based interventions to reduce the burden of anaemia among pregnant women in the region.Therefore, it is imperative to assess the current prevalence of anaemia and investigate the associated factors among pregnant women attending antenatal care in the Mampong municipality.

### 1.3 General Objective

To determine the prevalence and factors associated with anaemia in pregnancy among antenatal attendants at the Mampong municipal hospital.

### 1.5 Research Questions

1. What is the prevalence of anaemia among pregnant women attending antenatal care at Mampong Municipal Hospital?
2. What sociodemographic, economic, and nutritional factors are associated with anaemia in pregnancy?
3. How does antenatal education and healthcare practices influence anaemia prevalence among pregnant women?

4. What are the dietary habits and iron supplementation intake patterns among pregnant women at Mampong Municipal Hospital?

### 1.4 Specific Objectives

1. Determine the prevalence of anaemia among pregnant women attending antenatal care at Mampong Municipal Hospital.
2. Evaluate the sociodemographic, economic, and nutritional factors associated with anaemia in pregnancy.
3. Determine the effect of antenatal education and healthcare practices on anaemia prevalence.
4. Evaluate dietary habits and iron supplementation intake among pregnant women.

### 1.6 Justification for the Study

Anaemia in pregnancy remains a significant public health concern in Ghana, particularly in rural areas. The prevalence of anaemia in pregnancy is estimated at 42% nationally. Mampong municipal hospital serves a predominantly rural population with limited access to healthcare services. This study aims to investigate the prevalence and factors associated with anaemia in pregnancy among antenatal attendants at Mampong Municipal Hospital. Understanding these factors will inform targeted interventions to reduce the burden of anaemia in pregnancy, improving maternal and child health outcomes. Consequently, this study aims to determining the prevalence of anaemia in pregnancy among antenatal attendants. By investigating these factors, this study will provide valuable insights for policymakers, healthcare providers, and stakeholders to design and implement targeted

interventions to reduce the burden of anaemia in pregnancy in the Mampong Municipal Hospital catchment area.

### 1.7 Operational Definitions

**Anaemia:** A condition characterized by low hemoglobin levels (<11g/dl) in pregnancy (WHO, 2019).

**Antenatal Care:** Healthcare services provided to pregnant women to ensure optimal health outcomes (WHO, 2019).

**Prevalence:** The proportion of pregnant women with anaemia in the study population.

**Parity**: The number of previous births.

**Socioeconomic Status (SES):** Composite score of education, occupation and income.

**Nutritional status:** Dietary diversity score based on food frequency questionnaire.

**Malaria in Pregnancy:** Confirmed malaria diagnosis during pregnancy.

**Iron Supplementation:** Self-reported intake of iron supplements during pregnancy.

### 1.8 Organizations of the Study

The Chapter One comprised of anintroduction and provided an overview of the study, including the background, research questions, objectives, and significance of the study. The Chapter Twoalso emphasized on literature review. This section reviewed the relevant literature on the prevalence of anaemia in pregnancy among antenatal attendees, sociodemographic factors associated with anaemia in pregnancy, relationship between nutritional factors and anaemia and impact of antenatal care on anaemia prevalence.The section also provided an overview of the theoretical framework that guided the analysis of

the data. Methodology was also captured in Chapter Three which described the research method used in the study, including the sampling method, data collection method, data analysis, and ethical considerations. The Chapter Four of the study mainly focused on the study results. It also highly focused on the discussion gained from findings from the study. Finally, the Chapter Five of this study constituted the summary, conclusions, limitations and recommendations of the study. Under this section, the researcher focused on pinning out various approach used for the study, aims and findings of the study.

# CHAPTER TWO

# 2.0 LITERATURE REVIEW

## 2.1 Overview

Anaemia in pregnancy remains a pervasive public health concern, particularly in low- and middle-income countries, where it contributes significantly to maternal and perinatal morbidity and mortality. The condition is multifactorial, involving physiological, nutritional, infectious, socio-economic, and healthcare system-related dimensions. This literature review provides a comprehensive synthesis of existing research on the prevalence, causes, and consequences of anaemia in pregnancy, with an emphasis on both global patterns and the Ghanaian context. It explores key determinants such as sociodemographic and economic status, nutritional intake, antenatal healthcare practices, and iron supplementation.

## 2.2 Aneamia

Anaemia is characterized by a decrease in the concentration of hemoglobin (Hb), hematocrit, or red blood cell count below the normal reference range for individuals of the same age, gender, and ethnicity, within similar environmental conditions(Aheto *et al.*,2023a).WHO defines anaemia in children under five as a hemoglobin level below 11.0g/dl. This common condition results from reduced Hb levels, which are inadequate to meet the body's physiological needs. Anaemia is recognized as a major public health issue, affecting countries across all income levels, with varying prevalence rates based on socioeconomic factors. Blood hemoglobin concentration is the most reliable measure of anaemia at the population level (Gardner & Kassebaum, 2020a).

Globally, anaemia affects 1.62 billion people, which represents about 24.8% of the world's population (WHO, 2024). It impacts all age groups but is particularly prevalent in children under five. In fact, 293.1 million children in this age group (47.4%) are affected by anaemia, with 67.6% of them residing in Africa (WHO, 2024). Iron deficiency anaemia is particularly concerning, as it increases both morbidity and mortality among young children and pregnant women. Various factors contribute to the development of anaemia, with iron deficiency accounting for approximately 43% of cases in young children(Aheto *et al.*,2023b). The deficiency can be caused by insufficient dietary iron intake, poor iron absorption, higher iron demands during periods of rapid growth, and chronic blood loss. Other causes of anaemia include deficiencies in folate and vitamin B12, malaria, intestinal worms, and viral infections(Obeagu *et al.*,2023a).

In Ghana, national surveys highlight a concerning situation. The 2022 Ghana Demographic and Health Survey (GDHS) reported that 66% of children under five and 51% of pregnant women were anaemic. These findings are consistent with facility-based studies in the Ashanti and Northern Regions, where anaemia prevalence among antenatal clinic attendees ranged from 45% to 70% (Ogundele *et al.*,2021; Nuamah *et al.*,2019). Factors commonly reported include low dietary iron intake, poor education, infections such as malaria, and poor compliance with iron supplementation. A systematic review by Adu-Amankwaah et al. (2018) on maternal anaemia in Ghana emphasized that socioeconomic status, parity, and antenatal service utilization significantly influence anaemia outcomes.Iron deficiency remains the leading cause of anaemia worldwide, accounting for nearly 43% of all cases in young children (Aheto *et al.*,2023b). The deficiency often results from low intake of iron-rich foods, reduced iron absorption, increased physiological demands during pregnancy or

childhood growth, and chronic blood loss. Other contributing factors include folate and vitamin B12 deficiencies, helminthic infections, and chronic diseases like malaria and HIV (Obeagu *et al.*,2023a). These findings reinforce the need for context-specific interventions in Ghana and across Africa, especially in improving nutrition, infection control, and antenatal care access.

### 2.3 Global Epidemiology of Anaemia

Anaemia affects more than a billion people globally, with the highest rates observed in pregnant women and young children, especially those under five years of age. Anaemia remains one of the most significant public health challenges worldwide(Obeagu *et al.*,2023a), with profound implications for both individual health and broader socioeconomic development. The study of anaemia's global epidemiology is critical to understanding its widespread impact, its underlying causes, and the effectiveness of interventions aimed at reducing its prevalence.The global burden of anaemia has been substantial, affecting approximately 1.74 billion people globally as of 2019. The Global Burden of Disease (GBD) Study 2019 highlighted a prevalence rate of 22.8% across all age groups, a slight decrease from 27.0% in 1990. However, despite the reduction in prevalence, the total number of anaemia cases has increased, primarily due to population growth(Gardner & Kassebaum, 2020a). This paradox underscores the complexity of addressing anaemia globally and suggests that while public health interventions may have had some success, much work remains to be done. Despite the overall global decrease, anaemia remains disproportionately high in certain demographic and geographical groups. In particular, the burden is highest among children under five years old, with an alarmingly high prevalence of 39.7% in 2019.

Women of reproductive age also experience significant rates of anaemia, with a prevalence of 39% recorded in 2016 (WHO, 2019). These figures highlight the vulnerability of specific age groups, particularly during periods of rapid growth and reproductive health. Consequently, targeted interventions for children and women are essential in reducing the global burden of anaemia (WHO, 2022).

Age and gender disparities are prominent features in the epidemiology of anaemia. As mentioned, children and women of reproductive age bear a disproportionate burden of the disease(Dorsamy *et al.*,2022). These disparities arise due to several factors, including nutritional deficiencies, increased iron requirements during periods of rapid growth (such as during childhood and pregnancy), and societal and cultural barriers that may restrict access to adequate healthcare and nutrition(Dorsamy *et al.*,2022).In addition to gender and age factors, the global data reveal stark contrasts between regions. The highest prevalence rates of anaemia are observed in regions with limited access to healthcare, poor nutrition, and ongoing conflicts. In 2021, Sub-Saharan Africa, particularly Western Sub-Saharan Africa, recorded the highest prevalence of anaemia at 47.4%, followed by South Asia and Central Sub-Saharan Africa, both with a prevalence rate of 35.7%.

These regions face unique challenges, including endemic infectious diseases, lack of access to quality healthcare, and malnutrition.Conversely, regions such as North America, Western Europe, and Australasia report much lower rates of anaemia, with prevalence ranging from 5.7% to 6.8%(Dorsamy *et al.*,2022). These lower rates are largely attributable to better healthcare infrastructure, more robust nutrition programs, and greater access to iron supplements and other essential nutrients. However, even in wealthier nations, anaemia continues to pose a risk to certain vulnerable populations, including those from low-income

backgrounds and immigrant communities who may face barriers to accessing healthcare(Pobee *et al.*,2021a).

Anaemia is a multifactorial condition, and its causes vary widely across different regions and populations. Iron deficiency is the most common cause of anaemia, contributing to approximately 84.7% of all anaemia-related years lived with disability (YLDs) in 2021. Iron deficiency often stems from poor dietary intake, limited access to iron-rich foods, and in some regions, inadequate health education about the importance of nutrition. This nutritional deficiency is particularly prevalent in low- and middle-income countries where food insecurity is a major concern(Geta *et al.*,2022).In addition to nutritional deficiencies, haemoglobinopathies such as sickle cell disease and thalassemia also play a significant role in anaemia, particularly in regions with high rates of genetic disorders. These conditions, though less common than iron deficiency, contribute significantly to the burden of anaemia in areas such as Sub-Saharan Africa, the Middle East, and South Asia(Karami *et al.*,2022a).

### 2.3.1 Epidemiology of Anaemia in Ghana

Anaemia continues to pose a major public health threat in Ghana, particularly among vulnerable populations such as pregnant women, lactating mothers, and children under five. It is defined as a reduction in the concentration of hemoglobin (Hb), hematocrit, or red blood cell count below the standard reference range for individuals of similar age, sex, and ethnicity (Aheto *et al.*,2023a). In children under five, the World Health Organization (WHO) classifies anaemia as hemoglobin levels below 11.0 g/dL. In Ghana, anaemia is largely influenced by iron deficiency, inadequate intake of micronutrients such as folate and vitamin B12, parasitic infections (including malaria and intestinal helminths), chronic illnesses, and

socio-economic hardships (Obeagu *et al.*,2023a). The 2022 Ghana Demographic and Health Survey (GDHS) reported that 66% of children under five and 51% of pregnant women are anaemic, with severe anaemia being more common in rural settings. These figures signify that anaemia remains a critical concern in maternal and child health. Variations in prevalence are observed across regions, with higher rates often reported in the Northern, Upper East, Upper West, and parts of the Ashanti Region. Rural women and children are disproportionately affected due to lower access to diverse foods, healthcare services, potable water, and sanitation. Inadequate antenatal care attendance and poor compliance with iron supplementation during pregnancy further aggravate the problem.

Studies conducted in various health facilities in Ghana align with national data. For example, Nuamah et al. (2019) found that anaemia prevalence among antenatal clinic attendees in the Ashanti Region ranged between 45% and 70%. Similarly, Ogundele et al. (2021) documented that low educational attainment, unemployment, and large household sizes were associated with increased anaemia risk. Anaemia was also more common among women who had multiple pregnancies and short birth intervals, suggesting nutritional depletion and inadequate recovery between births. At the regional level, sub-Saharan Africa carries the heaviest anaemia burden globally. WHO (2024) reports that the region accounts for 67.6% of global childhood anaemia cases. Karami et al. (2022) noted in a systematic review that anaemia prevalence among pregnant women in Africa was 41.7%, with the highest burden reported in West and Central Africa. The major drivers include poor dietary diversity, frequent infections such as malaria and schistosomiasis, and inadequate public health infrastructure. Compared to high-income regions like Western Europe and North America, where prevalence rates are often below 10%, the burden in sub-Saharan Africa is alarming.

Iron deficiency anaemia is the most widespread form, accounting for approximately 43% of global anaemia cases in children (Aheto *et al.*,2023b). In Ghana, iron deficiency arises from insufficient dietary iron intake, consumption of iron-inhibiting foods, and poor absorption. Many local diets are dominated by starchy staples with low iron bioavailability. Cultural food restrictions during pregnancy, such as avoiding animal-source foods, also reduce iron intake. Furthermore, poor adherence to iron and folic acid supplements during pregnancy is frequently reported, with some women citing side effects, forgetfulness, and lack of counseling by health workers. The Ghana Health Service (GHS) promotes several interventions, including routine iron and folic acid supplementation, deworming during ANC visits, malaria prevention using insecticide-treated nets and intermittent preventive treatment in pregnancy (IPTp), and nutrition education. However, implementation challenges persist. Stock-outs of essential supplements, inadequate health personnel, and inconsistent follow-up reduce the effectiveness of these programs. Efforts to improve maternal education, community-based nutrition outreach, and male partner involvement in maternal health could help improve adherence to anaemia prevention strategies.

### 2.4 Clinical Features of Anaemia

The symptoms of anaemia may include shortness of breath, especially during physical activity, as well as weakness, fatigue, dizziness, palpitations, and headaches. There are also general signs that can indicate anaemia, such as pale skin and mucous membranes, especially when hemoglobin levels drop below 9 g/dL(Goicoechea *et al.*,2022). The heart may show signs of a faster heart rate (tachycardia), enlarged heart (cardiomegaly), and a murmur, particularly in the systolic phase. Specific signs can be linked to different types of anaemia.

For instance, iron deficiency may cause changes in the nails (koilonychia), jaundice can occur in cases of hemolytic or megaloblastic anaemia, and people with sickle cell anaemia may develop leg ulcers(Dorsamy *et al.*,2022).

In infants with iron-deficiency anaemia, there is often a noticeable decrease in cognitive abilities compared to healthy infants. These children may also experience delays in the development of nerve functions in their upper limbs. Furthermore, iron deficiency increases the risk of infections, lowers physical abilities, and negatively impacts concentration and learning(Fite *et al.*,2021a).

## 2.5 Types of Anaemia

Anaemia is a condition in which the body lacks enough healthy red blood cells or hemoglobin to carry adequate oxygen to the tissues. It is classified into various types based on the size, colour, and cause of the red blood cells. The main types of anaemia include:

### 2.5.1Microcytic Anaemia

#### 2.5.1.1 Iron Deficiency Anaemia (IDA)

Iron deficiency anaemia (IDA) is the most common type of anaemia worldwide, occurring when the body lacks sufficient iron to produce hemoglobin, the oxygen-carrying protein in red blood cells. Without enough iron, the bone marrow cannot produce enough hemoglobin, leading to the formation of smaller, pale red blood cells that are unable to carry oxygen efficiently (Kinyoki *et al.*,2021b). Iron deficiency can arise from a variety of causes, including inadequate dietary intake of iron, blood loss, or poor absorption of iron. Individuals at higher risk for iron deficiency anaemia include those with heavy menstrual

periods, gastrointestinal bleeding (due to conditions such as ulcers or colourectal cancer), and those with malabsorption syndromes, such as celiac disease. In children, iron deficiency anaemia is often linked to poor nutrition or exclusively breastfeeding without iron-fortified foods after the age of six months. Treatment typically involves iron supplements, but addressing the underlying cause of iron loss such as managing blood loss or improving diet is essential for long-term management (Obeagu *et al.*,2023b).

#### 2.5.1.2 Thalassemia

Thalassemia is an inherited disorder that affects the production of hemoglobin, a protein in red blood cells that binds to oxygen. Hemoglobin consists of two types of globin chains: α-globin and β-globin. In thalassemia, mutations in the genes responsible for producing these globin chains lead to an imbalance in the production of the α and β chains. This results in the production of abnormally shaped red blood cells, which are smaller and often fragile, leading to anaemia(Akowuah *et al.*,2022a). There are two main types of thalassemia: α-thalassemia and β-thalassemia, each with varying severity depending on the number of affected genes. In α-thalassemia, fewer α-globin chains are produced, and the severity depends on how many of the four α-globin genes are affected. In β-thalassemia, defects in the β-globin gene result in an inadequate production of β-globin chains. This disorder is most commonly found in people of Mediterranean, Southeast Asian, and African descent. Management of thalassemia varies, but it often involves blood transfusions and, in severe cases, bone marrow or stem cell transplants(Wemakor, 2019).

#### 2.5.1.3 Sideroblastic Anaemia

Sideroblastic anaemia is a group of disorders characterized by the inability of the bone marrow to properly incorporate iron into hemoglobin, despite the presence of sufficient iron. This results in the formation of abnormal red blood cells known as sideroblasts, which are red blood cells that contain iron deposits in their mitochondria. Sideroblastic anaemia can be inherited or acquired(Tesema *et al.*,2021). The inherited form is usually due to genetic mutations that affect enzymes involved in heme production. Acquired sideroblastic anaemia can be triggered by a variety of factors, such as chronic alcoholism, exposure to toxins like lead, or certain medications, particularly those that interfere with vitamin B6 metabolism, which is essential for heme production(Gardner & Kassebaum, 2020b). Symptoms of sideroblastic anaemia include fatigue, weakness, and pallor, and the disorder is often associated with iron overload due to the body's inability to properly use iron. Treatment typically involves addressing the underlying cause, such as avoiding alcohol or lead exposure, and in some cases, vitamin B6 supplementation or blood transfusions may be necessary(Stevens *et al.*,2022a).

#### 2.5.1.4 Lead Poisoning

Lead poisoning can lead to microcytic anaemia by interfering with several enzymatic processes involved in hemoglobin synthesis. Lead exposure, particularly in children, can disrupt the production and maturation of red blood cells (Klu *et al.*,2024). The lead interferes with the function of enzymes that are essential for heme synthesis, leading to a reduction in the production of normal hemoglobin and the formation of smaller, ineffective red blood cells. Chronic exposure to lead, often from environmental sources such as lead-based paints,

contaminated soil, or plumbing, can cause this type of anaemia. Symptoms of lead poisoning include irritability, developmental delays, abdominal pain, and in severe cases, neurological damage. In children, lead poisoning can have long-term effects on cognitive development. Treatment involves chelation therapy to remove the lead from the body, and in some cases, supportive therapies such as blood transfusions may be necessary to manage anaemia (Muñoz *et al.*,2015).

### 2.5.2 Normocytic Anaemia

Normocytic anaemia is a condition in which the size of red blood cells (RBCs) is normal, but their number or the amount of hemoglobin they contain is insufficient to meet the body's oxygen demands (Wemakor, 2019). This type of anaemia is typically seen in situations where there is an acute drop in red blood cell count, or when the bone marrow's ability to produce red blood cells is impaired. Normocytic anaemia can result from several conditions, including:

#### 2.5.2.1 Anaemia of Chronic Disease (ACD)

Anaemia of chronic disease, also known as anaemia of inflammation, is commonly seen in individuals with chronic infections, autoimmune diseases, or cancer. It occurs when the body's response to long-term illness disrupts the normal production of red blood cells(Stevens *et al.*,2022b). Chronic inflammation leads to the release of certain cytokines (e.g., interleukin-6) that affect iron metabolism by sequestering iron in the reticuloendothelial system (the liver and spleen), thus limiting its availability for red blood cell production. In addition, inflammatory cytokines suppress the production of

erythropoietin, a hormone that stimulates red blood cell production in the bone marrow. As a result, even though the body has enough iron, it is unable to use it efficiently to produce healthy red blood cells. This leads to microcytic anaemia(Fite *et al.*,2021b). Anaemia of chronic disease is typically mild to moderate and is often seen in conditions such as rheumatoid arthritis, chronic kidney disease, and tuberculosis. Treatment usually focuses on managing the underlying condition. In some cases, erythropoiesis-stimulating agents or iron supplementation may be used, but these treatments are more effective once the inflammation or disease is controlled(Turawa *et al.*,2021a).

#### 2.5.2.2 Acute Blood Loss Anaemia

Acute blood loss anaemia occurs when there is sudden and significant blood loss, such as in trauma, surgery, or gastrointestinal bleeding. Although the size of the red blood cells remains normal, the sudden loss of blood results in a drop in overall red blood cell count(Scheiner *et al.*,2020). The body may attempt to compensate for the blood loss by increasing the production of new red blood cells, but in the short term, the reduced number of RBCs leads to anaemia. Acute blood loss can also cause a drop in hemoglobin and hematocrit levels, and if the blood loss is severe, transfusions may be required to restore normal RBC levels(Pobee *et al.*,2021b).

#### 2.5.2.3 Aplastic Anaemia

Aplastic anaemia is a rare but serious condition where the bone marrow fails to produce enough red blood cells, white blood cells, and platelets. This failure can be caused by autoimmune diseases, exposure to toxic substances (such as benzene or certain medications),

viral infections (such as hepatitis or Epstein-Barr virus), or radiation. In aplastic anaemia, the bone marrow becomes severely damaged, leading to a reduction in the production of all blood cells, including RBCs(Simbauranga *et al.*,2015a). The size of the red blood cells remains normal, but their production is insufficient to maintain adequate oxygen transport. Treatment options include immunosuppressive therapy, bone marrow stimulants, and bone marrow or stem cell transplants(Adu-Amankwaah *et al.*,2018a).

#### 2.5.2.4 Hemolytic Anaemia

Hemolytic anaemia occurs when red blood cells are destroyed prematurely, leading to a reduction in their number. The size of the red blood cells may remain normal, but their lifespan is shorter than usual, which results in anaemia. Hemolytic anaemia can be caused by autoimmune diseases, infections, or inherited conditions(Kinyoki *et al.*,2021a). In autoimmune hemolytic anaemia, the body's immune system mistakenly attacks its own RBCs, leading to their destruction. In inherited forms of hemolytic anaemia, such as sickle cell anaemia or hereditary spherocytosis, red blood cells are abnormally shaped or fragile, causing them to break apart more easily(Adu-Amankwaah *et al.*,2018b). Hemolytic anaemia can also result from infections, such as malaria, in which the parasite infects and destroys red blood cells. Treatment for hemolytic anaemia focuses on addressing the underlying cause, such as immunosuppressive therapy for autoimmune diseases or blood transfusions in severe cases(Tandoh *et al.*,2021b).

### 2.5.3 Macrocytic Anaemia

Macrocytic anaemia is characterized by the presence of larger-than-normal red blood cells, which are often immature (megaloblasts) due to delayed or defective DNA synthesis in the bone marrow. The larger size of these RBCs typically results from deficiencies in essential vitamins required for DNA production, such as vitamin B12 or folate. This type of anaemia can arise from a variety of causes(Kalaivani & Ramachandran, 2018):

#### 2.5.3.1 Vitamin B12 Deficiency

Vitamin B12 is essential for proper DNA synthesis, and its deficiency can lead to the production of large, immature red blood cells. This is often seen in conditions such as pernicious anaemia, in which the body is unable to absorb vitamin B12 from the gastrointestinal tract due to a lack of intrinsic factor(Wemakor, 2019), a protein necessary for B12 absorption. Other causes of B12 deficiency include dietary insufficiency, malabsorption disorders (such as celiac disease), and gastrointestinal surgeries that affect nutrient absorption. Symptoms of B12 deficiency include fatigue, weakness, and neurological issues like numbness and tingling in the extremities. Treatment typically involves vitamin B12 injections or oral supplements(Fite *et al.*,2021b).

#### 2.5.3.2 Folate Deficiency

Folate, or vitamin B9, is another crucial nutrient required for red blood cell production. Folate deficiency can lead to the production of large red blood cells, similar to B12 deficiency. Folate deficiency may result from poor dietary intake, malabsorption disorders, certain medications (such as methotrexate or anticonvulsants), or alcoholism. Since folate is

vital for DNA synthesis, its deficiency impairs the production of new red blood cells, leading to macrocytic anaemia. Folate deficiency can also cause neural tube defects in developing fetuses, making it particularly important for pregnant women. Treatment typically involves folic acid supplementation(Tunkyi & Moodley, 2015a).

#### 2.5.3.3 Alcoholism

Chronic alcohol consumption can cause macrocytic anaemia through several mechanisms. Alcohol interferes with the absorption of both vitamin B12 and folate, leading to deficiencies of these essential nutrients. Additionally, alcohol has a direct toxic effect on the bone marrow, impairing red blood cell production. Chronic alcohol use is also associated with liver disease, which can contribute to macrocytic anaemia. The effects of alcohol on the body's ability to absorb and use vitamins, along with its impact on bone marrow function, make it a significant contributor to macrocytic anaemia(Mangla & Singla, 2016).

#### 2.5.3.4 Liver Disease

Liver disease, particularly cirrhosis, can lead to macrocytic anaemia due to the liver's role in red blood cell production and processing. The liver produces proteins involved in the synthesis of red blood cells and also processes vitamin B12 and folate, which are necessary for healthy RBC production. When the liver is damaged, it may not be able to perform these functions effectively, leading to anaemia. Cirrhosis, hepatitis, and other liver disorders are associated with the development of macrocytic anaemia, which often improves with treatment of the underlying liver condition(Kinyoki *et al.*,2021a).

#### 2.5.3.5 Hypothyroidism

Hypothyroidism, or an underactive thyroid, can contribute to macrocytic anaemia by slowing down the production of red blood cells. The thyroid hormone plays a key role in regulating metabolism and red blood cell production. When thyroid function is impaired, it can lead to a reduced rate of red blood cell production and the formation of larger-than-normal RBCs. Other symptoms of hypothyroidism include fatigue, weight gain, cold intolerance, and depression. Treatment typically involves thyroid hormone replacement therapy to normalize thyroid function and improve red blood cell production(Tesema *et al.*,2021).

### 2.5.4 Hemolytic Anaemia

Hemolytic anaemia occurs when red blood cells are destroyed at an accelerated rate, leading to a reduction in their overall number. While the size of the RBCs may be normal, their premature destruction results in anaemia. This type of anaemia can be caused by a variety of factors, including:

#### 2.5.4.1 Autoimmune Diseases

In autoimmune hemolytic anaemia, the body's immune system mistakenly targets and destroys its own red blood cells. This can occur in conditions such as lupus or other autoimmune disorders, where the immune system fails to distinguish between foreign invaders and healthy tissue(Simbauranga *et al.*,2015b). The destruction of RBCs in autoimmune hemolytic anaemia is often accelerated, leading to an insufficient number of healthy red blood cells. Treatment typically involves immunosuppressive drugs to inhibit the immune response and prevent further RBC destruction(Asgedom *et al.*,2024a).

#### 2.5.4.2 Inherited Conditions

Inherited forms of hemolytic anaemia, such as sickle cell anaemia and hereditary spherocytosis, result from genetic mutations that cause red blood cells to be abnormally shaped or fragile. In sickle cell anaemia, the red blood cells adopt a crescent or sickle shape, which makes them prone to breaking apart prematurely(Adamu *et al.*,2017b). This leads to a reduction in the number of healthy RBCs. In hereditary spherocytosis, the RBCs are spherical instead of the normal disc shape, which makes them more fragile and susceptible to destruction. These inherited conditions require ongoing management, which may include blood transfusions or other treatments to address anaemia and prevent complications(Le, 2016).

## 2.6 Anaemia in pregnancy

According to the World Health Organization, approximately 30% of pregnant women globally suffer from anaemia. Studies have shown varying prevalence rates, ranging from 14.1% in developed countries to 56.4% in developing countries (WHO, 2019). A prospective, observational, community-based study conducted by Suryanarayana et al.(2017) among four hundred and forty-six pregnant women showed significant overall improvement in the haemoglobin levels of pregnant women, during the follow-up (10.3–10.72%). About 35.6% of the women had maternal or fetal morbidity. Anaemia was one of the main pregnancy-related complications (62.3%), other complications included difficult labour (3%), postpartum hemorrhage, and preeclampsia 1.6% each abortion/stillbirth (3.5%). The fetal complications included low birth weight (25.5%) followed by premature delivery (0.2%) and birth asphyxia (0.5%)(Tunkyi & Moodley, 2015a).

A systematic review and meta-analysis study by Karami et al.(2022) examined the prevalence of anaemia in pregnant women globally. According to the results of this meta-analysis, the overall prevalence of anaemia in pregnant women is 36.8%. The highest prevalence of anaemia is mild at 70.8% and highest in the third trimester of pregnancy with the prevalence of 48.8% while the highest prevalence of anaemia in pregnant women was in Africa with the prevalence of 41.7%.The results of this study show a high prevalence of anaemia among pregnant women worldwide, and the highest of this prevalence is mild anaemia. The prevalence of anaemia in the third trimester was higher than in the first and second trimesters. Anaemia in pregnant women in developing countries is significantly higher than in developed countries due to pregnancy, economic, sociological, and health factors. According to the World Health Organization 2022, reports, from 35% to 75% (56% on average) of the pregnant women in developing countries are anaemic (WHO, 2022). Prevalence of anaemia in South Asian countries was among the highest in the world. India had the highest prevalence of anaemia (87%)(Suryanarayana *et al.*,2016). A high prevalence (64%) of anaemia was observed among pregnant women. Anaemia was predominantly observed among below poverty line families (59.4%) compared with above poverty line families (5.4%). The prevalence of anaemia increased with increase in gestational age and gravida and decreased with increase in birth interval (Suryanarayana *et al.*,2016).

Systematic Reviews and Meta-Analyses by Kassa *et al.* (2017) showed that the pooled prevalence of anaemia among pregnant women in Ethiopia was 31.66%. Based on the pooled prevalence of the subgroup analysis result, the lowest prevalence of anaemia among pregnant women was observed in Amhara region, 15.89% and the highest prevalence was in Somali region, 56.80% (Suryanarayana *et al.*,2016).

## 2.7 Sociodemographic and Economic Determinants of Anaemia in Pregnancy

Anaemia in pregnancy is a multifactorial condition influenced by various socio-economic and demographic variables. These factors not only affect a woman's access to healthcare services and nutritional resources but also shape her health-seekingbehaviour" s and vulnerability to disease. Understanding these determinants is essential for contextualizing the high prevalence of anaemia in low- and middle-income countries (LMICs), especially in sub-Saharan Africa(Tandoh *et al.*,2021a).

### 2.7.1 Age, Parity, Education Level, and Marital Status

Age is a significant determinant of anaemia risk during pregnancy. Adolescents and young mothers (below 20 years) are particularly vulnerable due to ongoing physical development, competition for nutrients between the growing adolescent and the fetus, and often poor nutritional practices (Gebre *et al.*,2015). Additionally, teenage pregnancies are frequently unplanned and associated with socio-economic disadvantages, further exacerbating nutritional deficiencies. Older mothers (above 35 years), particularly those with high parity, are also at risk due to cumulative nutritional depletion from repeated pregnancies and lactation (Suryanarayana *et al.*,2016). Multiparous women often have depleted iron stores if intervals between pregnancies are short and iron supplementation is inadequate. A study conducted in Ethiopia found a significantly higher prevalence of anaemia among women with three or more pregnancies compared to primigravidas (Abriha, Yesuf & Wassie, 2014). Education level has a strong inverse relationship with anaemia prevalence. Women with formal education are more likely to be aware of the importance of proper nutrition, iron-folic acid supplementation, early antenatal care (ANC) attendance, and malaria prevention

strategies. Educational attainment also influences economic status and decision-making autonomy, both of which contribute to better maternal health outcomes (Ogundele *et al.*,2021). Conversely, illiteracy and lack of health knowledge often result in poor dietary practices and low compliance with supplementation. Marital status, while less directly studied, intersects with socio-economic status. Married women are generally more likely to have spousal support financially and emotionally and this support can influence healthcare utilization and food security. However, in some patriarchal settings, married women may also face restrictions on autonomy and access to care. Unmarried women, particularly adolescents, may face stigma, reduced family support, and limited access to ANC, contributing to higher anaemia risk.

### 2.7.2 Household Income and Employment Status

Household income is a critical determinant of a pregnant woman's ability to access nutrient-rich foods, healthcare services, and preventive measures such as iron supplements. Women in low-income households often face barriers to purchasing iron-rich foods like red meat, fruits, and fortified cereals(Akowuah *et al.*,2022b). They are also less likely to afford transport to health facilities or pay for labouratory tests and medications when not covered by public health insurance.

Employment status influences not only financial stability but also the level of physical exertion, time available for rest, and exposure to occupational hazards. Women engaged in physically demanding, low-wage jobs may experience greater nutritional stress, contributing to anaemia. Furthermore, informal employment often lacks maternity protection, limiting the ability of pregnant women to attend ANC regularly (Adamu *et al.*,2020).

### 2.7.3 Rural vs Urban Residence and Access to Health Services

The place of residence plays a significant role in maternal health outcomes. Rural areas are often characterized by poor infrastructure, limited health facilities, shortage of qualified health personnel, and inconsistent supply of essential medications including iron and folic acid supplements. Women in rural settings may also face cultural and logistical barriers to ANC utilization, including long travel distances, high transport costs, and reliance on traditional birth attendants (Nuamah *et al.*,2019).Urban women generally have better access to healthcare services, diversified diets, and higher levels of education, yet disparities persist within urban populations, particularly in informal settlements. Urban poor women may suffer from food insecurity and overcrowding, which also predisposes them to infections that exacerbate anaemia, such as malaria and intestinal parasites.

### 2.7.4 Influence of Cultural Beliefs and Practices

Cultural norms and practices play a critical role in maternal nutrition and health-seekingbehaviour" . In many African communities, pregnancy is surrounded by a range of taboos and beliefs that influence dietary intake. Certain iron-rich foods, such as eggs, liver, or dark leafy vegetables, may be avoided during pregnancy due to fears that they will cause a large baby and difficult labour , or deformities in the fetus (Tawiah, 2018). These beliefs, often passed down generationally, can significantly limit a woman's nutrient intake during a critical period.Similarly, decision-making within households may rest with male partners or elder family members, which can impact women's autonomy to seek care or alter dietary habits. Engaging communities through culturally appropriate health education is essential to addressing these deep-rooted beliefs(Abdo *et al.*,2019).

### 2.8 Nutritional Factors Associated with Anaemia in Pregnancy

Nutrition is one of the most fundamental factors influencing the development and severity of anaemia in pregnancy. The high physiological demand for iron, folate, and other micronutrients during pregnancy makes pregnant women particularly vulnerable to nutritional deficiencies. Anaemia due to inadequate dietary intake or poor bioavailability of nutrients is common in many parts of sub-Saharan Africa, including Ghana(Ayensu *et al.*,2020).

#### 2.8.1 Common Nutritional Deficiencies Contributing to Anaemia

Iron deficiency accounts for approximately 50% of all anaemia cases globally (WHO, 2024). Pregnant women require about 1000 mg of iron throughout pregnancy, yet most women enter pregnancy with suboptimal iron stores. Inadequate intake of iron-rich foods, poor absorption due to phytates and tannins in local diets (common in cereals and tea), and increased physiological demands contribute to iron deficiency anaemia (Troiano, 2018).Folate and vitamin B12 deficiencies are less common but still important contributors to anaemia. Folate is essential for DNA synthesis and red blood cell production. Deficiency results in megaloblastic anaemia, often seen in women with poor diets or increased needs. Vitamin B12, primarily found in animal products, is crucial for neurological development and erythropoiesis. Deficiencies are more common among women who consume primarily plant-based diets, as is common in rural or low-income populations(Turawa *et al.*,2021b).

### 2.8.2 Dietary Patterns Among Pregnant Women in Ghana and Sub-Saharan Africa

In Ghana, traditional diets are predominantly carbohydrate-based, relying heavily on staples such as maize, yam, rice, and cassava. While these provide necessary energy, they are low in essential micronutrients unless complemented with legumes, vegetables, or animal proteins. Unfortunately, due to economic limitations or food preferences, the intake of such complementary foods is often inadequate(Abdo *et al.*,2019).

Studies in Ghana and across West Africa reveal that many pregnant women do not meet the recommended dietary intake for iron, calcium, and folate (Nuamah *et al.*,2019). Women in rural areas are especially affected due to limited access to diverse food options and food markets, leading to monotonous diets that lack critical nutrients.

### 2.8.3 Role of Food Insecurity and Dietary Diversity

Food insecurity is a major barrier to adequate nutrition during pregnancy. It is defined as the lack of consistent access to sufficient, safe, and nutritious food to maintain a healthy life. Pregnant women in food-insecure households are more likely to experience inadequate dietary diversity, poor intake of animal-source foods, and low energy and micronutrient consumption (FAO, 2022). Dietary diversity measured by the variety of food groups consumed is a strong predictor of micronutrient adequacy. Women with low dietary diversity are significantly more likely to develop anaemia due to inadequate intake of iron, folate, and vitamin-rich foods (Gebre *et al.*,2015). Promoting home gardening, nutritional counseling during ANC, and food fortification are some interventions used to address this issue.

### 2.8.4 Traditional Food Restrictions During Pregnancy

Cultural and religious practices also play a role in shaping dietary patterns during pregnancy. In some Ghanaian communities, it is believed that eating protein-rich foods such as eggs and meat may cause the baby to grow too large, leading to obstructed labour . Similarly, dark-coloured foods may be avoided due to myths about causing "dark" or "sick" babies (Ogundele *et al.*,2021). These beliefs can have a detrimental effect on nutrient intake, particularly in women who already face socio-economic or access-related barriers.While these restrictions are often well-intentioned and rooted in cultural identity, they pose a significant barrier to achieving optimal nutrition during pregnancy. Effective interventions must incorporate culturally sensitive approaches that address misconceptions(Kalaivani & Ramachandran, 2018).

## 2.9 Antenatal Education, Healthcare Access, and Practices

Early and regular antenatal care (ANC) is very important for a healthy pregnancy and for preventing anaemia. The World Health Organization recommends that pregnant women attend at least eight ANC visits. This allows health workers to monitor the pregnancy, detect problems early, and provide important services like iron supplements, malaria treatment, deworming, and health education. Studies have shown that women who attend ANC regularly are more likely to get these services, which help prevent anaemia (Taye *et al.*,2015; Abriha *et al.*,2014).

Health education given during ANC visits also helps pregnant women learn about good nutrition, hygiene, and taking their supplements. In Nigeria, Ogundele et al. (2021) found that women who received more education during ANC had lower rates of anaemia. In Ghana

and other parts of Africa, education has helped women eat better and take more iron-rich foods (Kumakech *et al.*,2020). Testing for anaemia during ANC visits is also very important. It helps health workers find anaemia early and start treatment. But in many rural areas, this testing is not done often because of a lack of equipment and trained staff (Nuamah *et al.*,2019; Ogundele *et al.*,2021).

Many women do not receive all the ANC services they need. Some come late for their first visit, or the clinic may run out of medicines. According to the Ghana Health Service (2022), although many pregnant women attend ANC at least once, fewer complete all the needed treatments like malaria prevention and iron supplements. The health system also faces many challenges. Some clinics do not have enough staff or supplies. There may be problems with keeping records and following up with patients. These issues make it hard to provide good care, especially in rural areas (Nuamah *et al.*,2019).

### 2.9.1 Iron Supplementation and Compliance

Iron and folic acid supplements are used around the world to prevent and treat anaemia in pregnancy. WHO recommends that pregnant women take 30 to 60 mg of iron and 400 micrograms of folic acid every day (WHO, 2016). Ghana's health system follows these guidelines, and clinics give iron tablets to pregnant women during ANC visits (GHS, 2021).But many women do not take the tablets as they are supposed to. In Ghana and Ethiopia, studies have shown that only about 30 to 50 percent of women take all the tablets given to them (Gebremedhin *et al.*,201). Reasons include side effects like nausea, forgetfulness, fear of taking too many drugs, low education, and poor explanation from health workers.Sometimes clinics run out of the tablets, especially in rural areas. Some

women are asked to buy the tablets themselves, which can be too expensive. The taste and size of the tablets can also make them hard to take.Health workers have an important role in helping women take their supplements. When they explain clearly, remind women to take the tablets, and help them with side effects, women are more likely to follow the advice (Obeidat *et al.*,2011).

### 2.5 Conceptual Framework

This conceptual framework illustrates the relationship between various factors and the prevalence of anaemia among pregnant women attending antenatal care at Mampong Municipal Hospital. It groups the influencing factors into three main categories: sociodemographic, economic, and nutritional. Each category contains specific elements that may contribute to the risk of anaemia. Mediating factors such as antenatal education, healthcare practices, dietary habits, and iron supplementation influence how these risk factors manifest. Together, these elements help to identify the key drivers of anaemia in pregnancy and areas for intervention.

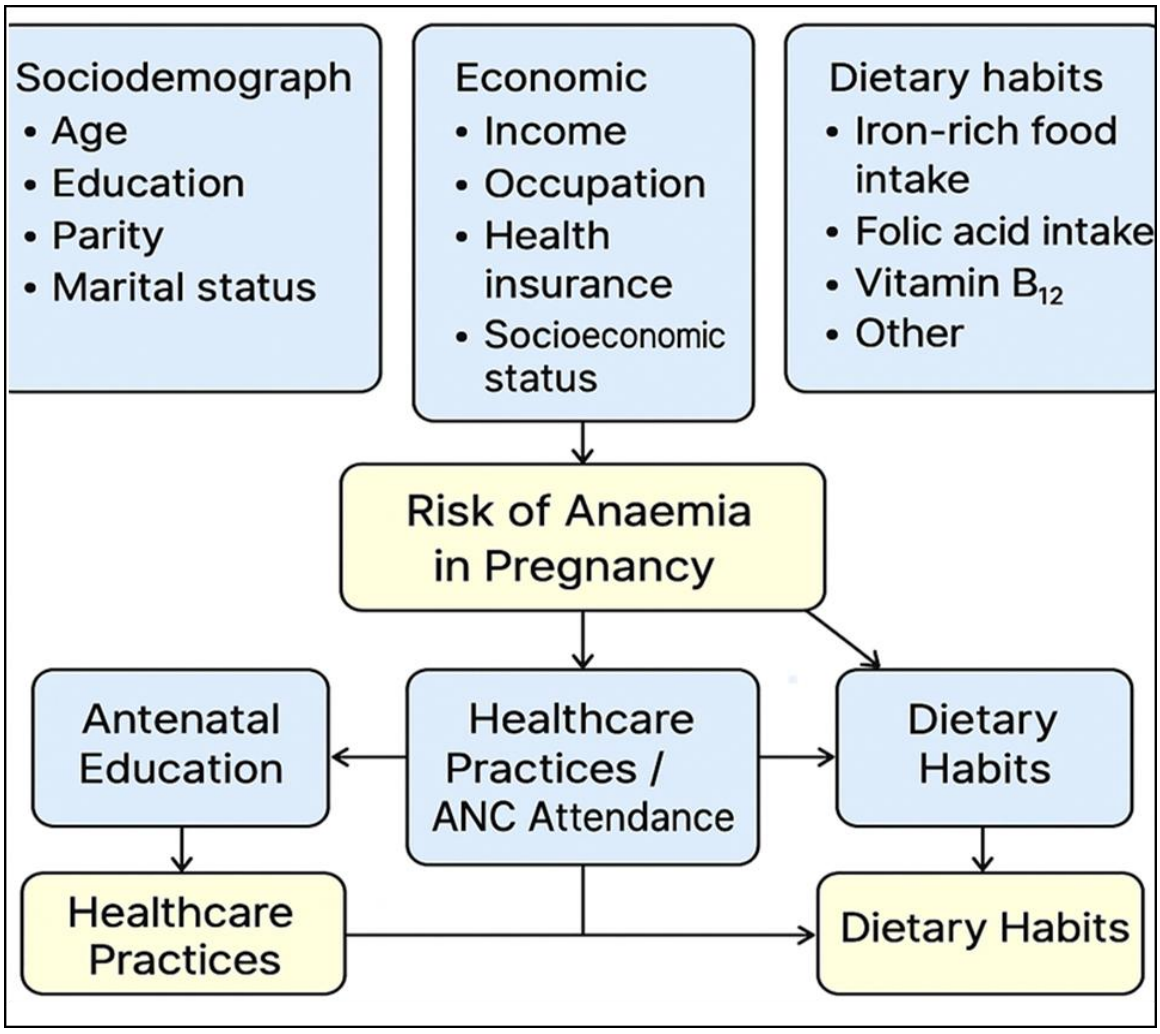


**Figure 2.1: Conceptual Framework for Determining the Prevalence and Associated Factors of Anaemia in Pregnancy (Sources: Author Construct, 2025)**

## 2.10 Summary

From the studies reviewed, it is clear that ANC visits and iron supplementation are key ways to reduce anaemia in pregnancy. Early and regular visits, health education, and preventive treatments all help. However, problems in the health system, like not enough staff and lack of medicine, make it hard to give good care. Many women also do not follow the advice or

complete their treatment. Studies in Ghana and other African countries show how important education and access to care are. But few studies have looked at these issues in the Mampong municipality. There is no recent information about how ANC services, health education, and iron tablet use are affecting anaemia in pregnant women in this area. Because of this gap, this study is important. It will help us understand how common anaemia is in Mampong and what causes it. The results can help health workers and decision-makers plan better ways to care for pregnant women and prevent anaemia.

# CHAPTER THREE

# 3.0 METHODOLOGY

## 3.1 Introduction

This chapter outlines the research approach used to collect and analyze data. This chapter provides a detailed explanation of the methods adopted to achieve the study's objectives. It describes the study area, research design, target population, sampling procedures, data collection instruments, and data analysis techniques.

## 3.2 Study Design

This study adopted a health facility-based cross-sectional design to assess the prevalence and associated factors of anaemia in pregnancy among antenatal care (ANC) attendants. The cross-sectional approach was appropriate as it allowed for the collection of data on anaemia status and associated variables (such as demographic, socioeconomic, and dietary factors) at a single point in time. The study was conducted over a three-month period, from December to February, 2025, at the Mampong Municipal Hospital.

## 3.3 Study Area

The research was conducted at the Mampong Municipal Hospital, located in the Mampong Municipality of the Ashanti Region, Ghana. This hospital is a key health facility in the municipality, serving as a referral center for neighboring towns and communities. It offers a range of healthcare services, including maternal and child health, general outpatient care, and inpatient services. The hospital began its operations with a maternity wing in 1954 and was officially established as a full hospital in 1973 by the Government of Ghana.

The hospital provides antenatal care services to approximately 1,500 pregnant women annually. It has a workforce consisting of 8 medical doctors, 15 midwives, and 25 nurses who provide essential healthcare services. The facility's capacity, accessibility, and patient volume made it a suitable site for assessing the prevalence and determinants of anaemia among pregnant women. The hospital's significant obstetric workload and broad catchment area ensure that findings from the study are relevant and applicable to the wider community.

### 3.4 Study Population

According to Peters et al. (2018), a population is defined as a group of individuals sharing common characteristics. The study population included systematically selected pregnant women aged 15 to 49 years who attended ANC services at Mampong Municipal Hospital and consented to participate.

### 3.5 Inclusion and Exclusion Criteria

**Inclusion Criteria:**

1. Pregnant women attending ANC from booking to the third trimester.
2. Women who were mentally sound and not suffering from any major illness.
3. Residents of the Mampong Municipality.
4. Willingness to participate in the study.

**Exclusion Criteria:**

1. Women transfused within the past two weeks, as it could affect Hb levels.
2. Women too ill to respond to the questionnaire.
3. Women without recorded haemoglobin levels.

4. Individuals who did not provide consent.

### 3.6 Sampling

Gentles *et al.* (2015), describe sampling as the selection of a portion of the population to represent the whole. In this study, sampling was designed to ensure representativeness and minimize bias.

#### 3.6.1 Sample Size Determination

The sample size for this study was determined using Cochran's formula, which is commonly used to estimate an ideal sample size when the population is large. The parameters used in the formula included a Z-score of 1.96 corresponding to a 95% confidence level, an estimated prevalence (p) of anaemia in pregnancy of 45.6% (0.456), a complementary probability (q) of 0.544 (i.e., 1 – p), and a margin of error (d) of 5% (0.05). Substituting these values into Cochran's formula yielded a minimum required sample size of 381 participants. This sample size was deemed sufficient to provide reliable and valid results for the objectives of the study. Based on this, the minimum required sample size was 381 participants.

#### 3.6.2 Sampling Procedure

A systematic random sampling technique was employed. An average of 40 antenatal clients attended the facility daily. Twenty participants were selected each day. Pieces of paper equal to the number of women present were labeled "YES" and "NO." Each woman picked one paper; those who picked "YES" and consented were enrolled. If a selected woman declined,

the process continued until 15 participants were selected daily. Data collection continued until 381 women were enrolled. Eligible participants with Hb test results were directed to a private area for interviews.

### 3.7 Pretest/Pilot Study

The questionnaire was pretested with 40 respondents in Nsuta Health, capital of Sekyere Central District, Ashanti Region. The aim was to gather feedback on question clarity, omissions, ambiguities, and response patterns. Participants were informed that the pretest responses were solely for improving the questionnaire. The pretest helped refine the questionnaire before actual data collection.

### 3.8 Data Collection Procedure

Data were extracted from ANC booklets of the respondent and structured questionnaires. Information collected included socio-demographic details and two haemoglobin readings at different trimesters. The questionnaire was adapted from a prior study and modified to suit the local context. It was pretested for clarity and relevance.

### 3.9 Data Analysis

Data were entered and cleaned using Microsoft Excel 2016, then exported to Stata version 15 for analysis. Descriptive statistics (means, standard deviations) were used for continuous variables, while frequencies and proportions described categorical variables. Variables such as age, gravidity, parity, ANC visits, and haemoglobin levels were categorized. Haemoglobin (Hb) levels were classified as follows:No anaemia: Hb > 11 g/dL, Mild

anaemia: Hb 10–10.9 g/dL, Moderate anaemia: Hb 7–9.9 g/dL, Severe anaemia: Hb < 7 g/dL. Chi-square tests assessed associations between categorical variables and anaemia levels. Binary logistic regression identified socio-demographic, economic, and dietary factors associated with anaemia.

### 3.10 Ethical Considerations

Ethical approval was obtained from the Committee on Human Research, Publications, and Ethics at KNUST (CHRPE/AP/188/25). Informed consent was obtained from all participants after explaining the study's purpose, procedures, potential risks, and benefits. Participation was voluntary, and refusal did not affect medical care. The hospital granted permission for the study, and ethical issues were reported to the committee as needed.

# CHAPTER FOUR

# 4.0 RESULTS AND DISCUSSION

## 4.1 Introduction

This chapter presents the findings on the prevalence and associated factors of anaemia in pregnancy among antenatal attendants at Mampong Municipal Hospital. The findings are discussed in comparison with existing literature to provide a broader understanding of anaemia in pregnancy.

## 4.2 Demographic Characteristics

The study sample comprised 381 individuals with diverse demographic characteristics. In terms of age, 80 (21%) were under 15 years old, 90 (23.6%) were aged 15-24 years, 62 (16.3%) were aged 25-34 years, 71 (18.6%) were aged 35-44 years, and 78 (20.5%) were 45 years or older. Regarding education, 76 (19.9%) had no formal education, 102 (26.8%) had primary education, 100 (26.2%) had secondary education, and 103 (27%) had tertiary education. In terms of occupation, 113 (29.7%) were employees, 98 (25.7%) were homemakers, 78 (20.5%) were students, and 92 (24.1%) were unemployed. Marital status showed that 194 (50.9%) were married and 187 (49.1%) were single. The number of children per household varied, with 88 (23.1%) having 1-2 children, 78 (20.5%) having 3-4 children, 103 (27%) having 5 or more children, and 112 (29.4%) having no children. Monthly household income distribution was as follows: 75 (19.7%) had an income of less than 500, 118 (31%) had an income greater than 2000, 88 (23.1%) had an income between 1001-2000, and 100 (26.2%) had an income between 500-1000. The ethnic background was predominantly Akan.

**Table 4.1: Demographic Characteristics of Respondent**

| Variable | Frequency | Percent (%) |
|---|---|---|
| **Age Range** | | |
| < 15 | 80 | 21 |
| 15-24 | 90 | 23.6 |
| 25-34 | 62 | 16.3 |
| 35-44 | 71 | 18.6 |
| 45 or older | 78 | 20.5 |
| **Level of education** | | |
| No formal education | 76 | 19.9 |
| Primary | 102 | 26.8 |
| Secondary | 100 | 26.2 |
| Tertiary | 103 | 27 |
| **Occupation** | | |
| Employee | 113 | 29.7 |
| Homemaker | 98 | 25.7 |
| Student | 78 | 20.5 |
| Unemployed | 92 | 24.1 |
| **Marital Status** | | |
| Married | 194 | 50.9 |
| Single | 187 | 49.1 |
| **Number of children** | | |
| 1-2. | 88 | 23.1 |
| 3-4. | 78 | 20.5 |
| 5 or more | 103 | 27 |
| None | 112 | 29.4 |
| **Monthly Household Income** | | |
| <500 | 75 | 19.7 |
| 500-1000 | 100 | 26.2 |
| 1001-2000 | 88 | 23.1 |
| >2000 | 118 | 31 |
| **Ethnic Background** | | |
| Akan | 363 | 95.3 |
| Ewe | 9 | 2.4 |
| Ga | 9 | 2.4 |
| **Religious Affiliation** | | |
| Christian | 346 | 90.8 |
| Muslim | 31 | 8.1 |
| Traditional | 4 | 1.0 |

***Field Survey, 2025***

### 4.3 Prevalence of Anaemia among Pregnant Women

The overall prevalence of anaemia among antenatal attendants at Mampong Municipal Hospital was 60.6% (231/381**).** The distribution of anaemia severity among antenatal attendants at Mampong Municipal Hospital is shown in the figure 4.1Severe anaemia was the most common (23.6%), followed by mild anaemia (20.7%) and moderate anaemia (16.3%). Few pregnant women (19.7%) did not have anaemia, while another 19.7% were not sure of their status.

Among the 381 participants, 31.5% (n=120) were experiencing their first pregnancy, while the majority had been pregnant multiple times. A total of 43.3% (n=165) had experienced 2–3 pregnancies, and 25.2% (n=96) had four or more pregnancies.Anaemia was most frequently diagnosed in the third trimester, with 30.4% (n=116) of participants receiving a diagnosis at this stage. In comparison, 18.4% (n=70) were diagnosed in the second trimester, and 11.8% (n=45) in the first trimester. Notably, 18.4% (n=70) of participants reported no anaemia diagnosis during their pregnancy. A majority (72.7%, n=277) of participants reported no prior history of anaemia in previous pregnancies. Most participants (91.1%, n=347) had no prior anaemia diagnosis before their current pregnancy.

Regarding anaemia treatment, 35.2% (n=134) of participants received iron supplements, while 32.8% (n=125) were given dietary counseling. A majority of participants (64.8%, n=371) did not experience bleeding during pregnancy. Among those who did, 20.5% (n=8) reported non-profuse bleeding, while 14.7% (n=2) experienced profuse bleeding.

**Table 4.2: Pregnancy Characteristics and Anaemia Among Participants(n=381)**

| Variable | Frequency | Percentage (%) |
|---|---|---|
| **Number of Pregnancies** | | |
| First pregnancy | 120 | 31.5 |
| 2-3 pregnancies | 165 | 43.3 |
| 4 or more pregnancies | 96 | 25.2 |
| **Stage of Pregnancy at Anaemia Diagnosis** | | |
| First Trimester | 45 | 11.8 |
| Second Trimester | 70 | 18.4 |
| Third Trimester | 116 | 30.4 |
| Not Diagnosed | 70 | 18.4 |
| **History of Anaemia in Previous Pregnancies** | | |
| Yes (First Pregnancy) | 35 | 9.2 |
| Yes (Second Pregnancy) | 40 | 10.5 |
| Yes (Third or More) | 29 | 7.6 |
| No | 277 | 72.7 |
| Not Sure | 15 | 3.9 |
| **Anaemia Diagnosis Prior to Pregnancy** | | |
| Yes | 4 | 1.0 |
| No | 347 | 91.1 |
| Not Sure | 30 | 7.9 |
| **Treatment for Anaemia** | | |
| Iron supplements | 134 | 35.2 |
| Dietary counseling | 125 | 32.8 |
| Blood transfusion | 5 | 1.3 |
| **Bleeding During Pregnancy** | | |
| Yes (Profuse) | 2 | .5 |
| Yes (Not Profuse) | 8 | 2.5 |
| No | 371 | 97 |

***Field Survey, 2025***

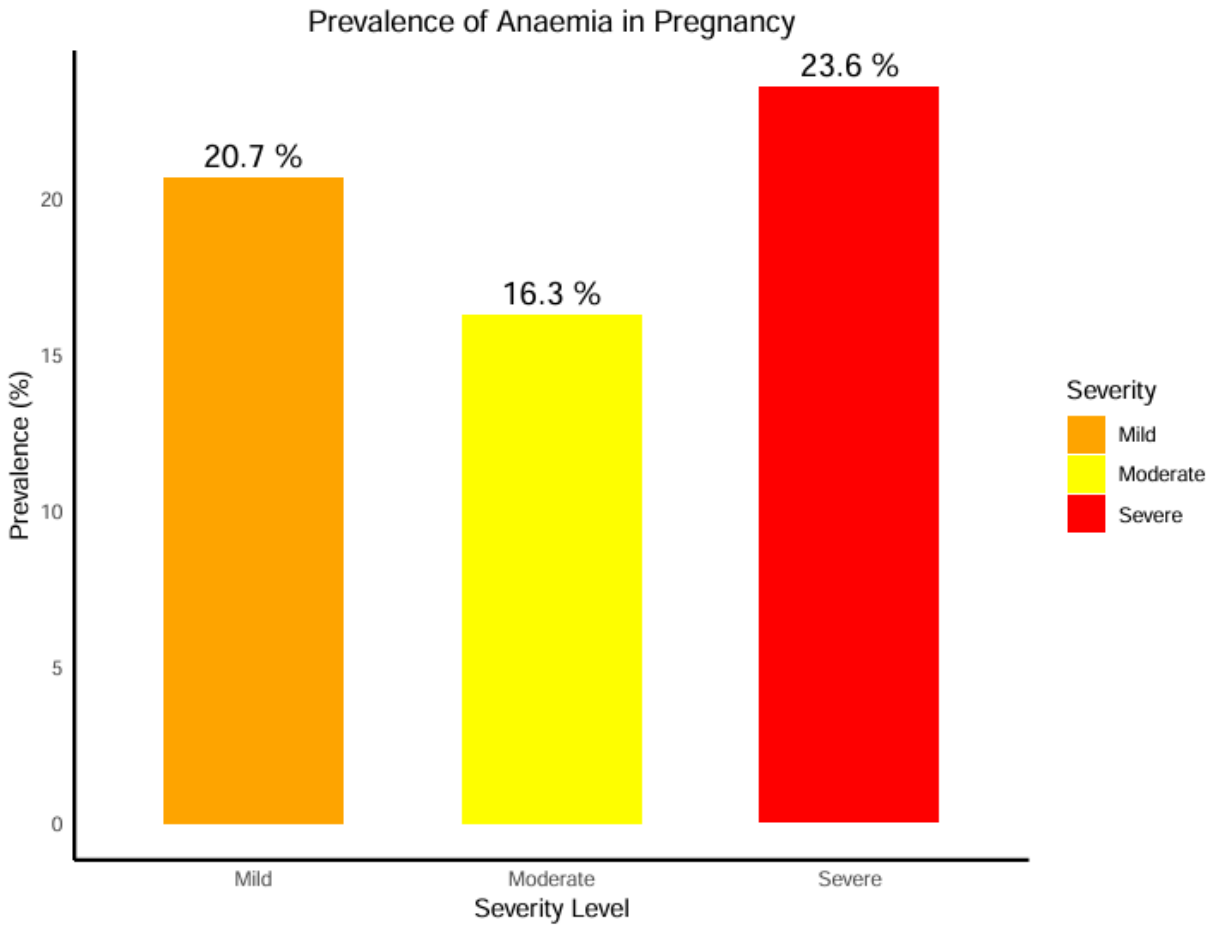


**Figure 4.1: Prevalence of Anaemia among Participant based on severity**

### 4.4 Influence of Sociodemographic Factors on Anaemia

Anaemia was significantly associated with several factors. Age had a p-value of 0.042, with the highest rates observed in women aged 35–44 years and 45 or older. Educational level showed a strong association with a p-value of 0.006. Occupation was significantly associated with anaemia, with a p-value of 0.001. Household income was a key determinant, with a p-value of <0.001. Ethnicity (p=0.02) and religion (p<0.001) were also significantly associated with anaemia. Marital status (p=0.126) and number of children (p=0.053) were not significantly associated with anaemia.

The study found that age, education, job status, income, and religion were important factors linked to anaemia in pregnant women. Women aged 35–44 years were 3.12 times more likely to have anaemia than those under 15 years old (*OR = 3.12, p = 0.042*). Education also played a role, as women with no formal education had 3.25 times higher odds of anaemia than those with higher education (*OR = 3.25, p = 0.006*).Job status was another key factor, with unemployed women being 7.12 times more likely to have anaemia than those with jobs (*OR = 7.12, p = 0.001*). Income also made a difference-women from low-income households (earning less than 500) had a 5.88 times higher risk of anaemia compared to those earning more than 2000 (*OR = 5.88, p < 0.001*). Religion was also significant, with Muslim women less likely to have anaemia compared to Christians (*OR = 0.32, p < 0.001*) (Table 4.4).

**Table 4.3: Prevalence of Anaemia by Demographics**

| Variable | Respondents | Anaemia Cases (%) | Chi-square ($\chi^2$) | p-value |
|---|---|---|---|---|
| **Overall** | 381 | 231 (60.6%) | - | - |
| **Age Range** | | | | |
| | | | | 0.042* |
| < 15 | 80 | 35 (43.8%) | 4.12 | |
| 15–24 | 90 | 50 (55.6%) | | |
| 25–34 | 62 | 40 (64.5%) | | |
| 35–44 | 71 | 55 (77.5%) | | |
| 45 or older | 78 | 51 (65.4%) | | |
| **Level of Education** | | | | |
| | | | | 0.006* |
| No formal education | 76 | 65 (85.5%) | 8.33 | |
| Primary | 102 | 60 (58.8%) | | |
| Secondary | 100 | 50 (50.0%) | | |
| Tertiary | 103 | 56 (54.4%) | | |
| **Occupation** | | | | |
| | | | | 0.001** |
| Employee | 113 | 55 (48.7%) | 10.21 | |

| | | | | |
|---|---|---|---|---|
| Homemaker | 98 | 50 (51.0%) | | |
| Student | 78 | 40 (51.3%) | | |
| Unemployed | 92 | 86 (93.5%) | | |
| Marital Status | | | | |
| | | | | 0.126 |
| Married | 194 | 110 (56.7%) | 2.18 | |
| Single | 187 | 121 (64.7%) | | |
| **Number of Children** | | | | |
| | | | | 0.053 |
| 1–2 | 88 | 50 (56.8%) | 3.75 | |
| 3–4 | 78 | 40 (51.3%) | | |
| 5 or more | 103 | 60 (58.3%) | | |
| None | 112 | 81 (72.3%) | | |
| **Monthly Household** Income | | | | |
| | | | | <0.001** |
| <500 | 75 | 70 (93.3%) | 12.88 | |
| 500–1000 | 100 | 55 (55.0%) | | |
| 1001–2000 | 88 | 50 (56.8%) | | |
| >2000 | 118 | 56 (47.5%) | | |
| **Ethnic Background** | | | | |
| | | | | 0.02* |
| Akan | 363 | 222 (61.2%) | 11.95 | |
| Ewe | 9 | 5 (55.6%) | | |
| Ga | 9 | 4 (44.4%) | | |
| **Religious Affiliation** | | | | |
| | | | | <0.001** |
| Christian | 346 | 221(63.9%) | 12.98 | |
| Muslim | 32 | 10(31.3%) | | |
| Traditional | 4 | 0 | | |

***Field Survey, 2025***

**Table 4.4: Logistic Regression of Demographic Characteristics**

| Variable | OR (95% CI) | p-value |
|---|---|---|
| **Age Range (Ref: <15 years)** | | |
| 15–24 | 1.52 (0.77–2.98) | 0.215 |
| 25–34 | 1.89 (0.92–3.88) | 0.081 |
| 35–44 | 3.12 (1.45–6.71) | 0.042 |
| 45 or older | 2.76 (1.22–6.22) | 0.052 |
| **Level of Education (Ref: Tertiary)** | | |
| **No formal education** | **3.25 (1.58–6.72)** | **0.006** |
| Primary | 1.24 (0.75–2.05) | 0.362 |
| Secondary | 1.10 (0.67–1.81) | 0.541 |
| **Occupation (Ref: Employee)** | | |
| Homemaker | 1.15 (0.69–1.93) | 0.564 |
| Student | 1.21 (0.72–2.03) | 0.482 |
| **Unemployed** | **7.12 (3.15–16.08)** | **0.001** |
| **Monthly Income (Ref: >2000)** | | |
| **<500** | **5.88 (2.76–12.54)** | **<0.001** |
| 500–1000 | 1.67 (0.94–2.98) | 0.082 |
| 1001–2000 | 1.21 (0.70–2.12) | 0.451 |
| **Religious Affiliation (Ref: Christian)** | | |
| **Muslim** | **0.32 (0.15–0.69)** | **<0.001** |
| Traditional | - | - |

***Field Survey, 2025***

Among all participants, the most frequently reported symptoms were pale skin 117 (30.7%), shortness of breath 86 (22.6%)**,** and fatigue 80 (21.0%). Among those diagnosed with anaemia (n=231), these symptoms were more common, with pale skin 92 (39.8%)**,** shortness

of breath 75 (32.5%)**,** and fatigue 65 (28.1%) being the most prevalent. Only 10 (4.3%) of anaemic participants reported no symptoms, compared to 53 (13.9%) in the overall sample, indicating a strong association between these symptoms and anaemia (Table 4.5).

**Table 4.5: Symptoms among Participants**

| Symptom | All Participants (n=381) | Anaemia Patients (n=231) |
|---|---|---|
| Dizziness | 45 (11.8%) | 35 (15.2%) |
| Fatigue | 80 (21.0%) | 65 (28.1%) |
| None | 53 (13.9%) | 10 (4.3%) |
| Pale skin | 117 (30.7%) | 92 (39.8%) |
| Shortness of breath | 86 (22.6%) | 75 (32.5%) |
| Total | 381 (100%) | 231 (100%) |

***Field Survey, 2025***

### 4.5: Relationship between Dietary Habits and Anaemia.

This study examined the dietary habits and nutritional factors among pregnant women (N=381). The findings indicate that 25.5% of participants followed a balanced diet, while 28.9% had an unbalanced or irregular diet. A significant proportion (22.8%) consumed either a mostly vegetarian or non-vegetarian diet. Iron intake varied, with 36.5% consuming iron-rich foods regularly, while 33.6% did not consume them at all. Iron supplementation was common, with 39.6% taking supplements daily, 31.2% occasionally, and 29.1% not taking them. Regarding vitamin C intake, 25.7% consumed it daily, while 16.3% never consumed vitamin C-rich foods. Some participants faced challenges in maintaining a healthy diet, with

19.4% reporting morning sickness, 15.2% fatigue, and 12.1% lifestyle-related issues (Table 4.6).

Multiple logistic regression analysis revealed significant associations between nutritional factors and anaemia among pregnant women. Compared to those on a balanced diet, women with unbalanced or irregular eating habits had higher odds of anaemia (AOR = 1.20, $p$ = 0.020). Not consuming iron-rich foods at all significantly increased the risk (AOR = 1.28, $p$ = 0.005), while daily iron supplement intake was protective; women who did not take supplements had 1.42 times higher odds of anaemia ($p$ = 0.0001).Those who never consumed vitamin C had higher odds (AOR = 1.22, $p$ = 0.008), and street food consumers were also more likely to be anaemic (AOR = 1.22, $p$ = 0.005). Lack of knowledge on iron-rich foods (AOR = 1.20, $p$ = 0.020) and absence of dietary counseling (AOR = 1.16, $p$ = 0.010) were also associated with increased anaemia risk (Table 4.7).

**Table 4.6: Dietary Habits among Pregnant Women**

| Variable | Frequency (n=381) | Percent (%) |
|---|---|---|
| **Typical Diet** | | |
| Mostly vegetarian/plant-based | 87 | 22.8 |
| Balanced diet | 97 | 25.5 |
| Mostly non-vegetarian | 87 | 22.8 |
| Unbalanced/Irregular eating | 110 | 28.9 |
| **Consumption of Iron-Rich Foods** | | |
| Regularly | 139 | 36.5 |
| Occasionally | 114 | 29.9 |
| Not at all | 128 | 33.6 |
| **Iron Supplement Intake During** Pregnancy | | |
| Yes (Daily) | 151 | 39.6 |
| Yes (Occasionally) | 119 | 31.2 |
| No | 111 | 29.1 |
| **Vitamin C Intake** | | |
| Daily | 98 | 25.7 |
| Weekly | 146 | 38.3 |
| Monthly | 75 | 19.7 |
| Never | 62 | 16.3 |
| **Difficulty Maintaining a Healthy Diet** | | |
| Yes (Morning sickness) | 74 | 19.4 |
| Yes (Fatigue) | 58 | 15.2 |
| Yes (Lifestyle issues) | 46 | 12.1 |
| No | 203 | 53.3 |
| **Primary Source of Food** | | |
| Home-cooked meals | 123 | 32.3 |
| Restaurant | 164 | 43 |
| Street food | 94 | 24.7 |
| **Knowledge of Iron-Rich Foods** | | |
| Yes (Books) | 50 | 13.1 |
| Yes (Social Media) | 48 | 12.6 |
| Yes (TV) | 28 | 7.3 |
| No | 255 | 66.9 |
| **Received Dietary Counseling During** Pregnancy | | |
| Yes (ANC) | 78 | 20.5 |
| Yes (Friends/Relations) | 33 | 8.7 |
| No | 270 | 70.9 |

***Field Survey, 2025***

**Table 4.7: Correlation Between Dietary Habits and Anaemia**

| Variable | AOR | 95% CI (AOR) | p-value |
|---|---|---|---|
| **Typical Diet** | | | |
| Balanced diet (Ref) | - | - | - |
| Mostly vegetarian | 1.13 | 1.00–1.30 | 0.045 |
| Mostly non-vegetarian | 1.05 | 0.85–1.30 | 0.3 |
| Unbalanced/Irregular eating | 1.2 | 1.03–1.40 | 0.02 |
| **Iron-Rich Foods** | | | |
| Regularly (Ref) | - | - | - |
| Occasionally | 0.91 | 0.81–1.02 | 0.1 |
| Not at all | 1.28 | 1.08–1.53 | 0.005 |
| **Iron Supplement Intake** | | | |
| Yes, Daily (Ref) | - | - | - |
| Occasionally | 0.86 | 0.75–0.98 | 0.04 |
| No | 1.42 | 1.18–1.70 | 0.0001 |
| **Vitamin C Intake** | | | |
| Daily (Ref) | - | - | - |
| Weekly | 0.93 | 0.83–1.04 | 0.15 |
| Monthly | 1.13 | 0.89–1.42 | 0.25 |
| Never | 1.22 | 1.05–1.42 | 0.008 |
| **Difficulty Maintaining Diet** | | | |
| No (Ref) | - | - | - |
| Morning sickness | 1.17 | 1.00–1.37 | 0.05 |
| Fatigue | 1.13 | 0.98–1.30 | 0.07 |
| Lifestyle issues | 1.1 | 0.95–1.27 | 0.12 |
| **Primary Food Source** | | | |
| Home-cooked (Ref) | - | - | - |
| Restaurant | 1.08 | 0.92–1.27 | 0.2 |
| Street food | 1.22 | 1.06–1.40 | 0.005 |
| **Knowledge of Iron-Rich Foods** | | | |
| Yes (Books) (Ref) | - | - | - |
| Social Media | 0.95 | 0.82–1.10 | 0.18 |
| TV | 0.97 | 0.85–1.11 | 0.32 |
| No | 1.2 | 1.03–1.39 | 0.02 |
| **Dietary Counseling** | | | |
| Yes (ANC) (Ref) | - | - | - |
| Friends/Relatives | 0.94 | 0.83–1.07 | 0.22 |
| No | 1.16 | 1.04–1.30 | 0.01 |

***Field Survey, 2025***

### 4.6: Effect of Antenatal Education on Anaemia Prevalence

The study assessed awareness, practices, and experiences related to anaemia during pregnancy among 381 participants.A significant proportion (35.4%) of respondents were unsure whether their healthcare provider had discussed the importance of iron-rich foods and supplements, while 34.9% reported not receiving such information, and only 29.7% confirmed that they had. Regarding adherence to iron supplements, 37.8% did not follow the recommended dosage, 33.3% did not take them at all, and only 28.9% adhered to the recommended intake (Table 4.8).

Prenatal check-up attendance was relatively balanced, with 37.8% attending regularly, 33.1% attending irregularly, and 29.1% not attending at all. However, satisfaction with prenatal care and anaemia-related advice was low, as 60.6% were dissatisfied. Additionally, 70.3% of participants were not taking any medications for a medical condition.In terms of antenatal care (ANC) visits, 34.6% had attended multiple visits, while 37.0% were unsure about their number of visits, and 28.3% had attended few or none. Notably, 74.0% of participants did not seek ANC early in their pregnancy. Furthermore, 63.8% reported not receiving iron supplements during ANC visits, and 58.8% were not interested in additional information about anaemia during pregnancy.Regarding pregnancy complications linked to anaemia, 34.9% had experienced complications, while 37.3% were unsure, and 27.8% had not encountered any related issues (Table 4.8).

**Table 4.8: Awareness, Practices, and Experiences Related to Anaemia During Pregnancy**

| Variable (Statement Form) | Yes (n/%) | No (n/%) | Not Sure (n/%) |
|---|---|---|---|
| Healthcare provider discussed the importance of iron-rich foods and supplements | 113 (29.7%) | 133 (34.9%) | 135 (35.4%) |
| Followed the recommended dosage of iron supplements | 110 (28.9%) | 127 (33.3%) | 144 (37.8%) |
| Frequently attended prenatal check-ups during pregnancy | 144 (37.8%) | 111 (29.1%) | 126 (33.1%) |
| Satisfied with the prenatal care and advice received about anaemia | 150 (39.4%) | 231 (60.6%) | - |
| Currently taking medications for a medical condition | 113 (29.7%) | 268 (70.3%) | - |
| Attended multiple antenatal care visits during this pregnancy | 132 (34.6%) | 108 (28.3%) | 141 (37.0%) |
| Sought antenatal care early in the current pregnancy | 99 (26.0%) | 282 (74.0%) | - |
| Provided with iron supplements during ANC visits | 138 (36.2%) | 243 (63.8%) | - |
| Interested in receiving more information on anaemia during pregnancy | 157 (41.2%) | 224 (58.8%) | - |
| Experienced pregnancy complications related to anaemia | 133 (34.9%) | 106 (27.8%) | 142 (37.3%) |

***Field Survey, 2025***

Participants whose healthcare providers did not discuss anaemia were significantly more likely to experience anaemia (OR = 1.45, $p$ = 0.008).Those who did not follow the recommended iron supplement dosage had 1.72 times higher odds of anaemia ($p<$ 0.001).Women who did not attend prenatal check-ups had significantly higher odds of anaemia (OR = 1.60, $p$ = 0.002).Not receiving iron supplements during ANC was highly

associated with anaemia (OR = 1.90, $p< 0.001$).Participants who experienced pregnancy complications were over two times more likely to have anaemia (OR = 2.05, $p< 0.001$).(Table 4.9).

**Table 4.9: Logistic Regression Analysis of ANC Educational Factors Associated with Anaemia During Pregnancy**

| Variable | Odds Ratio (OR) | 95% CI | P-Value |
|---|---|---|---|
| Healthcare provider discussed anaemia | | | |
| Yes (Ref) | 1 | - | - |
| No | 1.45 | 1.10 – 1.92 | 0.008 ** |
| Not Sure | 1.38 | 1.05 – 1.81 | 0.020 ** |
| Followed recommended iron supplement dosage | | | |
| Yes (Ref) | 1 | - | - |
| No | 1.72 | 1.28 – 2.32 | <0.001 ** |
| Not Sure | 1.5 | 1.14 – 1.98 | 0.005 ** |
| Attended prenatal check-ups | | | |
| Yes (Ref) | 1 | - | - |
| No | 1.6 | 1.20 – 2.15 | 0.002 ** |
| Not Sure | 1.42 | 1.08 – 1.85 | 0.012 ** |
| Satisfied with prenatal care | | | |
| Yes (Ref) | 1 | - | - |
| No | 1.78 | 1.35 – 2.35 | <0.001 ** |
| Currently taking medication | | | |
| No (Ref) | 1 | - | - |
| Yes | 1.25 | 0.95 – 1.64 | 0.11 |
| Received iron supplements during ANC | | | |
| Yes (Ref) | 1 | - | - |
| No | 1.9 | 1.45 – 2.49 | <0.001 ** |
| Interested in receiving more anaemia information | | | |
| Yes (Ref) | 1 | - | - |
| No | 1.55 | 1.20 – 2.00 | 0.002 ** |
| Experienced pregnancy complications related to anaemia | | | |
| No (Ref) | 1 | - | - |
| Yes | 2.05 | 1.55 – 2.72 | <0.001 ** |
| Not Sure | 1.38 | 1.04 – 1.83 | 0.025 ** |

## 4.7: Discussion

### 4.7.1: Demographic and Socioeconomic Influences

Several sociodemographic factors were found to be significantly associated with anaemia. Women aged 35–44 years had the highest prevalence (77.5%), and those with no formal education exhibited an anaemia prevalence of 85.5%, suggesting that ANC education plays a vital role in maternal health. A lack of education can prevent women from understanding the importance of good nutrition and healthcare, making them more vulnerable to anaemia(Stevens *et al.*,2022b). A similar study conducted in Nigeria by Oladipo et al. (2019), found that uneducated women were twice as likely to develop anaemia due to a lack of awareness of proper nutrition, limited knowledge about iron-rich foods, and inadequate healthcare-seekingbehaviour" (Muñoz *et al.*,2015).

Furthermore, unemployed women were more affected (93.5%), reinforcing the link between economic status and health outcomes. Without a stable income, many women struggle to afford a balanced diet that includes essential nutrients like iron, folic acid, and vitamin C, which are important for preventing anaemia(Wemakor, 2019). Women from lower-income households (earning <500 GHS) had the highest prevalence (93.3%), highlighting financial constraints as a barrier to adequate nutrition and healthcare access. A related study by WHO (2022) supports these findings, emphasizing that financial instability limits access to iron-rich foods, prenatal care, and iron supplements, increasing the risk of anaemia among pregnant women in low-income households. Similarly, a study in India by Patel et al. (2021), found that anaemia prevalence was higher in women from poor economic backgrounds due to limited food variety, reliance on carbohydrate-heavy diets, and inadequate healthcare services(Fite *et al.*,2021b). These findings suggest that improving financial support,

providing free or subsidized iron supplements, and increasing education on nutrition could help reduce anaemia rates among vulnerable groups.

### 4.7.2 Prevalence and Severity of Anaemia

The findings from this study indicate that anaemia remains a significant public health concern among pregnant women attending antenatal care at Mampong Municipal Hospital. The overall prevalence of anaemia among the study population was 60.6%, which similar with previous studies conducted in Ghana (Acheampong *et al.,*2018; Adu-Amankwaah *et al.,*2018a; Aheto *et al.,*2023a), such as a study in Ghana by Ampofo et al. (2021), which reported a 58.3% prevalence rate. This high prevalence can be attributed to multiple factors, including limited access to healthcare services, inadequate nutritional intake, and economic constraints that prevent women from obtaining iron-rich foods and supplements(Kinyoki *et al.,*2021b).

A study conducted in India found a higher prevalence rate of 65.2%, emphasizing the role of socio-economic disparities and lack of awareness about anaemia prevention(Kinyoki *et al.,*2021b). Similarly, research in Ethiopia by Tesfaye et al. (2019) reported an anaemia prevalence of 57.8%, citing poor dietary diversity and low compliance with iron supplementation as key contributors. In contrast, a study in high-income countries such as the United Kingdom (Li *et al.,*2020) reported a significantly lower prevalence of 18.4%, which is likely due to better healthcare access, higher literacy levels, and widespread nutritional education programs.

The results show that severe anaemia (23.6%) was the most common form, followed by mild (20.7%) and moderate (16.3%) anaemia. According to the World Health Organization,

anaemia severity in pregnancy is classified based on haemoglobin (Hb) levels: mild anaemia (Hb 10.0–10.9 g/dL), moderate anaemia (Hb 7.0–9.9 g/dL), and severe anaemia (Hb <7.0 g/dL). This distribution suggests that a considerable number of pregnant women experience a critical lack of haemoglobin levels, which may pose serious health risks such as preterm birth, low birth weight, and increased maternal mortality(Obeagu *et al.*,2023b). The study also revealed that the third trimester had the highest rate of anaemia diagnosis (30.4%), indicating that late pregnancy presents increased vulnerability due to heightened nutritional demands and greater fetal iron requirements. Similar findings were observed in a study by Okafor et al. (2020), where anaemia prevalence was highest in the third trimester (32.1%), attributed to increased fetal iron demand and maternal blood volume expansion. Additionally, a study in Bangladesh by Rahman et al. (2021) found that pregnant women with severe anaemia (Hb <7.0 g/dL) were at a threefold higher risk of complications such as postpartum hemorrhage and prolonged labour compared to those with normal haemoglobin levels(Gardner & Kassebaum, 2020b).

### 4.7.3 Nutritional and Dietary Factors

Nutritional habits were also a significant determinant of anaemia. The study found that only 36.5% of participants regularly consumed iron-rich foods, while 33.6% did not consume them at all. This low consumption of iron-rich foods can be attributed to economic limitations, cultural dietary preferences, and limited nutritional knowledge(Adamu *et al.*,2017b). Many pregnant women prioritize cheaper staple foods such as rice, maize, and cassava, which lack sufficient iron. A study by Tesema *et al.*,(2021)found that pregnant women in rural communities tend to consume more carbohydrate-based meals due to

affordability, leading to insufficient iron intake. Additionally, some cultural beliefs discourage the consumption of iron-rich foods like liver and red meat during pregnancy, fearing it may lead to complications during childbirth (Ayensu *et al.*,2020).

Iron supplementation was inadequate, with 29.1% of women not taking supplements during pregnancy. Many women avoid iron tablets due to side effects such as nausea, constipation, and dark stools. A study by Abdo *et al.*,(2019)in Ethiopia highlighted that lack of adherence to iron supplementation is often due to gastrointestinal side effects and misconceptions about its benefits, suggesting that healthcare providers should offer better counseling to improve compliance. Similarly, a study conducted in Bangladesh by Asgedom et al. (2024)found that women who received proper education about iron supplements were 40% more likely to adhere to their recommended dosage than those who did not. Another study in Kenya noted that pregnant women who had access to fortified foods and iron supplementation programs had significantly lower anaemia rates than those relying solely on dietary intake(Tunkyi & Moodley, 2015b).

Furthermore, limited access to diverse food sources exacerbates anaemia risk. Research in Nepal by Thapa *et al.* (2022), found that pregnant women who consumed more leafy vegetables, eggs, and fish had lower anaemia rates compared to those who primarily ate rice and lentils. This suggests that government policies promoting dietary diversity, fortification programs, and agricultural support for nutrient-rich foods could help mitigate anaemia prevalence (Wemakor, 2019).

### 4.7.4 Antenatal Education and Healthcare Practices

Antenatal care practices played a important role in anaemia prevention and management. The study found that 63.8% of participants did not receive iron supplements during antenatal visits, and 58.8% were uninterested in additional information about anaemia. Similarly, a study by Tadesse et al. (2020) in Uganda found that lack of knowledge about anaemia was a significant factor in poor adherence to iron supplementation. Additionally, 70.3% of women were not taking any medications for medical conditions, which could indicate an overall lack of access to proper healthcare services. Furthermore, women who did not attend prenatal check-ups regularly had significantly higher odds of developing anaemia. These results suggest that improved healthcare education and proactive engagement with pregnant women could improve adherence to recommended guidelines and reduce anaemia prevalence(Li *et al.*,2020). A review by the WHO (2021) highlighted that early and frequent antenatal care visits significantly reduce maternal anaemia prevalence through timely intervention and nutritional counseling.

# CHAPTER FIVE

# 5.0 CONCLUSION AND RECOMMENDATION

## 5.1 Conclusion

This study found that anaemia is common among pregnant women at Mampong Municipal Hospital, with 60.6% of participants affected. Severe anaemia was the most common type, showing that anaemia is a serious health concern. Several personal and economic factors were linked to anaemia. Women with no formal education, those who were unemployed, and those with low incomes had a higher risk of anaemia. Older women (35–44 years) also had the highest number of cases. Diet and nutrition also played an important role. Many women did not eat enough iron-rich foods, and some did not take iron or vitamin C supplements. This increased their risk of anaemia. Antenatal education and healthcare also influenced anaemia. Many women did not receive enough information on healthy diets and anaemia prevention. Some did not attend regular check-ups or take iron supplements as advised.

## 5.2 Recommendations

Based on the findings of this study, the following recommendations are proposed to reduce the prevalence of anaemia among pregnant women:

**Objective 1: Prevalence of Anaemia Among Pregnant Women**

1. Healthcare providers should do full blood count (FBC) regularly in order to diagnose anaemia early in the pregnancy.
2. Health workers should give personalized advice to pregnant women on how to prevent and manage anaemia.

3. Hospital management and health authorities should include anaemia data collection in their routine health reports to track how common it is over time.

**Objective 2: Factors That Cause Anaemia in Pregnancy**

4. Researchers and healthcare providers should study which groups of pregnant women are most at risk of anaemia, such as those with low incomes or who live in rural areas, and adjust care to meet their needs.
5. Community health workers should run education programs to teach low-income women about affordable, iron-rich foods.
6. Government and healthcare institutions should offer financial support to pregnant women to help them afford nutritious food and medical care.

**Objective 3: Antenatal Education and Healthcare on Anaemia Prevalence**

7. Antenatal care providers should teach pregnant women about the importance of iron-rich foods and iron supplements during their antenatal visits.
8. Healthcare providers should be regularly trained on the latest methods to prevent and treat anaemia.
9. Community leaders and health authorities should run community programs to raise awareness about the risks of anaemia and how to prevent it.

**Objective 4: Dietary Habits and Iron Supplement Use Among Pregnant Women**

10. Healthcare providers should run campaigns to encourage pregnant women to take their iron and folic acid supplements regularly.
11. Nutritionists and community health workers should organize cooking classes to show pregnant women how to prepare iron-rich meals with local ingredients.

12. Government and healthcare institutions should make sure iron supplements are easy to get and affordable, especially in rural areas.

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## APPENDICES

## QUESTIONNAIRE ON ANAEMIA IN PREGNANCY

## INTRODUCTION AND STATEMENT OF CONSENT

I am Dr Sandra G Agyemang an MPH student of AAMUSTED, undertaking a research with the title, prevalence and factors associated with anaemia in pregnancy among antenatal attendants at the Mampong municipal hospital.

The very intent of this survey is to gather important information about experiences and understanding of pregnant women on anaemia, its causes, factors, determinants and its impact on both maternal and foetal health. Your responses will help enhance awareness and improve healthcare strategies aimed at preventing and managing anaemia during pregnancy. Your participation in this survey is voluntary, and your responses will remain confidential. By completing this questionnaire, you will be contributing valuable insights that can assist healthcare providers and the government as a whole in better addressing the factors that promote anaemia in pregnancy. Thank you for your time and input.

If you have any questions or concerns about the questionnaire, feel free to contact me.

Please read the following points before agreeing to participate:

5. Voluntary Participation: Your participation is entirely voluntary. You may choose not to participate or withdraw at any time without any negative consequences.
6. Confidentiality: All information you provide will be kept confidential. Your responses will be anonymized, and no personally identifiable information will be included in any reports or publications resulting from this study.

7. Time Commitment: Completing the questionnaire will take approximately [5] minutes.
8. Potential Risks and Benefits: There are no known significant risks associated with participation. While there may not be direct benefits to you, your responses may help improve understanding and management of anaemia in pregnancy.
9. Contact Information: If you have any questions or concerns about the study, please contact [Sandra Gyanea Agyemang] at [0248129190].

By proceeding with this questionnaire, you indicate that you have read and understood the information provided, and you consent to participate in the study.

[ ]I consent to participate in this study.

[ ] I do not consent to participate in this study.

Thank you for your time and contribution to this important research

SECTION A: Sociodemographic Characteristics

1. What is your age?

a) < 15

b) 15-24

c) 25-34

d) 35-44

e) 45 or older

2. What is your highest level of education?

a) Primary

b) Secondary

c) Tertiary

d) No formal education

3. What is your occupation?

a) Employed

b) Unemployed

c) Student

d) Homemaker

4. What is your marital status?

a) Married

b) Single

c) Divorced

d) Widowed

5. How many children do you have?

a) None

b) 1-2

c) 3-4

d) 5 or more (SPECIFY) _____

You can fill in the number of children in the space above

6. What is your monthly household income?

a) <GH₵ 500

b) GH₵ 500-1000

c) GH₵ 1001-2000

d) >GH₵ 2000

7. Do you currently have health insurance?

a) Yes

b) No

8. IF YES, what type of health insurance do you have?

a) Government (NHIS)

b) Employer – sponsored

c) Private insurance

d) Other: ……..

9. IF NO, what is the reason?

a) Not interested

b) No money

10. What is your ethnic background?

a) Akan

b) Ewe

c) Ga

d) Other (SPECIFY)…….

State ethnic background you belong. example; Dagomba, Gonja, Bissa, Kusasi, Mamprusi etc)

11. What is your religious affiliation?

a) Christian

b) Muslim

c) Traditional

d) Others (SPECIFY…….)

State religious' affiliation for option d. example; Hinduism, Buddhism, Judaism etc.

12. Where do you currently reside?

a) Mampong

b) Suburb of Mampong

c) Other ( SPECIFY……...)

13. Do you live with your partner or a support person during your pregnancy?

a)Yes

b) No

c) Prefer not to say

SECTION B: Prevalence of Anaemia

14.How many pregnancies have you had?

a) First pregnancy

b) 2-3 pregnancies

c)4 or more pregnancies

15. Have you been diagnosed with anaemia during this pregnancy?

a) Yes ( Specify type, mild, moderate, severe anaemia )

b) No

c) Not Sure

16. At what stage of pregnancy were you diagnosed with anaemia (if applicable)?

a) First Trimester

b) Second Trimester

c) Third Trimester

d) Not Diagnosed

17. Do you have a history of anaemia in previous pregnancies?

a) Yes (Specify The Pregnancy: First, Second, Third……. Infer from ANC book.)

b) No

c) Not Sure

18. Have you ever been diagnosed with anaemia prior to pregnancy?

a) Yes

b) No

c) Not Sure

19. What treatment have you received for anaemia (if applicable)?

a) Iron supplements

b) Dietary counseling

c) Blood transfusion

20. Have you experienced any bleeding during pregnancy?

a) Yes (Specify….., Profuse, Not Profuse )

b) No

SECTION C: DIETARY HABITS

21. How would you describe your typical diet?

a) Mostly vegetarian/plant-based

b) Balanced diet (meat, vegetables, fruits, etc.)

c) Mostly non vegetarian

d) Unbalanced/Irregular eating habits

22. Do you consume foods rich in iron (e.g., red meat, spinach, beans, fortified cereals) ?

a) Regularly

b) Occasionally

c) Not at all

23. Do you take iron supplements during pregnancy?

a) Yes (How Often: Daily, Occasionally, Not At All ….)

b) No

24. How often do you consume foods rich in vitamin C (e.g., citrus fruits, tomatoes, peppers)?

a) Daily

b) Weekly

c) Monthly

d) Never

25. Do you experience any difficulty or challenges in maintaining a healthy diet during pregnancy?

a) Yes Please Specify: (morning sickness, body image concerns, fatigue, lifestyle issues, food safety concerns etc…)

b) No

c) Not Sure

6. What is your primary source of food?

a) Home-cooked meals

b) Restaurant

c) Street food /fast food

27. Do you have knowledge of iron-rich foods?

a) Yes (Specify The Source : Books, Social Media, TV etc……)

b) No

28. Have you received dietary counselling during pregnancy?

a) Yes (From Where: ANC, Friends, Relations ……)

b) No

SECTION D: SYMPTOMS AND DIAGNOSIS

29. Have you experienced any of the following symptoms commonly associated with anaemia during pregnancy? (Select all that apply)

a) fatigue

b) dizziness

c) shortness of breath

d) pale skin

e) weakness

f) headaches

g) chest pain

e) none of the above

30. How frequently do you feel fatigued during your pregnancy?

a) Very Frequently

b) Frequently

c) Rarely

d) Never

31. Do you feel your symptoms (if any) have worsened since becoming pregnant?

a) Yes (Which of the Symptoms: …….)

b) No

c) Not Applicable

32. Did your healthcare provider recommend a blood test for anaemia during your pregnancy?

a) Yes (What Was Your Haemoglobin Level: …….infer from the ANC book)

b) No

c) not sure

33. What was the result of the blood test (if applicable)?

a) Anaemia Diagnosed

b) No Anaemia

c) Not Sure

34. Have you experienced any complications during pregnancy?

a) Yes (Specify: Preeclampsia, Gestational Diabetes, Miscarriage, Placenta Previa )

b) No

35. Have you received any health education during pregnancy?

a) Yes (From Who: Doctor, Midwife, Nurse, Friends, Relations……..)

b) No

SECTION E: PAST MEDICAL HISTORY

36. Have you had any previous pregnancies?

a) Yes (Specify…….)

b) No

37. Have you had any chronic medical conditions?

a) Yes (Specify……..)

b) No

38. Have you experienced any previous bleeding disorders?

a) Yes (Specify: ……..)

b) No

39. Have you had any previous surgeries?

a) Yes (Specify type of Surgery ……..)

b) No

40. Have you ever been hospitalized for a medical condition?

a) Yes (Specify……..)

b) No

41. Do you have a family history of anaemia or bleeding disorders?

a) Yes (Specify……..)

b) No

42. Have you ever received blood transfusions?

a) Yes (specify number of units……..)

b) No

43. Are you currently taking any medications for a medical condition?

a) Yes (specify number of units……..)

b) No

SECTION F: ANTENATAL (ANC) DETAILS (FROM ANC BOOK )

44. How many antenatal care visits have you attended during this pregnancy?

a) 1-3 visits

b) 4-6 visits

c) 7 or more visits

45. When did you first seek antenatal care in your current pregnancy?

a) First Trimester (0-12 Weeks)

b) Second Trimester (13- 26 Weeks)

c) Third Trimester (27 + Weeks)

46. Were you provided with iron supplements during your ANC visits?

a) Yes

b) No

c) Not Sure

47. Did your healthcare provider discuss the importance of iron-rich foods and supplements for preventing anaemia during pregnancy?

a) Yes

b) No

c) Not Sure

48. Did you follow the recommended dosage of iron supplements?

a) Yes, Consistently

b) Yes, but occasionally missed doses

c) No, I Did Not take the supplements regularly

SECTION G: HEALTH ACCESS AND EDUCATION

49. How frequently do you attend prenatal check-ups during your pregnancy?

a) Monthly

b) Every few months

c) Rarely

d) Not at all

50. How satisfied are you with the prenatal care and advice you've received about anaemia?

a) Very Satisfied

b) Satisfied

c) Neutral

d) Dissatisfied

e) Very Dissatisfied

51. Would you be interested in receiving more information or education on anaemia during pregnancy?

a) Yes

b) No

SECTION H: PREGNANCY OUTCOME AND FOLLOW UP

52. Have you experienced any pregnancy complications related to anaemia (e.g., preterm birth, low birth weight)?

a) Yes

b) No

c) Not Sure

53. Have you been advised to follow up for further anaemia treatment or monitoring after pregnancy?

a) Yes

b) No

c) Not Applicable

SECTION I: ADDITIONAL COMMENTS

54. Do you have any additional comments or concerns about anaemia during pregnancy?

……

……

# APPENDIX B

**Kwame Nkrumah University of Science and Technology, Kumasi**

**College of Health Sciences**
SCHOOL OF MEDICINE AND DENTISTRY

COMMITTEE ON HUMAN RESEARCH, PUBLICATION AND ETHICS

Our Ref: CHRPE/AP/188/25 17th March, 2025

Miss Sandra Gyanea Agyemang
Akenten Appiah-Menka University of Skills
Training and Entrepreneurial Development,
Department of Public Health.
KUMASI-GHANA.

Dear Madam,

**LETTER OF APPROVAL**

| | |
|---|---|
| ***Protocol Title:*** | ***"Prevalence and Factors Associated with Anaemia in Pregnancy among Antenatal Attendants at the Mampong Municipal Hospital."*** |
| ***Proposed Site:*** | ***Mampong Municipal Hospital.*** |
| ***Sponsor:*** | ***Self-Sponsored.*** |
| ***Students:*** | Miss Sandra Gyanea Agyemang |
| ***Supervisor:*** | Dr. Joanna Apenkwa |

Your submission to the Committee on Human Research, Publications, and Ethics on the above-named protocol refer.

The Committee reviewed the following documents:

- A notification letter of 14th February 2025 from the Ghana Health Service, Mampong-Ashanti (study site) indicating approval for the conduct of the study in the municipality.
- A Completed CHRPE Application Form.
- Participant Information Leaflet and Consent Form.
- Research Protocol.
- Questionnaire.

The Committee has considered the ethical merit of your submission and approved the protocol. The approval is for one year, renewable after that, from **17th March 2025 to 16th March 2026**. The Committee may, however, suspend or withdraw ethical approval at any time if your study is found to contravene the approved protocol.

Data gathered for the study should be used for the approved purposes only. Permission should be sought from the Committee if any amendment to the protocol or use, other than submitted, is made of your research data.

The Committee should be notified of the actual start date of the project and would expect a report on your study, annually or at the close of the project, whichever one comes first. It should also be informed of any publication arising from the study.

Thank you for your application.

Yours faithfully,

Rev. Prof. John Appiah-Poku.
Honorary Secretary
**FOR: CHAIRMAN**

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