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FACTORS INFLUENCING COMPLIANCE WITH IRON SUPPLEMENTS INTAKE AMONG PREGNANT WOMEN IN THE GARU-TEMPANE DISTRICT OF THE UPPER EAST REGION

BY

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DECLARATION

I, Cosmos Atawoje Minyila, hereby declare that besides the acknowledged references to other people's work, this dissertation is the result of my own independent work. I further declare that this work neither in whole nor in part has been submitted anywhere for any kind of award.

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(STUDENT)

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DR. AGNES M. KOTOH DATE

(SUPERVISOR)

DEDICATION

This piece of work is dedicated to God Almighty for the gift of life and strength. Secondly, to my family for their support and encouragement that went a long way to motivate me to produce this work.

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I finally want to thank faculty members of the school of public health for the exposure that laid the foundation for this work to start in the first place.

ABSTRACT

Introduction: Anaemia is a global public health problem that affects both poor and rich countries. Males, females are affected and particularly pregnant women. Iron supplementation is one of the key interventions used to control anaemia in pregnancy. However, compliance with the intake of the supplements is a key factor in controlling anaemia. This study sought to explore the factors that affect compliance.

Methodology: Community-based cross-sectional study design was used to inform this study. It covered 355 pregnant women aged 15-45 years randomly sampled from ANC attendees in eight out of the nine sub-districts in the Garu-Tempane district of the Upper East Region. Quantitative data was analyzed using STATA version 15. Bivariate and multiple logistic regression analysis was performed to determine the association between the independent variables and the outcome variable.

Results: The study found that two iron supplements are used in the district: Iron Folic Acid (IFA) and Ferrous Sulphate (FS). 64.51 percent of the pregnant women were anaemic. Compliance with IFA was 66.2 percent and 65.63 percent with respect to FS. The factors that were associated with compliance included; religion, household size, gravida, ANC attendance, side effect, counselling and anaemia

Conclusion: This study indicated that the prevalence of anaemia among pregnant women is high, suggesting more work needs to be done to reduce it to acceptable limits. Also, compliance with the intake of iron supplements was found to be moderately high among pregnant women aged 15-45 years. Predictors of compliance could be exploited to address the high prevalence of anaemia.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF ACRONYMS

AIDS	Acquired Immune Deficiency Syndrome
ANC	Antenatal Care
ART	Antiretroviral Treatment
CDC	Center for Disease Control
DHD	District Health Directorate
DHIMS	District Health Information System
FS	Ferrous Sulphate
GDHS	Ghana Demographic and Health Survey
GHS	Ghana Health Service
GSS	Ghana Statistical Service
Hb	Haemoglobin
HIV	Human Immune Virus
IDA	Iron Deficiency Anaemia
IFA	Iron Folic Acid
LLIN	Long Lasting Insecticide treated Net
MoH	Ministry of Health
SD	Sub-District
SRS	Simple Random Sampling
SP	Sulphurdoxine Pyramethine
UNICEF	United Nations children fund
WHO	World Health Organization

CHAPTER ONE

1.0 INTRODUCTION

This chapter provides background information on the study, problem statement, conceptual framework, justification for the study, objectives of the study and research questions.

1.1 Background to the study

Pregnancy is one of the most exciting periods in the life of most women particularly the married ones, but it can also be a moment that brings misery, emotional torture and suffering when unexpected complications that sometimes result in ill health and even death occur (Patil, 2013). One of the sure causes of misery in pregnancy is anaemia.

Anaemia is a condition in which the number of red blood cells or their oxygen-carrying capacity is insufficient to meet person physiological needs. It is a serious global public health problem that affects low, middle and high-income countries and has significant adverse health and socio-economic consequences. It has been established that two billion people, more than a third of the world's population, are affected by anaemia globally (Munasinghe, 2014). The most reliable and commonly used indicator of anaemia at the population level is haemoglobin concentration (WHO, 2015). Anaemia prevalence is noted to be highest in third world countries. Although it affects all, sexes and ages, pregnant women and children under five years are most affected. Globally, 42.6 percent of the population is said to be anaemic translating into 9.6 million people. Out of 9.6 million people affected by anaemia, 42.6 percent of children were aged 6-59 months old and pregnant women constituted 38.2 percent (WHO, 2015; Macdonald *et al.*, 2010).

The prevalence of anaemia in pregnancy is estimated to be approximately 41.8 percent globally, varying from as low as 5.7 percent in the USA to as high as 75 percent in the Gambia (Chathuranga, Balasuriya, & Perera, 2014).

In Ghana, the prevalence of anaemia among women is 42.4 percent. Out of these women, 32.2 percent have mild anaemia, 9.8 percent have moderate anaemia while 0.4 percent have severe anaemia (GSS, 2015).

Prevalence of iron deficiency varies considerably in populations; some known factors include age, gender, physiological, pathological, environmental, and socioeconomic conditions. The most known type of anaemia in pregnancy is iron deficiency anaemia which occurs as a result of low intake of iron and excessive iron loss. The risk factors responsible for this during pregnancy include low iron consumption, frequent vomiting, multiple pregnancies and closely spaced pregnancies (World Health Organization, 2012).

The consequence of anaemia in pregnancy if allowed to continue has implications for the individual, families, communities and the country as a whole. This ranges from decreased work productivity leading to economic losses to ultimately maternal morbidity and mortality. Anaemia in pregnancy is also linked to adverse birth outcomes; thus contributing to an inter-generational cycle of poor health and development (Macdonald *et al.*, 2010).

In Ghana, various interventions have been implemented to control anaemia, particularly among pregnant women. Among them is the free iron supplementation that gives ferrous sulphate, folic acid and multivitamin supplements to pregnant women who attend ANC services. Research work into compliance to IFA supplementation uptake has revealed 40%–60% compliance among adolescent girls and pregnant women respectively (Mithra, Unnikrishnan, & Mohan, 2014).

With the high prevalence of anaemia in the country, the Garu-Tempane district has recorded anaemia prevalence of 60.5 percent in 2015 and 31.3 percent in 2016 (DHD-Garu-Tempane, 2017), this research is set out to investigate factors that influence compliance to the intake of iron supplement in the Garu-Tempane district.

1.1 Problem statement

In any population, anaemia prevalence of 2.5 percent or less is considered normal or acceptable, but when iron deficiency anaemia exceeds 5 percent then, it is considered as a public health problem (World Health Organization, 2001). Globally, 42.6 percent of the population is said to be anaemic. The figure for Africa is higher (62.3%). In the case of pregnant women, iron deficiency anaemia is 38.2 percent globally and 46.3 percent in Africa (World Health Organization, 2015).

According to WHO (2015), 62 percent of pregnant women in Ghana are anaemic. The 2014 Ghana Demographic and Health Survey (GDHS) Report show that more than four in every ten women are anaemic (42%) and that of the Upper East Region is 39.6 percent. The proportion of women with slight anaemia is higher in the rural areas (44%) as against 41 percent in urban areas. In general, 32.2 percent, 9.8 percent and 0.4 percent have mild, moderate and severe anaemia respectively in Ghana (GSS, 2015). A study by Jaween (2013) within the Tamale Metropolitan Area revealed that 47 percent of the respondents (pregnant women) were anaemic. The prevalence rate is even higher around the middle belt of the country. A study conducted in the Sunyani Municipal Area by Anlaakuu, (2015) have shown a prevalence rate of 44.3 percent among pregnant women. A review of the

study District ANC performance in 2015 has also indicated a 60.5 percent of pregnant ANC registrants have Hb levels below 11 gm/dl (anaemia) (DHIMS 2).

A lot of factors contribute to anaemia globally. According to Mohandas (2013), malaria causes anaemia by destroying red blood cells and indirectly by decreasing the production of new red blood cells. Malaria is reported to be among the top 10 diseases in Ghana and a major cause of anaemia (GSS, 2015). Micronutrient deficiencies is well documented to be a major cause of anaemia because they form part of the red blood cell (iron) (Abbaspour, Hurrell, & Kelishadi, 2014), and are necessary for the production of new red blood cells (iron, folate, vitamin B12) and transport iron throughout the body (vitamin A) (Oliveira *et al*., 2008)

The effects of anaemia are fatal among women. The devastating effects of anaemia in women among others include increased fatigue, decreased work productivity and cognitive ability, and increased morbidity and mortality. Anaemia contributes about 20 percent of all maternal deaths (Noronha *et al*., 2012). An estimated 50,000 women are said to die from severe iron deficiency anaemia during pregnancy and childbirth and approximately 200,000 severe birth defects are recorded annually from folate deficiency (UNICEF, 2004). Analysis of the cause of maternal deaths at the Korle-Bu Teaching hospital has shown that anaemia in pregnancy contribute to 12.7 percent and indirectly accounts for 54.8 percent of the deaths (Adu-Bonsaffoh & Kwame-Aryee, 2017). Anaemia is projected to cost Ghana more than GHc1.9 billion and impact negatively on productivity if measures are not taken to curb the current trend. If anaemia is reduced by half, productivity will be improved and this will impact positively on the country's development agenda (Citifm, 2015).

In Ghana, several intervention programmes have been put in place to curb anaemia among pregnant women. Some of these interventions include;

1. The distribution of Long-Lasting Insecticide Treated Nets (LLIN)
2. The national deworming exercises
3. The use of Sulphadoxine Pyramethine (SP) as prophylaxis against malaria
4. The use of iron supplements (ferrous sulphate, folic acid and multivitamin)

In spite of the above-mentioned interventions which are ongoing, the country including the Upper East Region is still recording alarming rates of anaemia. It is in the light of the continued trend of anaemia among pregnant women and its negative consequences on pregnancy and birth outcomes that it has become imperative to explore challenges undermining the effort to bring down anaemia in the country to acceptable limits. Iron supplementation, being one of the key flagship interventions to curb anaemia among pregnant women, its uptake is critical to bringing anaemia among pregnant women to acceptable limits (less than 5%). Compliance with the intake of IFA in South India was found to be 64.7 per cent (Mithra *et al*., 2014)**.** However, the level of compliance to iron supplementation intake is not much explored in Ghana and the study district in particular. This study assesses factors influencing compliance with the intake of iron supplementation among pregnant women in the Garu-Tempane District.

1.3. The conceptual framework

1.3.1. The Behavioral Model of Health Services Use.

The behaviour model of health services use by Andersen (1995) is anchored on the fact that, the utilization of health services by individuals is modelled by their predisposition to the use of such services, factors which promote or hinder the use of services and their need for health care. Each component of the model independently or directly influences a

pregnant woman's decision to either take the iron supplements as prescribed or otherwise. Research has documented that a pregnant woman's decision to comply with the prescribed uptake of iron supplements is influenced by demographic characteristics such as age, marital status, educational level, religion, gravida and ethnicity among others.

Age as a factor in compliance with the intake of iron supplement can be explained as one advance in age, it is expected that the accumulated knowledge and experience will have a positive bearing in compliance. However, age can also be a negative factor to compliance in that, as one age, the negative cultural practices of that locality can be accrued and possibly work against compliance (Gabrysch, *et al.*, 2011).

Formal education is a key factor to consider regarding compliance and health-seeking behaviour generally. A pregnant woman who has a high level of education is more independent compared to a woman without education or only basic education. They are able to grasp concepts and also independently read educational materials to enhance their understanding which will influence their compliance level.

Marital status is another factor that may influence the intake of supplements in one way or the other. Women who are single are more independent to take health-related decisions on matters compared to married or cohabiting women. On the other hand, married women have couples around them who can also remind them to take the supplements if they forget.

Obstetric and health factors play important role in compliance with the intake of iron supplements. First is gravida; Gravida of a woman may also play a role in compliance. Women who have had previous pregnancies may gather more experiences and become used to taking the supplements religiously than women who are having their first pregnancy experience. The reverse can also be the case, women who had previous pregnancy

experience may become complacent in taking the supplements compared to primates who because of the unknown, may religiously follow the course of the supplements. Frequency of Antenatal Care (ANC) visits can also affect compliance. When the frequency is high, the possibility of the pregnant woman receiving more counselling on the importance of taking the iron supplements is high thereby, help the woman to comply with the intake of the supplements.

A pregnant woman's compliance with the intake of iron supplements is influenced to a large extent by the quality of counselling received from the midwife. The counselling received may influence a woman's decision as to whether to take the supplements or not. A woman who might have experienced some level of side effects from the supplement may take a decision to either continue or stop using it all together. According to Gebremedhin, *et al.*, (2014), a relatively higher proportion of women with low compliance (63.3%) reported side-effect as the reason for non-adherence to the intake of iron-folic acid.

There are also other factors that directly affect compliance. These factors are not socio-demographic nor obstetric in nature. First is Prolong dosage which can lead pregnant women to become fed-up with the supplements. A woman who is expected to take three different supplements at different times of the day for the period of the pregnancy might think that it is too much and may decide to ration it (i.e. taking the supplement according to her own terms rather than the recommended dosage).

A woman who has food at home to eat before taking the supplement will not be at the same level as compared to a woman who struggles so much to get food to eat. Therefore, food availability becomes another determining factor for compliance.

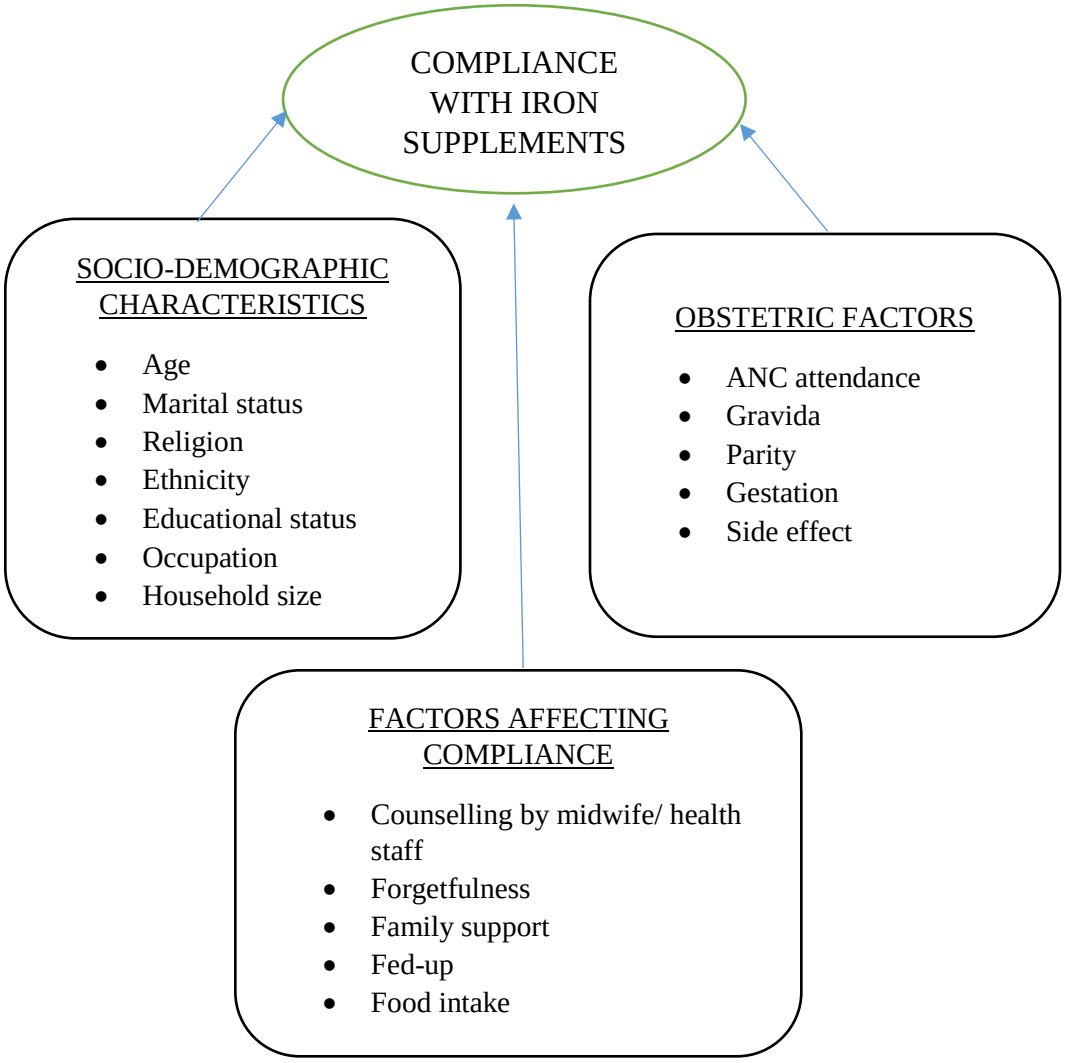
Forgetfulness is another contributory factor to compliance. About 48.8 per cent of pregnant women who did not comply with the intake of the iron-folic acid (IFA) attribute it to forgetfulness (Mithra *et al*., 2014). Some pregnant women may forget to take the supplements within certain periods of the day especially if they are engaged in other economic activities or even household chores. On the other hand, a woman who leaves home at dawn to her workplace and comes back home late at night might not be able to take the afternoon dose. This situation can affect compliance.

Family support is also key to compliance. When the family members are able to remind the pregnant woman to take the medications, it will also go a long way to help.

When compliance is compromised, it affects a woman's Hb status leading to anaemia particularly if the woman's diet is deficient in iron sources.

These factors influence a pregnant woman's decision to comply with the routine iron supplements or otherwise.

Figure 1; A Conceptual Framework for compliance with the intake of iron supplements by pregnant women



Source: adopted and modified from the behavioural model of health service use (Andersen, 1995)

1.4 Justification.

Anaemia is highly prevalent in Ghana, particularly during pregnancy. Anaemia is a major cause of morbidity and mortality particularly in developing countries and has both maternal and foetal consequences (Akhtar & Hassan, 2012). Iron deficiency contributes significantly to the current level of anaemia, particularly among pregnant women. According to the

Ghana Demographic and Health Survey report (GDHS), by the Ghana Statistical Service (GSS), (GSS, 2015), anaemia occurrence among pregnant women in Ghana is 42.4 percent. The effects and impact of anaemia among pregnant women cannot be overemphasized, it includes; low productivity due to low physical activity and ultimately increased risk of morbidity and mortality (World Health Organization, 2008).

To control anaemia in pregnancy in Ghana, various interventions have been put in place, it includes the iron supplementation programmes. The needed results have not been realized since the implementation of these interventions. This provided fertile grounds for health professionals to raise pertinent questions regarding;

- Implementation strategies
- Reliability of the supplements and
- Compliance of pregnant women to the taking of the supplements

But effectiveness and success of such interventions hitch largely on the compliance to Iron supplements tablets intake (Kumar & Priya, 2018). This study, therefore, sought to determine compliance of pregnant women to the taking of these supplements aimed at boosting their iron stores leading to increment in Hb levels and the factors associated with the intake of the supplements in the Garu-Tempane District of the Upper East Region. This will contribute towards the formulation of strategies by players within the health sector to tackle the high prevalence of anaemia in pregnancy in the district and the Upper East Region at large.

1.5 Research questions

1. What is the level of anaemia prevalence among pregnant women in the Garu-Tempane District?
2. What is the rate of compliance of iron supplements intake by pregnant women in the Garu-Tempane District?
3. What factors affect the compliance of pregnant women's intake of iron supplements?
4. Is there any association between compliance of iron supplement intake and anaemia?

1.6 Main Objective

To determine the level of compliance and examine factors associated with pregnant women's intake of iron supplement in the Garu-Tempane District.

1.6.1 Specific objectives

1. To assess the prevalence of anaemia among pregnant women.
2. To determine the level of compliance of iron supplements intake among pregnant women.
3. To examine factors associated with compliance of iron supplements intake among pregnant women.
4. To explore the association between compliance of iron supplement intake and anaemia among pregnant women.

CHAPTER TWO

2.0 LITERATURE REVIEW

2.1 Introduction; Definition of Anaemia.

Anaemia is a condition in which the number of red blood cells or their oxygen-carrying capacity is insufficient to meet physiologic needs (Macdonald, *et al*, 2010). It is defined as a decreased level of haemoglobin in the blood, resulting in lower quantities of oxygen available to support the body's activities. It is affected by age, sex, altitude, smoking, and pregnancy status among other factors.

Internationally there are accepted haemoglobin values which determine anaemia in women. For pregnant women, all anaemia is Hb <11g/dL, mild anaemia is Hb between 10.0-10.9g/dL, moderate anaemia is Hb between 7.0-9.9g/dL while that for severe anaemia is Hb < 7.0g/dL. The cut-offs for that of non-pregnant women of childbearing age (15 to 49 years) all anaemia is Hb <12, mild anaemia is Hb between 10.0-11.9g/dL, moderate anaemia is Hb between 7.0-9.9g/dL while that for severe anaemia is Hb < 7.0g/dL. These figures are applicable to most countries but need to be adjusted for high-altitude locations (World Health Organization, 2001).

Due to differences in haemoglobin distribution amongst healthy populations in different parts of the world, many countries have established their own haemoglobin cut-off values to define anaemia in pregnancy. In Ghana, the Ministry of Health's haemoglobin value for anaemia at all stages of pregnancy is 10.0g/dl (Ahenkorah, 2015; Patience, 2016). To ensure that data on anaemia is uniform across the globe for the purposes of research and comparison, WHO has recommended a cut-off of Hb > 11.0 g/dL (World Health Organization, 2001)

2.1.1 Distribution and public health significance of anaemia

Anaemia is one of the issues of public health concern in the world. Globally, anaemia affects 56 million pregnant women (41.8%). In Africa, 65.8 percent of pregnant women are anaemic (World Health Organization, 2008). The WHO has categorized prevalence of anaemia as a public health problem as follows:

- <5 percent, no public health problem;
- 5–19.9 percent, mild public health problem;
- 20–39.9 percent, moderate public health problem;
- ≥40 percent, severe public health problem

Almost every country in the world has some form of anaemia as a problem of public health concern. There are 68 countries that have severe anaemia, 91 with moderate anaemia, 33 mild anaemia (World Health Organization, 2008). Table 1 shows regional anaemia prevalence.

Table 1; Global and WHO regional prevalence of anaemia for pregnant women for 2011

WHO Region	Percentage of Population with Anaemia
Global	38.2
The region of the Americas	24.9
South-East Asia Region	48.7
European Region	25.8
Eastern Mediterranean Region	38.9
Western Pacific Region	24.3

(WHO, 2015)

According to the GDHS 2015, the prevalence of anaemia among women is 42.4 percent, this puts Ghana among countries with severe public health problem regarding anaemia. Data from the District Health Information Management Systems 2 (DHIMS 2) of the Garu-Tempane district in 2015 revealed anaemia prevalence rate of 60.5 percent among pregnant women who attended ANC at the various Health facilities within the district.

2.1.2 Classification of anaemia

Anaemia is classified based on the criteria adopted. The physiologic anaemia (morphological appearance of the red cells during anaemia) and pathologic mechanisms which cause anaemia. (Chowdhury, Rahman, & Abm, 2016).

According to Cheesbrough, (2006), there are three main contributory factors to the development of anaemia; Blood loss, reduction in the normal production of red cells and the premature destruction of red blood cells. These factors turn to cause anaemia. The main causes of anaemia are;

- Malnutrition (micronutrient deficiency)
- Acute and chronic infections (Parasitic, bacterial, and viral infections)
- Inherited haemoglobinopathies (inherited and acquired disorders)

Malnutrition (Iron deficiency) anaemia; Iron is an important part of the production of haem component of haemoglobin. It is also needed although not in large quantity for the production of muscle myoglobin and cytochromes. When iron is not sufficient enough for the production of haemoglobin, it results in iron deficiency anaemia (Macdonald, *et al*., 2010)

2.1.3 Iron requirements during Pregnancy

Iron supplementation for pregnant women was necessitated by the observed high incidence of iron deficiency as the requirements for both mother and the fetus increase with increasing duration of pregnancy. This increased need and demand cannot be met without iron supplementation particularly for pregnant women in developing countries. The Total maternal requirements during pregnancy for extra iron averages about 800 mg (elemental iron), out of this, the fetus and placenta needs is about 300mg. The 500mg is utilized during maternal haemoglobin mass expansion (Chander *et al;* 2008). The placental and fetal requirement is mandatory and iron from food or dietary intake will be utilized by the fetus and the placenta irrespective of maternal iron status. On the average, a pregnant mother iron needs increases from a 0.8 mg per day in the first trimester to between 6 - 7 mg per day in the second half of pregnancy. In all, on the average, a pregnant woman daily needs of iron are between 2mg to 4.8 mg of iron per day. A pregnant mother should consume 20 to 48 mg of iron from other sources, for example, diet (Chander *et al,* 2008).

2.1.4 Strategies to address iron deficiency Anaemia

There are three widely used strategies for correcting an iron deficiency in pregnant women.

- Education combined with dietary modification or diversification to improve iron intake and bioavailability
- Iron supplementation
- Iron fortification of foods. (Chowdhury *et al*., 2016)

This paper will narrow down on supplementation since that is the area the research work is centred on.

2.1.5 Iron supplementation

The most known and commonly used strategy to control iron deficiency particularly in the developing countries is iron supplementation. However, the iron distribution mechanisms, as well as compliance, remain the major limitations. Two strategies that are commonly used to boost the iron status of pregnant women are Oral iron supplementation such as ferrous sulphate and ferrous gluconate used for the following two reasons; bioavailability and low cost. In the case of adults, the recommended therapy for iron-deficiency anaemia is a 300-mg tablet of ferrous sulphate (60 mg of iron), about 3 times daily. Absorption of these supplements are enhanced when taken on an empty stomach but nausea and epigastric pain sometimes are experienced. Lower doses between meals should be taken or by mothers who experience side effects, iron should be provided and taken when eating even though the absorption of medicinal iron is reduced by food by about two thirds (Cook, 2005) Iron supplementation is recommended for pregnant women in developing countries, this is because most women always have low iron stores in these countries before conception (Center for Disease Control, 2010).

2.1.6 Prevention and control of anaemia in pregnancy

To prevent anaemia among pregnant women, diet is very key. Pregnant women should be encouraged to eat iron-rich foods or use foodstuff that has been fortified with iron, folic

acid, vitamins A and B12. This will help boost their iron stores and prevent anaemia (World Health Organization, 2008).

In Ghana, a number of anaemia control measures have been implemented for pregnant women. All pregnant women who attend ANC are given iron supplements irrespective of their Hb levels. A study done in Indonesia has shown that children of mothers who take iron supplements during pregnancy had a 40 percent decreased risk of dying in their first five years of life (Titaley, *et al*., 2010)). Malaria is also known to cause anaemia, to this end, pregnant women are given Sulphurdoxine Pyramethine (SP) to prevent malaria and LLINs are also shared among pregnant women (Ministry of Health, n.d.) (Ghana Health Service, 2015). Worms particularly schistosomiasis and Hookworm are also known to be associated with anaemia, de-wormers are therefore given to pregnant women who attend ANC (Ghana Health Service, 2015).

2.2 Compliance

According to Lutsey, *et al*., (2017) compliance is the willingness and ability of a pregnant woman to follow a prescribed course of treatment (that is, intake of iron supplements). This implies that compliance is a function of both maternal initiatives to attend prenatal clinics where iron supplement distribution occurs and iron supplementation taking behaviour encouraged. This shows that these two conditions are important to follow the course of treatment.

2.2.1 Measurement of Compliance

Measurement of compliance with regards to iron supplements was done in several ways by different researchers. Compliance was measured based on the last seven days iron supplements given to pregnant mothers prior to the survey and 70 percent intake of the supplement is considered as compliance (Sadore *et al*., 2015). In a research carried out by Dutta, Patel, & Bansal, (2014), compliance was measured by pill counting method considering intake of 80 percent or more as compliant. In another study, pregnant women were grouped into two: control group and treatment group and followed for 20 weeks. The women were. The control group was made to buy their iron supplements while the treatment group was given. At the end of the 20th week, intake of the supplements was measured and classify as low compliance if intake is less than 70 percent and high compliance if intake is greater than or equal to 70 percent (Seck & Jackson, 2017). In another research work, failing to take or missing of two or more doses by the pregnant woman was regarded as non-compliance (Mithra *et al*., 2014). Standards for compliance varies significantly across the board. Compliance was measured based on 75 percent intake of two weeks dose of iron supplements (Gebremedhin, *et al*., 2014) which is a higher standard compared to the intake of 70 percent allocation as stated above in the research carried out by Mithra *et al*., 2014.

This study also adopts the compliance criteria of 75 percent as used by Gebremedhin, *et al*. since this work also relies on the pill count method.

2.3 Factors Associated with Compliance to Iron supplementation

A lot of factors have been identified to be associated with iron supplementation. These factors are noted to influence the intake of the supplements either positively or negatively. Seck & Jackson, (2017) have identified the following factors that affect compliance:

2.3.1 Side-effects.

Some mothers turn to stop temporarily the intake of iron supplements as a result of the side effects they experience. According to Getachew *et al.*, (2018) 40 percent of respondents said side effect contributed significantly to their inability to comply with the intake of IFA. Some of the side effects include; nausea, vomiting, diarrhoea and constipation.

2.3.2 Counseling by midwives

Pregnant women who are counselled by midwives who take their time to explain the importance of the supplements and the need to acquire more when the initial supplements run out are more likely to comply compared with those who do not receive these messages. Counselling on the importance of taking the IFA given to pregnant women were found to be significant is a study in Northern Ethiopia (Getachew *et al*., 2018)

2.3.3 Forgetfulness

Mothers sometimes forget to take their supplements but readily take the supplements when they remember or are reminded. The most common cause for non-compliance to the intake of IFA was forgetfulness which accounted for at least one fourth (25.1%) of the

respondents (Dutta *et al*., 2014). Also, in another research, (Sadore, *et al*., (2015) found that forgetfulness is the second key reason for skipping doses of IFA supplement (42.1%)

2.3.3 Fed up of having to take so many tablets.

Too many pills, having to take at least two tablets of the iron tablets at a time at least twice a day has been identified to be one of the obstacles to compliance. For some mothers, accessibility to the health facility is a major determinant. Some pregnant women complain of walking between 30 to 60 minutes so were unable to attend ANC regularly (Sadore, *et al*., 2015).

2.3.4 Family support

Family support is an important factor identified in helping or supporting pregnant women to keep to the regular intake of the iron supplements without skipping. Gebre, (2015), found family support to be significantly associated with compliance with the intake of iron supplements. in his findings, 39 per cent of pregnant women attributed their ability to comply with the intake of IFA to family support.

2.4 Knowledge of IFA supplement and Anaemia

Knowledge of IFA supplement and Anaemia also affect compliance with the intake of the supplements. According to Sadore, *et al*., (2015), in Ethiopia, Pregnant mothers with better understanding and knowledge of iron supplement were 3.5 times more likely to comply with iron-folate supplement as compared to those who had inadequate knowledge about iron-folate supplementation, and mothers with good knowledge of anaemia were

4.45 times as likely to comply with the intake of IFA as compared to those with poor knowledge of Anaemia.

2.5 Compliance and anaemia

One other significant factor considered in this study is the relationship between anaemia and women who comply with the intake of iron supplements against those who are non-iron supplement compliant. Studies have shown that, compliance with the intake of IFA was found to be influenced by socio-economic status (SES), women with lower SES seem to be more compliant to the intake of IFA than those with higher SES, older women (25 years and above) are also found to be more compliant than those below 25 years (Mithra *et al*., 2014). Knowledge of anaemia status is key in influencing pregnant women to comply with the intake of IFA (Kumar & Priya, 2018)

In another study conducted in an Urban slum in India, Women who were anaemic were found to be non-compliant to the intake of IFA in (Dutta *et al*., 2014), this study found a significant association between anaemia and non-compliance to the intake of IFA. Kuril *et al*., (2016) in a study of adolescent girls found out that, adherence to the intake of IFA has a significant influence on anaemia status. In this study, a mean Hb status was increased from 10.61±1.32 to 11.02±1.06 with adherence of 85.2 percent

In conclusion, Sadore, *et al.*, (2015) recommended that further studies be carried out on compliance with iron-folate supplement using a different strategy altogether. They recommended the pill count strategy as the way forward in overcoming previous limitations regarding studies done in the area of compliance to iron supplementation. According to Seck & Jackson, (2017), adequate counselling is a key factor to compliance, future studies

about the effectiveness of iron/folic acid supplementation should concentrate on the nature of the interaction between midwives and the pregnant women during ANC visits and quality of training given to midwives with respect to knowledge about anaemia

This study will, therefore, adopt the direct pill count strategy.

CHAPTER THREE

3.0 METHODOLOGY

This chapter provides an in-depth description of the methodology used for this study. It covers the study design, study area, study population, sample size calculation, sampling method, data collection techniques and tools, variables, quality control, data processing and analysis, a pretest of instruments and ethical considerations.

3.1 Study Area

The Garu-Tempane District is one of the 13 Districts in the Upper East Region of Ghana. The District has two constituencies, the Garu and Tempane constituencies with its administrative capital at Garu. The Garu-Tempane District Assembly was established in 2004 as defined by the Local Government Legislative Instrument (L.I. 1769). The district has a projected 2017 population of 150,723 people distributed sparsely in 209 communities. The assembly consists of nine Area Councils, 30 Electoral Areas and 30 Unit Committees. The District Health Directorate has also created nine administratively sub-districts with a total of 56 health facilities.

The District lies in the South-Eastern part of the Upper East Region of Ghana. It covers an area of 1060.91 square/km. It lies approximately on latitude $11^0 38^l$N and11^0N and longitude 0^0 06^l E and 0^0 23^l E.

The District shares boundaries with Bawku Municipal to the north; Bunkpurugu-Yunyoo District to the south; Bawku West District to the west; and the Republic of Togo to the east. Garu-Tempane is part of the interior continental climatic zone of the country characterized by pronounced dry and wet seasons. The vegetation of the district is largely Sahel

savannah; consisting of grassland separating deciduous trees among which can be seen a few broad-leaved species.

3.2 Study population

The study population consisted of all antenatal attendants between the ages of 15 years to 49 years at the time of data collection.

3.2.1 Inclusion Criteria

All pregnant women aged 15 to 49 years, residing in the district for at least three months. And have made an antenatal visit, given an iron supplement and not more than 36 weeks gestation.

3.2.2 Exclusion criteria

1. Pregnant women who are visibly sick and weak to talk or on admission will be left out because they can not be engaged in an interview.
2. Pregnant women above 36 weeks. This is because they could go into labour after this period and might be unavailable for interview.
3. Pregnant women who have a history of recent blood transfusion (within the previous one month).

3.3 Study design

This study is a community based quantitative cross-sectional study carried out from April to May 2018 in eight out of the nine sub-districts within the Garu-Tempane District in the Upper East Region. This method was used because it offered the researcher the opportunity

to collect data on both the independent and dependent variables simultaneously, and it is relatively faster and cheaper to undertake (Mann, 2003).

3.4 Variables

3.4.1 Dependent variables

The main dependent variable in the study was compliance with the intake of iron supplements. Compliance was determined by taking the iron supplements given to the pregnant woman from her last ANC visit and physically counting the number of tablets left relative to the number of days taken and quantity issued. Statistical tools are then used to establish whether or not, there is a relationship between compliance and the independent variables.

The dependent variable was dichotomized at the analysis stage; first, compliance was categorized into compliance and coded as “1” and non-compliance coded as “0”.

3.4.2 Independent variables

The independent variables in the study were categorized into three groups. First, was the socio-demographic characteristics (age, marital status, ethnicity, educational status, religion, occupation and household size). Second, obstetric factors (ANC attendance, Gravida, side effects). Thirdly, factors affecting compliance (Counselling by midwife/ health staff, Forgetfulness, Family support, Fed-up, Food intake, anaemia status). These variables were chosen based on previous research work and observations made in the line of the researcher's work experiences.

Table 2; Variable definition

Variables	**Operational definition**	**Type of variables**	**Scale of measurement**
Hb of a pregnant woman	Hb level of a pregnant woman at the time of interview	Dependent	Continuous
Age of participant	Age in years at last birthday of the pregnant woman as reported during the interview.	Independent	Discrete
Gestational age of pregnancy	Gestational age in weeks of pregnancy during the time of interview	Independent	Discrete
Gravidity	The number of pregnancies women have had	Independent	Discrete
Educational level	The highest educational level attained	Independent	Ordinal
Marital status	Refers to the marital status of the pregnant woman	Independent	Categorical
Occupation	The work of the pregnant woman	Independent	Categorical
Number of ANC visit	The number of times the pregnant woman has visited the ANC clinic	Independent	discrete
Side effects	Experiences of discomfort felt after the intake of the iron supplement	Independent	Categorical
Food available	Ability to eat a meal before taking the iron supplement	Independent	Categorical
Forgetfulness	Inability to remember to take the iron supplement	Independent	Categorical
Anaemia status	Determining the Hb level of the pregnant woman	dependent	ordinal
Iron supplements compliance	Determining compliance of pregnant woman regarding iron supplement intake	dependent	ordinal

3.5 Sample size and sampling method

3.5.1 Sample Size Calculation

This study appears to be the first in the district and that attempted measuring compliance of pregnant women with regards to the intake of iron supplements. The sample size was therefore calculated based on a similar study carried out in South India which reported a 64.7 percent intake of iron supplements compliance rate among pregnant women (Mithra *et al.*, 2014).

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

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

P= Proportion of pregnant women who comply with intake of iron supplements is 64.7 percent which is equals to 0.392

q= Proportion of pregnant women who do not comply with intake of iron supplements which is equal to 1-0.647% = 0.353

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

$n = (1.96^2 * 0.647* 0.353) / 0.05^2$

$= (3.8416 * 0.2283) / 0.0025$

$= 0.8770 / 0.0025$

$= 350$

A minimum of 350 questionnaires was required to meet the standard using the Cochran formula. An extra 10 percent, that is, 35 was added making 385 participants to make up for

unexpected situations such as loss to follow-up to collect data at the household after mother has been registered and participants who have decided willingly to withdraw from the study. Three hundred and fifty-five (355) questionnaires were returned and analyzed

3.5.2 Sampling Procedure

Any pregnant woman that walks into the eight sampled sub-districts health facilities (health centres, clinics and CHPS compounds) that provide ANC services and met the legibility criteria was registered and recruited into the study after taking her through the consent process and agreeing to participate using the registration forms. The registered women are then followed to their various homes in the communities after two weeks by which time they are expected to have finished taking at least half of the supplements given. The questionnaire is then administered on them and data collected at participants various home.

Eight out of the nine sub-districts were randomly selected using simple random sampling (SRS). The number of participants per sub-district was arrived at based on the population of expected deliveries in that area (this is 15% of projected population of the sub-district)

3.8 Ethical considerations

Approval was sought by the researcher and obtained from Ghana Health Service Ethics Review Committee (ERC) for the study to be conducted (Protocol ID no. GHS-ERC: 063/12/17) in the Garu-Tempane District of the Upper East Region and specifically. Permission was equally sought and granted from the District Director of Health Services in whose facilities, registration of participants was carried out as well as community leaders

from the sampled communities before the data collection. Consent to participate in the study was also obtained from all participants during the registration period before follow-up was made for the data collection interviews. Consenting through signing or thump printing usually precedes the main interviews after risk and benefits of the study had been fully explained to study participant as outlined in the consent form attached to all the questionnaires (see appendix 1). An opened, private and non-interruptive comfortable place is then identified for the interview.

3.6 Data collection techniques and tools

The study employed two data collection tools, these were structured questionnaire and Haemocue 301. The questionnaire was used in collecting quantitative data from respondent whereas the Haemocue machine was used to determine the Hb level of respondents.

Research assistants with a minimum of senior high education and fluent in English and either Kussal or Bimoba were recruited (Almost all other minor ethnic groupings in the district speak Kussal), trained and positioned in the selected health facilities. They recruited all registered pregnant women who passed the legibility criteria and were willing to participate. These pregnant women were then followed up to their homes at the end of the second week after registration for data collection.

Eight research assistants were recruited and oriented on the purpose of the study and given hands-on training on how to collect the data. Four of the research assistants were laboratory technicians who were engaged in measuring the Hb level of participants.

Pre-testing of the questionnaire was carried out at a neighbouring district (Binduri District) as part of the measures put in place to improve the quality of the data collection. This activity was aimed at testing the appropriateness of the data collection tools in gathering the desired data. It was also meant to unearth unforeseen difficulties or challenges such as the flow of questions and ambiguous questions. Data gathered from the pretesting process was excluded from the study results.

At the close of each day of the data collection period, the answered questionnaire was cross-checked by reading through to ensure the questions were completed. Double data entry was done afterwards. The two data sets were compared and inconsistencies resolved by cross-checking with the questionnaire, this helped in minimizing errors. All data was backed up with an external storage device.

3.7 Data processing and analysis

The data collected was inputted into Microsoft Excel sheet and imported into STATA version 15 (StataCorp LP) and analyzed. Participant's socio-demographic characteristics were summarized using descriptive statistics in terms of means with correspondent frequencies and percentages. Categorical variables were summarized into frequencies and proportions and continuous variables were summarized into means. Variables such as age were re-categorized into age groups, Hb grouped into non-anaemic and anaemic, ANC attendance grouped as less than four and greater than or equal to four attendances, gravida was equally grouped into less than four live births and greater than or equal to four live births. Bivariate analysis was done to assess significant differences between compliance and categorical variables.

Analyzed information was presented using tables under the various exploratory variables. Pearson Chi-square ($\chi 2$) test was used to establish any significant statistical associations between the independent variables and the dependent variables at a 95 percent confidence interval (CI). Throughout the analysis, two-tailed test was used and the variables that were statistically significant ($p<0.05$) were included in a multivariate model using the logistic regression. Adjusted odds ratio (AOR) was calculated to determine the strength of association. Results of the study participants were reported using descriptive statistics.

3.9 Study assumptions

The following assumptions have been made in order to achieve the desired outcome for the study:

1. That all communities in the study district are presumed to be homogenous.
2. Respondents fully understood all questions asked and all answers given were honest and truthful.
3. Data collectors systematically administered the questionnaire and the responses provided were not in any way altered.
4. The opinions expressed by the study subjects were fairly representative of the minds of the general population and outcome can be applicable to the general population
5. There were no errors in the data entry.

This chapter cantered on the research methodology used in the study. It looked at the study design, the sample size and sampling techniques used among other areas as found in the chapter. The next chapter presents and describes the key findings from the study.

CHAPTER FOUR

4.0 RESULTS

4.1 Socio-demographic characteristics of respondents

A total of 355 pregnant women residing in the eight randomly selected sub-districts of the Garu-Tempane district who attended ANC were interviewed. The mean age of the respondents was 28.19 years (Standard deviation of 6.79), about half of the respondents (49.9%) were of the age group 20-29 years (table 3). Out of the number interviewed majority (61.1%) of the respondents were of the Kussasi Ethnic extraction. As at the time of administering the questionnaire, most of the pregnant women were married (88.2%) with only 0.9 per cent of them cohabitating with their partners. A little over half of the pregnant women (51.6%) interviewed had no formal education with just five respondents representing 1.4 per cent attaining tertiary education. All respondents alluded to belonging to one religious group or the other. A little over half (52.1%) of the respondents indicated they are Christians with just 1.6 per cent belonging to the traditional religious faith. The rest (46.2%) were Muslims.

Furthermore, farming was the main source of income for the majority of the women. 200 (56.3%) of the respondents engage in farming followed by trading, in which 80 (22.5%) of them were involved in. 55 (15.6%) of the respondents said they were not engaged in any income generating activity. Pregnant women who had at least four (4) deliveries previously constituted about a third (38.6%) of the respondents. Those who have had one delivery were just a fourth (24.6%) of the respondents.

The least household size in the study was two, constituting 2.8 percent of the respondents with a household size of five to six forming the majority (38.3%).

Table 3; Socio-demographic characteristics of study participants

Variable	Frequency	Percentage
Age		
10-19	31	8.73
20-29	177	49.86
30+	147	41.41
Total	355	100
Marital Status		
Single	39	10.99
Married	313	88.17
Cohabitating	3	0.85
Total	355	100
Education		
No formal education	183	51.55
Primary	77	21.69
Middle school/JSS/JHS	69	19.44
SHS/Secondary	21	5.92
Tertiary	5	1.41
Total	355	100
Religion		
Christianity	185	52.11
Islam	164	46.20
Traditional African Religion	6	1.69
Total	355	100
Occupation		
Unemployed	55	15.49
Farmer	200	56.34
Trader/Business	80	22.54
Government employee	14	3.94
Private sector employee	4	1.13
Other (specify)	2	0.56
Total	355	100
Ethnicity		
Kussasi	217	61.13
Bimoba	86	24.23
Bissa	30	8.45
Others	22	6.20
Total	355	100
Trimester of Pregnancy		
First	16	4.51

Second	162	45.63
Third	177	49.86
Total	355	100
Gravida		
1	87	24.51
2	69	19.44
3	62	17.46
4 or more	137	38.59
Total	355	100
Household size		
1-2	10	2.82
3-4	72	20.28
5-6	136	38.31
6-7	63	17.75
8-9	39	10.99
10+	35	9.86
Total	355	100

4.2 Association between socio-demographic characteristics of respondents and Compliance with the intake of iron supplements

A bivariate analysis using Chi-square test was used to determine significant relationship between independent variables and the depended variable, iron supplements (IFA and FS).

As shown in Table 4, variables such as religion, household size and gravida are statistically significant to compliance with the intake of iron supplements (IFA and FS). Pregnant women who are Christians were more likely to comply with the intake of the iron supplements compared to pregnant women who are Muslims or traditional worshipers (p=0.002). Also, household size was found to be associated with compliance with iron supplement intake (p=004). Compliance was found to increase with increasing household size, from 60 percent of the household size of two members to 90 percent of the household size of at least 11 members were found to be compliant. Gravida was equally statistically

significant to compliance with the iron supplements (IFA p=0.05 and FS p=0.016). Pregnant women with at least four previous pregnancy experience (76.6%) were more likely to comply with the intake of iron supplements compared to pregnant women with less previous pregnancy experience.

Women with secondary and tertiary (80%) education were more likely to comply with iron supplement intake relative to pregnant women with JHS/JSS (59.4%) or no formal education (65%), however, this association was found not to be significant

Table 4; Comparison of Socio-demographic characteristics of study participants with compliance towards Iron supplements

Exposure Variable	Compliance of Iron Supplements						
	N=355	Iron Folic Acid			Ferrous Sulphate		
		Compliance (IFA)		P-Value	Compliance (FS)		P-Value
		Non-Compliance	Compliance		Non-Compliance	Compliance	
Age				0.050			0.062
15-19	31	14 (45.160)	17 (54.84)		14 (45.16)	17(54.84)	
20-24	92	32 (34.78)	60 (65.22)		31(33.70)	61(66.30)	
25-29	85	31 (36.47)	54 (63.53)		31(36.47)	54(63.53)	
30-34	74	29 (39.19)	45 (60.81)		31(41.89)	43(58.11)	
35-39	51	11 (21.57)	40 (78.43)		12(23.53)	39(76.47)	
40+	22	3 (13.64)	19 (86.36)		3(13.64)	19(86.36)	
Marital Status				0.05			0.062
Single	39	19(48.72)	20 (51.28)		19(48.72)	20(51.28)	
Married	313	99(31.63)	214(68.37)		101(32.27)	212(67.73)	
Cohabitating	3	2(66.67)	1(33.33)		2(66.67)	1(33.33)	
Ethnicity				0.096			0.107
Kussasi	217	66(30.41)	151(69.59)		67(30.88)	150(69.12)	
Bimoba	86	30(34.88)	56(65.12)		31(36.05)	55(63.95)	
Bissa	30	16(53.33)	14(46.67)		16(53.33)	14(46.67)	
Others	22	8(36.36)	14(63.64)		8(36.36)	14(63.64)	
Religion				0.002			0.002
Christianity	185	48(25.95)	137(74.05)		49(26.49	136(73.51)	

Islam	164	71(43.29)	93(56.71)		72(43.9)	92(56.10)	
Traditional	6	1(16.67)	5(83.33)		1(16.67)	5(83.33)	
Education				0.339			0.251
No Education	183	64(34.97)	119(65.03)		67(36.61)	116(63.39)	
Primary	77	23(29.87)	54(70.13)		22(28.57)	55(71.43)	
Middle SCH/JSS/JHS	69	28(40.58)	41(59.42)		28(40.58)	41(59.42)	
Secondary/ SHS	21	4(19.05)	17(80.95)		4(19.05)	17(80.95)	
Tertiary	5	1(20)	4(80)		1(20)	4(80)	
Household size				0.001			0.004
1-2	10	4(40)	6(60)		4(40)	6(60)	
3-4	72	32(44.44)	40(55.56)		32(44.44)	40(55.56)	
5-6	136	53(38.97)	83(61.03)		53(38.97)	83(61.03)	
7-8	63	22(34.92)	41(65.08)		22(34.92)	41(65.08)	
9-10	39	6(15.38)	33(84.62)		7(17.95)	32(82.05)	
11+	35	3(8.57)	32(91.43)		4(11.43)	31(88.57)	
Occupation				0.148			0.283
Unemployed	55	21(38.18)	34(61.82)		21(38.18)	34(61.82)	
Farmer	200	70(35)	130(65)		72(36)	128(64)	
Trader	80	28(35)	52(65)		27(33.75)	53(66.25)	
Government employee	14	1(7.14)	13(92.86)		2(14.29)	12(85.71)	
Private employee	4	0(0)	4(100)		0(0)	4(100)	
Others	2	0(0)	2(100)		0(0)	2(100)	
Gravida				0.005			0.016
1	87	40(45.98)	47(54.02)		39(44.83)	48(55.17)	
2	69	26(37.68)	43(62.32)		26(37.68)	43(62.32)	
3	62	22(35.48)	40(64.52)		23(37.1)	39(62.90)	
4+	137	32(23.36)	105(76.64)		34(24.82)	103(75.18)	

4.3 Compliance with iron supplement intake

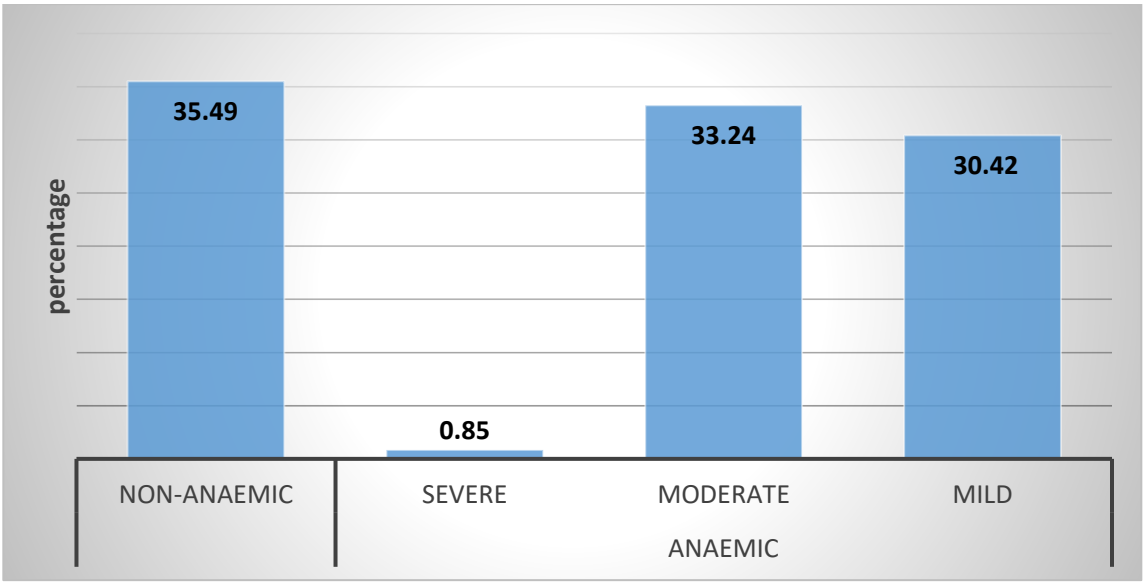
Compliance was measured by taking at least 75 percent of the iron supplement given within the specified period (took at least 75 percent of the expected dose). Two of the iron supplements was identified from the interview with the pregnant women during their ANC visits, these are IFA and FS. With regards to IFA, the overall compliance was 66.2

percent. Compliance with the intake of FS was a bit lower than IFA, 233 (65.6%) was the compliance rate with regards to FS.

4.4 Level of anaemia among respondents

64.5 per cent of the participants were found to be anaemic (Hb<11.0g/dl) with a mean Hb of 10.42g/dl and ranged 10.3g/dl to 10.6g/dl. 30.4 per cent of respondents had mild anaemia (Hb 10.0-10.9g/dl), 33.2 per cent had moderate anaemia (Hb 7g/dl – 9.9 g/dl) whilst less than a per cent of them had severe anaemia (Hb < 7 g/dl). (Fig. 2).

Figure 2; Status of anaemia among respondents



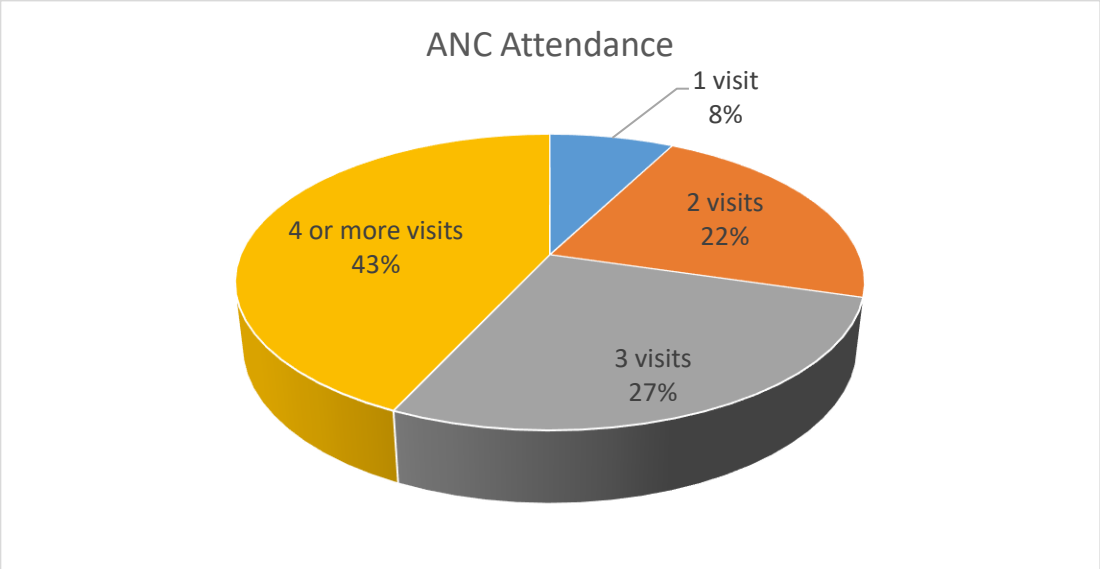
4.5 Factors Associated with Compliance of Iron supplementation

The factors identified to influence the intake of iron supplements particularly IFA include; frequency of ANC visits, counselling by Health staff, side effects, and forgetfulness among others.

4.5.1 Frequency of ANC visits

A total of 153 respondents constituting less than half of the respondents (43.1%) were able to make the WHO recommendation of at least four ANC visits. The rest of the respondents made either one, two or at most three visits (Figure 5).

Figure 3; ANC attendance

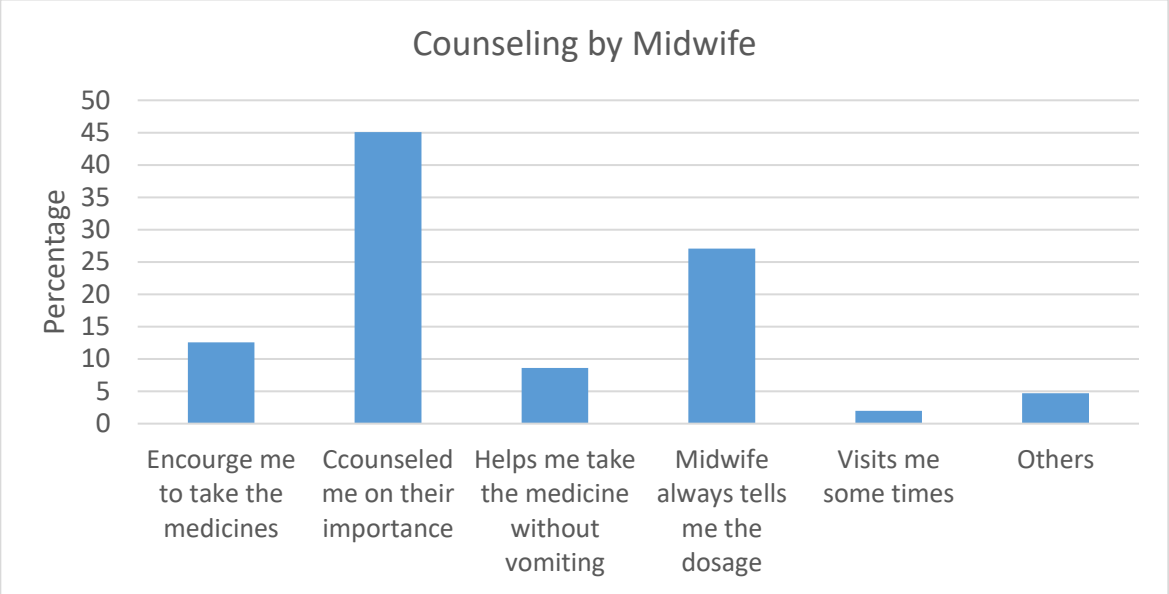


4.5.2 Counselling by Health staff (Midwife)

A total of 255 out of the 355 respondents affirmed they were counselled by a midwife on the intake of iron supplements which helped them to comply with the intake of the iron supplements. Out of the 255 respondents, 115 (41.1%) (fig. 6) respondents said counselling on the importance of the iron supplements by the midwives during ANC visits helped them

to continue with the intake of the supplements. Only five (5) representing 2 percent of the respondents making the least reasons given, said they were visited at home by the midwife that encouraged or motivated them to comply with the intake of the supplements

Figure 4; Reasons given during counselling for the intake of the iron supplements



4.5.3 Side effect

Some of the respondents reported they were not made aware of the possible side effect of the iron supplements. 112 (32%) of the respondents said they were told of the possible side effects of the iron supplements whilst the majority of the 243 (68.5%) of them said no one had told them of the possible side effect of the iron supplements.

Also, 119 (33.5%) of the respondents said the side effect of the supplements has affected their continuous intake of the supplements whilst 236 (66.5%) said the side effect did not affect them regarding the intake of the iron supplements.

When asked whether side effects affect their intake of the supplements, 145 (40.9%) of them said yes, it affects their intake of the supplements while 210 (59.2%) of them said no, it does not have any effect on them taking their supplements.

Nausea was found to be the most reported side effect, a little over half (54.2%) of the respondents who experienced side effect reported Nausea as the notable side effect (table 4)

Table 5; Side effects of IFA and FS experienced by respondents

Side Effect	Frequency	Percentage
A headache	1	0.85
Fever	5	4.24
Nausea	64	54.24
Feeling sleepy	18	15.25
Stomach pains	6	5.08
Darken colour of stool	12	10.17
Others	12	10.17
Total	118	100

4.5.4 Food intake

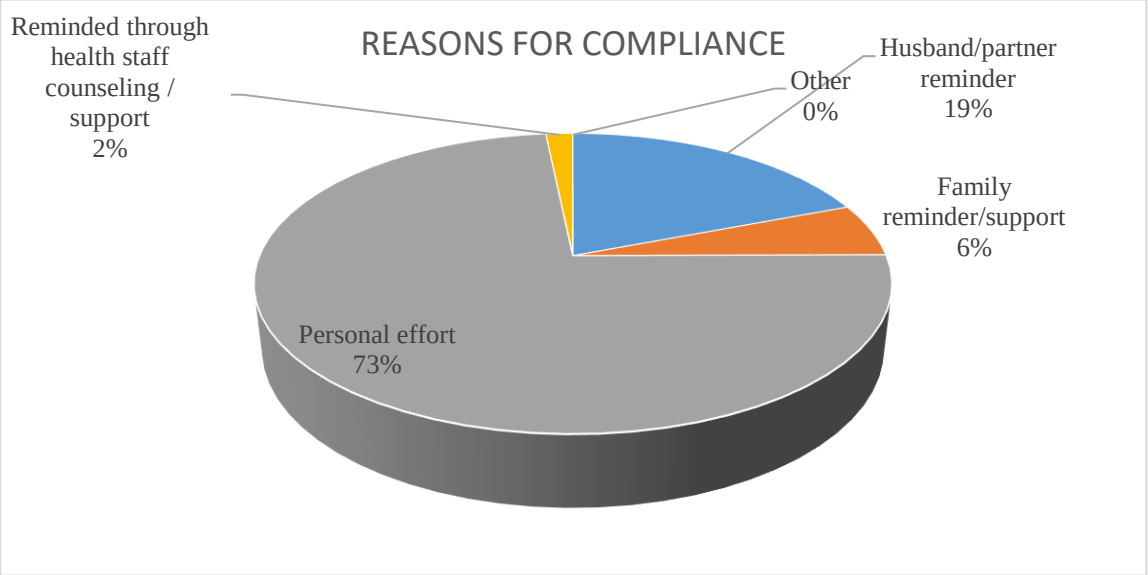
More than three-quarter of the respondents, 299 (84.2%) indicated that inability to get food to eat does not deter them from taking the supplements. On the other hand, 15 (4.2%) of the respondents says lack of food affects their intake of the supplements whilst 41 (11.6%) says an inability to get food to eat before taking the supplements sometimes affects their intake.

4.5.5 Reasons for compliance / non-compliance

The reasons or factors that helped respondents to take the iron supplements or otherwise was grouped into two, the first is the factors that improve compliance with the intake of

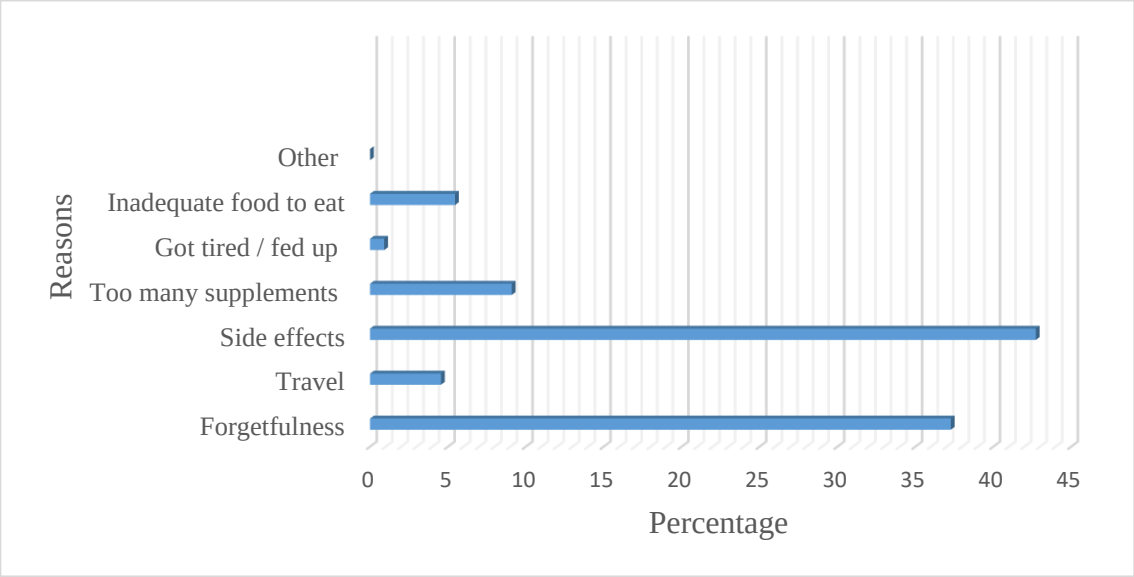
the supplements. Almost three-fourths (73.0%) of the respondents indicated that it was due to their personal effort (fig. 5), this was followed by partner reminder whilst healthcare counselling constituting the least factor (2.0%)

Figure 5; Reasons for compliance



The major reason respondents have given as to why they could not comply with the intake of the iron supplements was the side effect of the supplements (42.7%), this was followed closely by forgetfulness (37.3%). Fed-up or got tired of taking the supplement was the least reason (0.9%) (fig. 6)

Figure 6; Reasons for non-compliance



4.6 Association between Obstetric history and health characteristics of respondents and compliance

All obstetric factors identified were found to be statistically significant to the intake of iron supplements except food intake (Table 6). ANC attendance was found to be significant (p=0.031). Pregnant women who had at least four ANC visits (72.6% for IFA and 71.9% for FS) were more likely to be compliant compared to those who made less than four visits (61.39% for IFA and 60.89% for FS). Also, pregnant women who said they were counselled by either a midwife or health staff during ANC visits on the importance of taking the iron supplements was significant and compliant (p=0.000). The pregnant women who received counselling (74.5% for IFA) were more likely to comply with the intake of the iron supplements compared to those who said they were not counselled (45.0% for IFA). The data pattern was almost the same for FS.

Another important factor was the side effect. This was found to be statistically significant (p=0.000) for both supplements. Most pregnant women who experienced side effect were non-compliant (80.0%) to the intake of the iron supplements as compared to those who said they also experienced side effect and yet compliant to the intake of the iron supplements (20.0%). Therefore, pregnant women who experienced side effect after taking the iron supplements were more likely not to comply with the intake of the iron supplements as compared to those who did not experience a side effect.

Table 6; Association between obstetric history and health characteristics of respondents and compliance

Exposure Variable	Compliance of Iron Supplements						
	N=355	Iron Folic Acid			Ferrous Sulphate		
		Compliance (IFA)		P-Value	Compliance (FS)		P-Value
		Non-compliance	Compliance		Non-compliance	Compliance	
ANC Attendance				**0.028***			**0.031***
< 4 visits	202	78(38.61)	124(61.39)		79(39.11)	123(60.89)	
≤ 4 visits	153	42(27.45)	111(72.55)		43(28.10)	110(71.9)	
Midwife counsel				**0.000***			**0.000***
Yes	255	65(25.49)	190(74.51)		68(26.67)	187(73.33)	
No	100	55(55)	45(45)		54(54)	46(46	
Food intake				0.877			0.891
Yes	339	114(33.63)	225(66.37)		116(34.22)	223(65.78)	
No	2	1(50	1(50)		1(50)	1(50)	
Sometimes	14	5(35.71)	9(64.29)		5(35.71)	9(64.29)	
Side effect				**0.000***			**0.000***
Yes	145	116(80)	29(20)		117(80.69)	28(19.31)	
No	210	4(1.90)	206(98.10)		5(2.38)	209(97.62)	
Anaemia Status				**0.007***			**0.002***
Anaemic	229	89(38.86)	140(61.14)		92(40.17)	137(59.83)	
Non-Anaemic	126	31(24.60)	95(75.40)		40.17	59.83	

Significant at p=0.05

4.7 Compliance and Anaemia

The data has shown that compliance among participants who took IFA was 66.2 per cent while 33.8 per cent were non-compliant. Of the IFA non-compliant cohort, about 4 out of every 10 of them (38.0%) were anaemic. Compliance with the intake of ferrous sulphate was 65.6 per cent. From this percentage, among the participants who took ferrous sulphate, 40.2 per cent of them who are anaemic are non-compliant to the intake of the ferrous sulphate (Table 5).

Table 7; Anaemia status verses compliance to iron supplement compliance

	Iron Folic Acid		Ferrous Sulphate		
	Non-compliance	Compliance	Non-compliance	Compliance	N=355
Anaemia	89(38.86)	140(61.14)	92(40.17)	137(59.83)	229(64.50)
Non Anaemia	31(24.60)	95(75.40)	30(23.81)	96(76.19)	126(35.50)
Total	120(33.80)	235(66.20)	122(34.37)	233(65.63)	355

There was a significant association between anaemia and compliance with intake of supplements (p=0.002) (Table 6). Most pregnant women who complied with the intake of iron supplements were found not to be anaemic. This result implies women who were compliant to the intake of the iron supplements were likely to be non-anaemic (75.4%) compared to those pregnant women who were anaemic (61.1%).

4.8 Correlates of Compliance to IFA tablets

Independent factors from both the socio-demographic and obstetrics characteristics that had a statistically significant association (p-value < 0.05) with compliance to the intake of

iron supplements in the bivariate analysis were included in the multiple logistic regression analysis. The variables included were religion, household size, gravida, ANC attendance, counselling by health staff, side effect and anaemia status. They were all independently associated with compliance with compliance to the intake of iron supplements except ANC attendance and anaemia status.

Table 8: Correlates of Compliance to IFA tablets among respondents

Correlates of Compliance to IFA	COR (95% Ci)	P-value	AOR (95% Ci)	P-Value
Religion				
Muslim	1		1	
Christian	2.179(1.388-3.421)	0.001*	3.881(1.596-9.437)	0.003*
Traditional	3.817(0.436-33.403)	0.226	1.509(0.022-101.736)	0.848
Household size				
≥ 4	1		1	
< 4	0.424(0.262-0.687)	0.000*	0.746(0.292-1.904)	0.540
Gravida				
≥ 4	1		1	
< 4	0.450(0.279-0.727)	0.001*	0.363(0.143-0.921)	0.033*
ANC attendance				
≥ 4	1		1	
< 4	0.602(0.382-0.947)	0.028*	2.014(0.803-5.049)	0.135
Counselled by midwife				
No	1		1	
Yes	3.573(2.201-5.798)	0.000*	5.187(1.888-14.251)	0.001*
Side Effect				
No	1		1	
Yes	0.005(0.002-0.014)	0.000*	0.003(0.001-0.010)	0.000*
Anaemia				
No anaemia	1		1	
Anaemic	0.513(0.316-0.833)	0.007*	1.664(0.620-4.465)	0.312

***-significant at p =0.05**

The odds of a Christian pregnant woman complying with intake of IFA is 3.9 times higher than Muslim pregnant women (AOR=3.88, CI=1.596-9.437, p=0.003) as shown in table 8.

The same pattern follows for the intake of FS (AOR=3.59, CI=1.523-8.451, p=0.003) as shown in table 9. Pregnant women who have had less than four pregnancies in the past compliance to the intake of IFA was reduced by 64 percent as compared to respondents who have had at least four pregnancies (0.36(0.143-0.921) p=0.033), however, the reduction was lower (56%) in the case of FS (AOR=0.44, CI=0.179-1.070, p=0.07).

Counselling of pregnant women by midwife or health staff was also found to be significantly associated with compliance. The odds of a pregnant woman who said she was counselled by a midwife or health staff being compliant to the intake of IFA was 5.2 times compared to those who said they were not counselled by health staff (AOR=5.19, CI=1.888-14.251, p= 0.001). For that of FS, the odds of a pregnant woman being compliant to the intake of FS after being counselled by health staff was 3.4 times compared to those who did not receive counselling by health staff (AOR=3.40, CI=1.350-8.568, p=0.009).

The side effect of the iron supplement was also found to be significantly associated with compliance with the intake of supplements. The odds of a pregnant woman who experienced side effect after taking IFA was reduced by 99.7 per cent compared to those who did not experience side effects of the IFA (AOR 0.003(0.001-0.010) p=0.000). Also, the odds of pregnant women who experienced side effects after taking FS was reduced by 99.6 per cent compared to the women who did not experience side effect (AOR=0.004, CI=0.001-0.013, p=0.000).

Table 9; Correlates of Compliance to FS tablets among respondents

Correlates of Compliance	COR (95% CI)	P-value	AOR (95% CI)	P-value
Religion				
Muslim	1		1	
Christian	2.172(1.386-3.404)	0.001*	3.588(1.523-8.451)	0.003*
Traditional	3.913(0.447-34.240)	0.218	1.226(0.024-61.464)	0.931
Household size				
≥ 4	1		1	
< 4	0.460(0.286-0.740)	0.001*	0.902(0.364-2.237)	0.824
Gravida				
≥ 4	1		1	
< 4	0.488(0.304-0.782)	0.003*	0.437(0.179-1.070)	0.070
ANC attendance				
≥ 4	1		1	
< 4	0.609(0.387-0.956)	0.031*	1.955(0.806-4.745)	0.138
Counselled by midwife				
No	1		1	
Yes	3.228(1.995-5.224)	0.000*	3.401(1.350-8.568)	0.009*
Side Effect				
No	1		1	
Yes	0.006(0.002-0.016)	0.000*	0.004(0.001-0.013)	0.000*
Anaemia				
No anaemia	1		1	
Anaemic	0.465(0.286-.758)	0.002*	1.082(0.436-2.687)	0.866

***-significant at p=0.05**

CHAPTER FIVE

5.0 DISCUSSION

The objective of this study was to determine the level of compliance and factors associated with pregnant women's intake of iron supplement in the Garu-Tempane District. The key findings presented in chapter four are discussed in this chapter.

5.1 Prevalence of anaemia in pregnancy

Anaemia in pregnancy is a serious global public health problem that affects low, middle and high-income countries and has significant adverse health and socio-economic consequences. Anaemia accounts for 12.6 percent of all maternal deaths in Sierra Leone (MoHS, 2016).

This study found the prevalence of anaemia to be 64.5 per cent among the pregnant women. This proportion (that is anaemia greater than 40.0%) should qualify the district in the area of anaemia to be categorized as having a severe public health problem (WHO, 2001). The 64.5 percent prevalence of anaemia was higher to the routine data of the studied district reported on DHIMS 2 (2017) platform of 39.5 per cent but much higher compared to the national rate of 42 per cent (GSS, 2015). This difference between the national figure and the study could be due to the targeted population. Whereas the national reported figure considered all women in reproductive age, this study only considered pregnant women. A similar study carried out around the middle belt of Ghana (Sunyani) found the prevalence of 41.1% (Anlaakuu, 2015).

In another study in Nigeria by Esike *et al.*, (2016), the prevalence of anaemia among pregnant women was lower (56.0%) but much higher in India (72.8%) (Prashant *et al.*,

2017). The variation in the observed prevalence rates across the country, the sub-region and across the continent may be due to different causes of anaemia, types of anaemia interventions, differences in methodology used in determining haemoglobin levels, dietary differences, study design and period of study.

From the findings, it is obvious the various interventions put in place to control anaemia in pregnancy is not yielding the desired results. It could also be that pregnant women in the district consume low iron foodstuff and not adhere to intake of iron supplements.

5.2 Compliance of iron supplements intake among pregnant women

The results of this study support the evidence that the prevalence of anaemia among pregnant women is high across Ghana and has become a major public health problem that needs urgent action. Routine data from the study district as captured in their DHIMS2 platform indicates anaemia prevalence of 60.5 percent in 2015, this called for an evaluation of various interventions put in place to curb this problem including how compliant pregnant mothers have been with reference to the intake of allocated iron supplement given them during ANC services.

Analysis of compliance of intake of the two iron supplements (IFA and FS) among pregnant women attending ANC show almost no variation between the two supplements. Compliance was found to be 66.2 percent and 65.6 percent for IFA and FS respectively. These figures are comparable to similar studies in Ethiopia where compliance to IFA was found to be 64.7 percent (Getachew *et al*., 2018) and 61.7 percent in Indian (Dutta *et al*., 2014). These findings are very similar and could be attributed to similar research strategy (pill count).

There were various reasons given by respondents for their ability to comply with the intake of the iron supplements. The majority (73.0%) of the respondents attributed their compliance to the IFA/FS intake to personal effort, partner reminder (19.0%), other family members' support (6.0%) and health staff reminder (2.0%).

However, there were six reasons given by those who were not able to comply. Side effect was the commonest reason given (49.0%) for non-compliance with the intake of the pills attributes their inability to a side effect. This was followed by forgetfulness, it constituted thirty-seven per cent (37.3%) of the non-complied respondents. Other reasons given were too many pills to take (9. 1%), inadequate food to eat before taking the pills (5.5%), traveling and away from the pills (4.6%) and got tired of taking the pills or being fed-up constituted the least and involve less than a percentage (0.9%) of the non-complied respondents.

Respondents indicated they were motivated by certain factors for taking the supplements. The dominant motivating factor as indicated by the respondents was the perception of an improved unborn child after taking the pills (50.1%). The second main factor was the perception of improved health upon taking the pills (38.3%), also admonishment from midwives to take the tablets (8.7%) was also a motivating factor and the fear of becoming ill if not taking the pills (2.8%) was the least motivating factor.

5.3 Factors Associated with Compliance

Socio-demographic, obstetric and health factors were examined to identify those that are significantly associated with compliance to the intake of the iron supplements. Socio-demographic factors such as religion and household size were significant. However, other

socio-demographic factors such as age, marital status, education and occupation were found not to have any statistical significance with compliance to the intake of iron supplements (IFA and FS). Obstetric and health factors such as gravida, ANC attendance, received counselling by midwife/health staff and side effect status was equally statistically significant to compliance.

Religion was a significant factor to compliance which is consistent with the findings from Nepal by Nirmala Neupane, (2015). The possible reasons could be due to the message of obedience being preached in their places of worship. It may be easy to apply the concept of obedience to Gods' message to other aspects of life (obedience/compliance with IFA and FS).

Household size was another factor that was significantly associated with compliance with IFA. Compliance was noted to have direct proportional relationship with household size, as household size increases, compliance also increases. This could be due to a reminder to take the supplements by other family members when the pregnant woman forgets to take her iron supplements.

Obstetric factor such as gravida was significantly associated with compliance to iron supplements (IFA and FS). Women with at least four previous pregnancy experiences were more compliant to the intake of the IFA and FS as compared to women with less than four previous pregnancies. This was consistent with the findings of Sadore, *et al*., (2015) in southern Ethiopia who found gravida to be significantly associated with compliance with IFA intake. The possible reason for this association could be due to the fact that, for each live birth in the past, the pregnant woman could have received counselling on the importance of the iron supplements and also the fact that, for each pregnancy, the pregnant

woman was given iron supplements to take and will, therefore, become used to taking the supplements thereby increase compliance rate.

ANC attendance of at least four visits was significantly associated with compliance compared to those with less than four visits. This finding was consistent with the findings in Ethiopia where ANC attendance of at least four (4) AOR was 2.83(1.46–5.48) compared to less than four ANC attendance (Getachew *et al*., 2018). This could be due to the fact that those with at least four visits could have been exposed to more sessions of health education and counselling on iron supplements and other related health talks compared to those with less than four visits. Other reasons could be that health staff could help pregnant women during their ANC visits by discussing compliance with iron supplement, admonishing them to take the pills as indicated, and educating them on health benefit of taking the iron supplement.

Other significant health factors such as counselling and side effect were found to be significant. A side effect was one of the factors that affect compliance. Side effects experienced by respondents were statistically significant and have independent negative predictor of IFA / FS compliance. This was equally observed in Ismailia, Egypt conducted by Ibrahim *et al*., (2011). Seck and Jackson, (2017) in their study in Senegal identified gastrointestinal side effect as the single most important factor that affects compliance to IFA negatively. People usually will not want to be discomforted by anything hence if taking the iron supplements will lead to the experience of side effects which bring discomfort to them, then they are better off staying away from taking the supplements which leads to non-compliance. Perhaps weekly intake of the iron supplements can improve intake and appropriate counselling could help.

Counselling on the importance of the intake of the IFA/FS by a midwife or health staff on duty during ANC sessions was also found to be significantly associated with compliance. Pregnant women who said they received counselling during ANC sessions were found to largely comply to the intake of the iron supplements compared to those who did not receive any form of counselling on the importance of the iron supplements. This finding was consistent with the work done by Sadore *et a*l., (2015) in Ethiopia. Appropriate counselling could help prepare the psychology of the pregnant woman and also reduce her fears of the possible side effects they may experience. Perhaps, this could account for the association between counselling and compliance.

This study did not find any significant relationship between compliance with iron supplements and key socio-demographic factors such as educational status, marital status as well as ethnicity. This is in shape contrast to the findings of Ugwu *et al*., (2014) in Enugu Nigeria and Nirmala Neupane, (2015) in Nepal in which these factors were found to be associated with compliance. Possible reasons for this significant difference could be due to the fact that the environment and cultures differ. Also, methodologies may also differ. Whereas some have to buy the supplements and take, in this study, the iron supplements were given for free.

5.4 Anaemia status and compliance

In this study, anaemia was found to have an association with compliance to the intake of the iron supplements. Pregnant women who were found to be anaemic had reduced effect on compliance compared to non-anaemic pregnant women. This was collaborated by the work of Mithra *et al*., (2014) in Southern India who found that the odds of non-anaemic

pregnant women complying with taking of IFA were 1.8 times compared to pregnant women who were anaemic. However, in another study in India by Dutta *et al.*, (2014), they found no statistical significance between anaemia status and compliance to the intake of IFA.

One can possibly conclude that due to pregnant women inability to adhere to or comply with the intake of the iron supplements contributed significantly to their anaemic status. This is because for each skip of taking the iron supplement, one may be inching towards anaemia particularly when the diet of that pregnant woman is not sufficient in iron or the diet may contain some inhibitors such as phytates that limits the absorption of iron. This conclusion is collaborated by the fact that pregnant women who were compliant had lesser number of them being anaemic compared to non-compliant pregnant women.

5.5 Study strength and Limitation

There are some strengths and limitations of this study. One of the major strengths is the ability of the study to collect data at the end of the two weeks after registration and physically counting the pills to determine compliance. This helps reduce recall biases. Also, information about ANC attendance is gotten directly from the ANC booklet.

There were a few identified limitations of this study. First, the researcher's inability to do a stool test to confirm the intake of iron supplements, which can confirm the actual intake of the pills and also give a better measure of compliance. Secondly, the study was limited to pregnant women who attended ANC services. This may not be representative of all pregnant women in the study district as some pregnant women may decide not to attend

ANC but acquire their own iron supplements. Thirdly, the study did not take into account, the previous intake of the iron supplements.

CHAPTER SIX

6.0 CONCLUSION AND RECOMMENDATIONS

6.1 Conclusion

This study involves pregnant women aged 15-45 years. The results show that anaemia prevalence rate of 64.5 per cent among them. Compliance with intake of iron supplements was moderately high (66.2% for IFA and 65.5% for FS); suggesting that there is still room for improvement (recommended acceptable limits of anaemia is a prevalence of less than 5 percent (WHO 2011)). Predictors with compliance were; religion, household size, gravida, ANC attendance, Counselling, and side effect and anaemia status.

Pregnant women who are Christians, a household size of at least four, women with at least previous four live births, pregnant women with at least four ANC attendance, those who were counselled by midwives on the importance of iron supplements, and pregnant women who did not experience side effects were found to be compliant. Women who were found to be anaemic were largely those who were less likely to comply with the intake of the iron supplements.

Personal effort and partner/family support were the key factors attributed to a pregnant woman ability to adhere to the intake of the supplements. Side effects such as nausea, feeling sleepy were the other factors that worked against compliance. Overall, anaemia status was found to be associated with compliance.

6.2 Recommendations

Based on the findings of the study, the following recommendations are made

1. On the prevalence of anaemia

   The Nutrition Unit of the District Health Directorate should intensify education on the consumption of iron-rich food. Food demonstrations using iron-rich locally available foodstuff should be carried out on a routine basis across the district. Malaria and worm control activities such as the free distribution of Long-Lasting Insecticide Treated Nets (LLIN), free distribution of Sulphadoxine Pyramethine (SP) and free deworming should be intensified to help reduce the prevalence of anaemia

2. Compliance and its associated factors

   The district should ensure that counselling on the importance of iron supplements intake is intensified. Every pregnant woman should benefit from this counselling. Also, public awareness should be created on the importance of ANC attendance using public fora and the mass media. Incentives such as certificates can be given to women who attend at least 90 percent of her ANC sessions.

   Notable side effects of IFA and FS should be explained to ANC women. They should be encouraged to see a physician each time they encounter a side effect for counselling. The general public should be educated on the need to accompany family members who become pregnant for ANC services so that they can be counselled to remind the pregnant woman to take the iron supplement each time they forget.

Effects of anaemia should be explained to all pregnant women attending ANC thereby helping to increase compliance and ultimately decrease anaemia prevalence.

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APPENDICES

APPENDIX 1: CONSENT FORM FOR PREGNANT WOMEN AGE 15-49 YEARS IN STRUCTURED INTERVIEW

DEPARTMENT OF POPULATION, FAMILY AND REPRODUCTIVE HEALTH

SCHOOL OF PUBLIC HEALTH, LEGON GHANA

CONSENT FORM FOR PREGNANT WOMEN AGE 15-49 YEARS IN STRUCTURED INTERVIEW

Title: Compliance of iron supplements intake among pregnant women in the Garu-Tempane District of the Upper East Region

Researcher: Cosmos Atawoje Minyila

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PART I: INFORMATION SHEET

Introduction

I am Cosmos A. Minyila, pursuing a Master's degree in the School of Public Health, University of Ghana, Legon. I am researching on compliance of iron supplement intake by pregnant women. I am gladly inviting you to be part of this study. You do not have to decide today whether or not you will participate in the research. Before you decide, you

are obliged to seek clarification from me or any other person you feel comfortable with about the study. This consent form may contain words that you do not understand. Please ask me to stop as we go through the information and I will take time to explain. If you have questions later, you can ask.

Purpose and Nature of the Study

This study will involve your participation in responding to some questions about the intake of some tablets given you during your antenatal care (ANC) visits between you and me that will take a maximum of one hour of your time. You are being invited to take part in this study because I feel that your experience as a pregnant mother can contribute much to my understanding and knowledge of ANC practices among pregnant women in your community. Many women in your community are not able to start antenatal care early and also, what influences the intake or otherwise of the medicines given you by the midwife just because of your condition as a pregnant woman. The information you will give will help us to learn what to do so that women in this community and other communities who become pregnant can start antenatal care early and befit fully from the services.

Potential Risks and Discomforts

I am asking you to share with me some very personal and confidential information, and you may feel uncomfortable talking about some of the topics. You do not have to answer any question or take part in the research if you don't wish to do so. You do not have to give me any reason for not responding to any question, or for refusing to take part in the research

Secondly, you will be pricked on your finger and a sample of your blood taken to test for your blood level and discarded in your presence. The results of your blood level will be disclosed to you before you leave.

Possible Benefits

There will be no direct benefit to you except the disclosure of your Hb status, but your participation is will go a long way to help us find out more about how to promote early start of antenatal care and find potential solutions to the barriers on the intake of ANC medicines given to pregnant women in your community.

Additional Costs and Compensation

You will not be compensated for participating in the study. If you agree to participate in the study, I will visit you at home or any place that you think is comfortable for you. I will only ask you to spare some of your time to answer the questions I will ask.

Confidentiality

If you participate in the study, other community members who see us together may ask you questions about the study. I will not share information about you to anyone outside who is not part of the study team. The information that I will collect from this study will be used for academic purposes. A number instead of your name will be used for any information

about you. Only I will know what your number is and I will lock that information up with a lock and key. It will not be shared with or given to anyone.

Sharing the Results

Nothing that you tell me will be shared with anybody outside the study team, and nothing will be attributed to you by name. The knowledge that I will get from this study will be shared with the

District Director of Health so that they will see what to do to improve maternal health services in your community. I may publish the results so that other interested people may learn from the study.

Voluntary Participation and Right to Withdraw from the Study

You do not have to take part in this study if you do not wish to do so, and choosing to participate will not affect you in any way. You may withdraw from the study at any time that you wish. I will give you an opportunity at the end of the interview to review your responses, and you can ask to change any responses that you want. You do not have to give me any reason for withdrawing.

Contacts for Additional Information

If you have any questions or clarification to make, you can ask them now or later. If you wish to ask questions later, you may contact any of the following: Cosmos A. Minyila,

School of Public Health, Legon on the following numbers 0204847193 / 0242688510, or email cosfan2006@yahoo.com or Dr Agnes Millicent Kotoh, School of Public Health, Legon on 0208088267, or email nyamikye@yahoo.co.uk and Hannah Frimpong, GHS-ERC administrator on 0302681109.

PART II: CERTIFICATE OF CONSENT

I have been invited to participate in a study about compliance of iron supplement intake by pregnant women. The document describing the benefits, risks and nature and purpose of the study has been read and explained to me. I have been given an opportunity to ask questions or seek clarifications about the study; I am satisfaction with the explanation. I therefore, agree voluntarily to participate in this study.

_____ _____ _____

Full name of participant Signature or Thumb print Date

Declaration by witness (if participant cannot read the form herself)

I was present while the benefits, risks and nature and purpose of the study were read to the participant. All questions were answered and the participant has agreed voluntarily to take part in the study

_____ _____

_____

Full name of witness Signature of witness or Thumb print Date

I certify that the nature and purpose, the potential benefits, and possible risks associated with participating in this study have been explained to the above individual to the best of my ability. I confirm that the participant was given an opportunity to ask questions about the study, and all the questions asked by the participant have been answered correctly and to the best of my ability. I confirm that the consent has been given freely and voluntarily

_____ _____

_____

Name of researcher Signature Date

APPENDIX 2: STRUCTURED QUESTIONNAIRE FOR PREGNANT WOMEN AGED 15-49 YEARS

DEPARTMEN OF POPULATION, FAMILY AND REPRODUCTIVE HEALTH, SCHOOL OF PUBLIC HEALTH, LEGON GHANA

QUESTIONNAIRE ON FACTORS INFLUENCING COMPLIANCE WITH IRON SUPPLEMENTS INTAKE AMONG PREGNANT WOMEN IN THE GARU-TEMPANE DISTRICT

Questionnaire No: …… Name of community……

Address ……. Date ……/……/20…….

NO	QUESTION	CODE
	SOCIO-DEMOGRAPHIC DATA	
1	What is your age? (***Completed years)***…… **(confirm from any valid ID)**	q1age
2	Are you registered with the national health insurance scheme? (***Tick inside the bracket)***	q2nhis
	Yes [ ]	1
	No [ ]	2
3	**Health insurance status** (***Tick inside the bracket)***	q3nhisv
	Valid [ ]	1
	Invalid [ ]	2
	Never enrolled [ ]	3
4	**Marital status** (***Tick inside the bracket)***	q4mstatus
	Single [ ]	1
	Married [ ]	2
	Cohabiting/living with partner [ ]	3
5	**Ethnicity** (***Tick inside the bracket)***	q5ethnic
	Kusassi [ ]	1
	Bimoba [ ]	2
	Bissa [ ]	3
	Other ***(Please specify)*** [ ]	4
6	**Religion**? (***Tick inside the bracket)***	q6religion
	Christian [ ]	1
	Muslim [ ]	2
	Traditionalist [ ]	3

	Other ***(Please specify)*** [ ]	4
7	**Occupation?** (your main source of income) (***Tick inside the bracket)***	q7oc
	Unemployed [ ]	1
	Farmer [ ]	2
	Trader/Business [ ]	3
	Government employee [ ]	4
	Private sector employee [ ]	5
	Other (specify)……	6
8	**Level of formal education** (***Tick inside the bracket)***	q8elevel
	No formal education [ ]	1
	Primary [ ]	2
	Middle school/JSS/JHS [ ]	3
	SHS/Secondary [ ]	4
	Tertiary [ ]	5
9	Age of current pregnancy (in weeks) ( )	q9gest
	(**Confirm from ANC card**)	
10	How many times have you been pregnant ( )	q10gravid
11	How many deliveries have you had in the past? ( )	q11para
	NA [ ] **skip to question 13**	
12	What is the age (in completed months) difference between your last born and this current pregnancy (***Tick inside the bracket)***	q12childd
	1 [ ]	1
	2 [ ]	2
	3 [ ]	3
	4 or more [ ]	4
13	What is your monthly income? ***(in Ghc)*** (***Tick inside the bracket)***	q13income
	50-100 [ ]	1
	100-300 [ ]	2
	300- 500 [ ]	3
	500-1000 [ ]	4
	above 1000 [ ]	5
	not applicable [ ]	99
	Household Information	
14	How many people live in this household?	q14hhs
	1-2 [ ]	1
	3-4 [ ]	2
	5-6 [ ]	3
	7-8 [ ]	4
	8-10 [ ]	5
	11 or more [ ]	6
15	Who is the head of this household? (***Tick inside the bracket)***	q15hh
	Myself [ ]	1
	My husband [ ]	2
	Father-in-law [ ]	3
	Mother-in-law [ ]	4
	Other ***(Please specify)***……..	5
16	What is the occupation (main source of income) of the household head? (***Tick inside the bracket)***	q16hhhoc
	Farmer [ ]	1
		2

	Trader/Business [ ] Government employee [ ] Private sector employee [ ] unemployed [ ] Other (specify)…….....	3 4 5 6
17	What is the level of education of the household head? (***Tick inside the bracket)*** No formal education [ ] Primary [ ] Middle school/JSS/JH [ ] Secondary [ ] Tertiary and above [ ]	q17hhedu 1 2 3 4 5
18	What is the monthly income of the household head? ***(in Ghc)*** (***circle only one)*** 50 or less [ ] 50-100 [ ] 100-300 [ ] 300- 500 [ ] 500-1000 [ ] above 1000 [ ] Not applicable [ ]	q18hhicome 1 2 3 4 5 6 99
	HEALTH SEEKING BEHAVIOURS	
19	Do you attend ANC with your current pregnancy? (***circle only one)*** Yes [ ] No [ ]	q19attanc 1 2
20	Where is your main source of ANC for this pregnancy (***multiple answers allowed***) Hospital [ ] Health Centre [ ] Clinic [ ] CHPS [ ] TBA [ ] Other (*specify*)…….. [ ]	q20whreanc 1 2 3 4 5 6
21	How many times did you attend ANC for this pregnancy (***circle only one)*** 1 [ ] 2 [ ] 3 [ ] 4 or more [ ]	q21ancvisits 1 2 3 4
22	Why do you attend ANC? (***multiple answers allowed***) To receiving counseling [ ] To check the health of my unborn child [ ] To receiving immunization [ ] Because the nurses asked us to [ ] To check my health [ ] Other (*specify*)……..	q22whyanc 1 2 3 4 5 6
23	In your view, at what age of pregnancy should one initiate ANC? (***circle only one)*** 1 month [ ] 2 months [ ]	q23timeanc 1 2 3 4

	3 months [ ] 4 months [ ] 5 months [ ] 6 months [ ] 7 months and above [ ]	5 6 7
24a	What iron supplements are you given? (***multiple answers allowed***) Folic acid [ ] Ferrous sulphate [ ] Multivitamin [ ] Iron 3 [ ]	q24asupstak 1 2 3 4
24b	Do you take the iron supplements given you? (***circle only one)*** Yes [ ] No [ ]	q24btakeis 1 2
	Ask 25, 26, 27 and / or 28 depending on which supplement(s) has been given	
25	**Iron Folic Acid** ***(fill all spaces)*** Quantity given/taken ……..( ) Balance at hand …….....( ) # of days (between day of interview and date last given supplement)…….( ) Quantity utilized (A)……( ) Quantity expected to utilize (B)……..…….( ) Quantity miss out (B-A)…….……( )	q25takeifa
25a	Percentage of compliance of IFA [ ] %	q25aifac
26	**Ferrous Sulphate** ***(fill all spaces)*** Quantity given/taken ……..……..( ) Balance at hand …….....( ) # of days (between day of interview and date last given supplement)……...…( ) Quantity utilized (A)……( ) Quantity expected to utilize (B)……..……( ) Quantity miss out (B-A)…….……( )	q26takefs
26a	Percentage of compliance of Ferrous Sulphate [ ] %	q26afsc
27	**Multivitamin** ***(fill all spaces)*** Quantity given/taken…….……..( ) Balance at hand …….....( ) # of days (between day of interview and date last given supplement)…….……( ) Quantity utilized (A)……( ) Quantity expected to utilize (B)……..……..……( ) Quantity miss out (B-A)…….……( )	q27takemv
27a	Percentage of compliance of Multivitamin [ ] %	q27amvc
28	**Iron 3** ***(fill all spaces)*** Quantity given/taken ……..……..( ) Balance at hand …….....( ) # of days (between day of interview and date last given supplement)……..( ) Quantity utilized (A)…….……( )	q28takei3

	Quantity expected to utilize (B)……..…….( ) Quantity miss out (B-A)…….…….( )	
28a	Percentage of compliance of iron 3 [ ] %	q28ai3c
29	Have you been given Sulphurdoxine Pyramethine (SP) during your ANC visits ***(show sample)***? (***circle only one)*** Yes [ ] No [ ] **if no skip to question 31**	q29takesp 1 2
30	If yes, do you take your drugs as required (***circle only one)*** Yes [ ] No [ ] Sometimes [ ]	q30comsp 1 2 3
31	Do you sleep under insecticide treated Net? (***circle only one)*** Yes [ ] No [ ] Sometimes [ ]	q31llin 1 2 3
32	Have you had malaria recently (within last two months)? (***circle only one)*** Yes [ ] No [ ] **if no skip to question 34**	q32malaria 1 2
33	If yes, when (circle only one) A week ago [ ] Two weeks ago [ ] A month or 2 ago [ ]	q33whenmal 1 2 3
34	How often were you de-worming before pregnancy? (circle only one) Every 3 months [ ] every 6 months [ ] Not at all [ ]	q34deworm 1 2 3
	FACTORS AFFECTING INTAKE OF IRON SUPPLEMENTS	
35	Do you have dislike for taking pills generally (***circle only one)*** Yes [ ] No [ ]	q35dislikepill 1 2
36	Do you take the iron supplements as expected? (***circle only one)*** Yes [ ] No [ ] **if no skip to question 38**	q36isexpect 1 2
37	If yes, how are you able to do that? (***circle only one)*** Husband/partner reminds me [ ] Family reminder/support [ ] Personal effort [ ] Reminded through health staff counseling / support [ ] Other (Specify) [ ]	q37ishelp 1 2 3 4 5
38	If no, what accounts for that? (***circle only one)*** Forgetfulness [ ] Travel [ ] Side effects [ ] Too many supplements / duration of supplements to take [ ] Got tired / fed up [ ] Inadequate food to eat [ ] Other ***(specify)*** [ ]	q38isnot 1 2 3 4 5 6 7

39	What motivates you to take the iron supplement tablets? (***circle only one)*** The perception of improved health upon taking the tablets [ ] The perception of improved unborn child after taking the tablets [ ] The admonishment from midwives to take the tablets [ ] The fear of becoming ill [ ] Other (specify)…….	q39ismotivat 1 2 3 4 5
40	Have you been told the reasons for which you are to take the supplements? (***circle only one)*** Yes [ ] No [ ] **if no skip to question 42**	q40isexplain 1 2
41	If yes, what is/are the reason(s)? .... …… …….	q41isreason
42	Is the midwife / health staff of help to you in taking your supplements? (***circle only one)*** Yes [ ] No [ ] **if no skip to question 44**	q42mwhelp 1 2
43	If yes, nature of help .... …… ……	q43mwnature
44	If no, explain .... …… ……	q44mwnot
45	Do you experience any side effects? (***circle only one)*** Yes [ ] No [ ] **if no skip to question 48**	q45seffect 1 2
46	If yes, does the side effect discourage you from taking the supplements? (***circle only one)*** Yes [ ] No [ ]	q46sedisc 1 2
47	What is the nature of the side effect Headaches [ ] Fever [ ] Nausea [ ] Feeling sleepy [ ] Stomach pain [ ] Darken colour of stool [ ] Other (*specify*) [ ]	q47senature 1 2 3 4 5 6 7
48	Were you informed by health staff of possible side effects of the supplements? (***circle only one)*** Yes [ ] No [ ]	q48inforse 1 2
49	Does side effect(s) affect your intake of the supplements	q49seonis

	Yes [ ] No [ ]	1 2
	FOOD AND NUTRITION	
50	Do you usually get food to eat before taking your iron supplements? Yes [ ] **if yes skip to question 52** No [ ] Sometimes [ ] **if sometimes skip to question 52**	q50food 1 2 3
51	If no, do you still go ahead to take the iron supplements? Yes [ ] No [ ] Sometimes [ ]	q51nofood 1 2 3
52	Do you avoid taking any food as a result of the pregnancy? Yes [ ] No [ ] **if no skip to question 54**	q52afood 1 2
53	If yes, what food do you avoid? Meat [ ] Fish [ ] Eggs [ ] Milk [ ] Fruits [ ] Others (specify) …….	q53fooda 1 2 3 4 5 6
54	Do you practice any form of pica? Yes [ ] No [ ] **if no skip to question 56**	q54pica 1 2
55	If yes, what do you eat? Clay [ ] Chalk [ ] Cola nuts [ ] Uncooked maize dough/starch [ ] Chewing stick/wooden sponge [ ] Others (*specify*) ……..	q55whatpica 1 2 3 4 5 6
56	Do you take tea and coffee? Yes [ ] No [ ]	q56tea 1 2
57	If yes, how often do you take it? Twice a day [ ] Once a day [ ] Weekly [ ] Monthly [ ] Sometimes [ ]	q57teafreq 1 2 3 4 5

Thank you for your time

HB STATUS

HB level [---- ---- . ---] g/dl

Appendix 3; REGISTRATION FORM FOR PREGNANT MOTHERS

REGISTRATION FORM FOR PREGNANT MOTHERS									
NAME E OF FACILITY:									
S/N	Mothers' name	Address (full name of family head)	Community	Indicate only supplements issued				Date given	Date of interview
				Q'ty of folic acid	Q'ty of ferrous sulphate	Q'ty of multivitamin	Q'ty of iron 3		

APPENDIX 4: ETHICAL CLEARANCE

GHANA HEALTH SERVICE ETHICS REVIEW COMMITTEE

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

Research & Development Division
Ghana Health Service
P. O. Box MB 190
Accra
Tel: +233-302-681109
Fax + 233-302-685424
Email: ghserc@gmail.com

MyRef. GHS/RDD/ERC/Admin/App 18/003
Your Ref. No.

23rd March, 2018

Cosmos Atawoje Minyila
University of Ghana
School of Public Health
Legon, Accra

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

GHS-ERC Number	**GHS-ERC: 063/12/17**
Project Title	Compliance of Iron Supplements Intake among Pregnant Women in the Garu-Tempane District of the Upper East Region
Approval Date	23rd March, 2018
Expiry Date	22nd March, 2019
GHS-ERC Decision	**Approved**

This approval requires the following from the Principal Investigator

- Submission of yearly progress report of the study to the Ethics Review Committee (ERC)
- Renewal of ethical approval if the study lasts for more than 12 months,
- Reporting of all serious adverse events related to this study to the ERC within three days verbally and seven days in writing.
- Submission of a final report **after completion** of the study
- Informing ERC if study cannot be implemented or is discontinued and reasons why
- Informing the ERC and your sponsor (where applicable) before any publication of the research findings.

Please note that any modification of the study without ERC approval of the amendment is invalid.

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

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

SIGNED.....
DR. CYNTHIA BANNERMAN
(GHS-ERC CHAIRPERSON)

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