PREVALENCE AND FACTORS ASSOCIATED WITH ANAEMIA AMONG PREGNANT WOMEN ATTENDING ANTENATAL CLINIC IN THE SECOND AND THIRD TRIMESTERS AT PUMWANI MATERNITY HOSPITAL, NAIROBI

OKUBATSION TEKESTE
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DECLARATION

I, Okubatsion Tekeste Okube declare that this dissertation is my own original work and has not been presented for a degree award at any other University.

Signed: …….Date:…….....

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SUPERVISOR'S APPROVAL

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DEDICATION

I dedicate this work to my loving wife Selam Feshatsion Gebremedhin and my parents for their love, support and encouragement. Thank you Selam for keeping up with an absent husband.

May the almighty God bless both of you!

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LIST OF ABBREVIATIONS

ANC	Antenatal clinic
IFA	Iron and Folic acid
APGAR	**A**ppearance, **P**ulse, **G**rimace, **A**ctivity, **R**espiration
CDC	Centre for Disease Control and Prevention
CLSI	Clinical Laboratory Standards Institute
GOK	Government of Kenya
Hb	Haemoglobin
HIV	Human Immunodeficiency Virus
IDA	Iron Deficiency Anaemia
INACG	International Anaemia Consultative Group
KNBS	Kenya National Bureau of Statistics
KNH	Kenyatta National Hospital
LBW	Low Birth Weight
MCH	Maternal and Child Health
MMR	Maternal mortality rate
MoH	Ministry of Health
MOPHS	Ministry of Public Health and Sanitation
MUAC	Mid Upper Arm Circumference
SPSS	Statistical Package for Social Sciences
UNICEF	United Nations Children's Fund
USAID	United States Agency for International Development
WHO	World Health Organization

OPERATIONAL DEFINITION OF TERMS

Anaemia: A condition in which when the haemoglobin (Hb) level in the body is less than 11 gram per decilitre, which decreases oxygen-carrying capacity of red blood cells to tissues.

Antenatal clinic (ANC): Maternal and Child Health clinic which provides care for expectant parents; the mother's and baby's health is monitored, maintained and optimized to ensure a healthy pregnancy, safe delivery and post delivery period. Moreover the clinic provides nutritional supplements (iron/folate) and dietary information throughout the pregnancy.

Appearance, Pulse, Grimace, Activity, Respiration (APGAR) score: A numerical expression of an infant's condition, usually determined at 60 seconds after birth, based on heart rate, respiratory effort, muscle tone, reflex irritability and color.

Febrile illness: A nonspecific term for an illness of sudden onset accompanied by fever

Folic acid: water soluble B vitamin (B_9) found mostly in leafy green vegetables like kale and spinach, orange juice, and enriched grains. Folic acid plays an important role in the production of red blood cells and helps fetal neural tube develop in the brain and spinal cord.

Gravidity: the number of times that a woman has been pregnant.

Haemoglobin (Hb): Iron-containing oxygen-transport metallo-protein in the red blood cells which is composed of globin and heme that gives red blood cells their characteristic colour.

Iron: A micronutrient needed for the transport of oxygen in blood to various parts of the body.

Iron deficiency: A state of insufficient iron to maintain normal physiological functions of body tissues.

Iron deficiency anaemia: An advanced stage of iron depletion defined as iron deficiency and low haemoglobin resulting in the condition of anaemia.

Maternal death: The death of a woman while pregnant or within 42 days of termination of pregnancy, irrespective of the duration and site of the pregnancy, from any cause related to or aggravated by the pregnancy or its management but not from accidental or incidental causes.

Multigravida: A pregnant woman with one or more previous pregnancies.

Parity: the number of times that a woman has given birth to a fetus at a gestational age of 24 weeks or more, regardless of whether the child was born alive or was stillborn.

Pregnancy: The state of carrying a developing embryo or fetus within the female body for a period of 280 days or 40 weeks.

Primagravidae: A woman who is pregnant for the first time.

Supplementation: Provision of specified dose of nutrient preparation which may be in the form of tablet, capsule, oil solution or modified food for either treating an identified deficiency or prevention of the occurrence of such a deficiency in an individual.

First Trimester of pregnancy: (0 to 13 Weeks of gestational age)

Second Trimester of pregnancy: (14 to 26 Weeks of gestational age)

Third Trimester of pregnancy: (27 to 40 Weeks of gestational age)

ABSTRACT

Background: It is estimated that 41.8% of pregnant women worldwide are anaemic. In Africa 57.1% of pregnant women are anaemic. In Kenya the prevalence of anaemia among pregnant women was 55.1% which is a severe public health problem based on the World Health Organization classification of anaemia. Anaemia is a major cause of morbidity and mortality of pregnant women and increases the risks of foetal, neonatal and overall infant morbidity and mortality.

Objectives: The broad objective was to assess the prevalence and determinants of anaemia among pregnant women in the second and third trimesters of pregnancy attending antenatal clinic at Pumwani Maternity Hospital, Nairobi.

Methodology: A cross-sectional study was conducted from 8th June to 18th August, 2015, on 258 pregnant women who attended antenatal clinic at Pumwani Maternity Hospital in Nairobi. Systematic sampling method was used to select the study participants. The data was collected using pre-tested semi-structured questionnaire through interviews and an assessment of anthropometric and haemoglobin measurements. Descriptive analysis using means, frequency and proportions was computed. Chi-square test ($p<0.05$) and odds ratio with corresponding 95% confidence interval was used to determine the association between independent and dependent variables. Multivariable logistic regression analysis was performed to determine the independent factors associated with anaemia in these pregnant women.

Results: The findings of the study revealed that the prevalence of anaemia among the pregnant women was 57%. Of these, 2.7% were severely anaemic, 70.7% were moderately anaemic and 26.5% were mildly anaemic. Multivariable logistic regression analysis revealed that advanced maternal age (31yrs and above) [AOR=2.71; P=0.012], government or private employed [AOR=2.94; P=0.002] and self-employed [AOR=1.91; P=0.039], not taking iron and folic acid supplementation during the current pregnancy [AOR=2.04; P=0.016] and having mid upper arm circumference of less than 23cm [AOR=2.52; P=0.003] were factors independently associated with anaemia.

Conclusion: The prevalence of anaemia among pregnant women at Pumwani Maternity Hospital was 57% which is a severe public health problem. The study revealed that anaemia during pregnancy is caused by many factors, including late pregnancy, lack of formal employment and

economic autonomy, poor nutritional status and not taking iron and folic acid supplementation during pregnancy. All these factors lead to poor health condition during pregnancy thus by the time such mothers attend for ante natal clinic, they are already in anaemic state.

Recommendations: Reproductive advice and education should be given to all reproductive age women to create awareness about the risk of developing anaemia with late pregnancy. Employed pregnant women should be given enough maternity leave before and after delivery from their employers. There is a need for interventions such as mass media campaigns, outreach education, life skill programmes to educate women on the importance of early ante natal clinic booking and compliance with the use of prescribed medications, consumption of more diversified extra meal and iron-rich foods during pregnancy than usual.

CHAPTER ONE: INTRODUCTION

1.1 Background Information

Anaemia describes a situation in which there is a reduction of haemoglobin concentration in the blood of pregnant women to a level below 11g/dl. Anaemia is one of the most common nutritional deficiency diseases observed globally and affects more than a quarter of the world's population (WHO/CDC, 2008). Globally, anaemia affects 1.62 billion people (25%), among which 56 million are pregnant women (Balarajan, 2011; WHO/CDC, 2008). It is estimated that 41.8% of pregnant women worldwide are anaemic. At least half of this anaemia burden is assumed to be due to iron deficiency. Iron deficiency anaemia (IDA) is the most common nutritional disorder in the world affecting 2 billion people worldwide with pregnant women particularly at risk (WHO guideline, 2012). In developing countries, the prevalence of anaemia during pregnancy is 60.0% and about 7.0% of the women are severely anaemic (Agan et al., 2010). In Africa 57.1% of pregnant women are anaemic (de Benoist et al., 2008). Sub-Saharan Africa is the most affected region, with prevalence of anaemia estimated to be 17.2 million among pregnant women. This constitutes to approximately 30% of total global cases (WHO, 2008). In Kenya the prevalence of anaemia among pregnant women is 55.1% and among non-pregnant women is 46.4% (Ministry of Health, 2013). Anaemia during pregnancy is considered severe when haemoglobin concentration is less than 7.0 g/dl, moderate when the haemoglobin concentration is 7.0 to 9.9 g/dl, and mild when haemoglobin concentration is 10.0 to 10.9 g/dl (Balarajan et al., 2011; Salhan et al., 2012; Esmat et al., 2010). When the prevalence of anaemia among pregnant women is 40.0% or more, it is considered as a severe public health problem (McLean et al., 2008).

Anaemia during pregnancy has a variety of causes and contributing factors. Iron deficiency is the cause of 75% of anaemia cases during pregnancy (Balarajan et al., 2011; Haidar, 2010). Infectious diseases such as malaria, helminthes infestations and HIV are implicated with high prevalence of anaemia in sub-Saharan Africa (Ouédraogo et al., 2012 and Tolentino and Friedman, 2007). Loss of appetite and excessive vomiting in pregnancy and heavy menstrual flow before pregnancy are also documented causes of anaemia during pregnancy (Noronha et al., 2010). Socio-economic conditions, abnormal demands like multiple pregnancies, teenage pregnancies, maternal illiteracy, unemployment/underemployment, short pregnancy intervals,

age of gestation, primigravida and multigravida (Haniff *et al*., 2007; Noronha *et al.*, 2010), smoking, excessive alcohol consumption, are the main contributing factors of anaemia during pregnancy (Moosa and Zein, 2011; Esmat et al. 2010).

Anaemia during pregnancy is a major cause of morbidity and mortality in pregnant women and infants in developing countries (Akhtar and Hassan, 2012). In 2013, an estimated 289,000 women died worldwide. Developing countries account for 99% (286 000) of the global maternal deaths with sub- Saharan Africa region alone accounting for 62% (179 000). About 800 women a day are still dying from complications in pregnancy and childbirth globally (WHOa, 2015). Anaemia contributes to 20% of all maternal deaths (WHOb, 2015). Anaemia in pregnancy causes low birth weight (Banhidy et al., 2011), fetal impairment and infant deaths (Kalaivani, 2009). Iron deficiency anaemia affects the development of the nation by decreasing the cognitive and motor development of children and productivity of adults (Balarajan et al., 2011; Vivek et al., 2012). Deficiency of folic acid during pregnancy can result in developing neural tube defect that develops in embryos during the first few weeks of pregnancy leading to malformations of the spine, skull, and brain (Wolff et al., 2009).

Iron and folate requirements increase during pregnancy, therefore, the likelihood of developing iron and folate deficiency is high if there is no supplementation during pregnancy (Marti-Carvaja et al., 2002). It is therefore recommended that all pregnant women should start taking iron and folic acid supplementation as early as possible to avoid the complications of iron and folic acid deficiency during pregnancy. Supplementation with folic acid has also been shown to reduce the risk of congenital heart defects, cleft lips, limb defects, and urinary tract anomalies (Wilcox, et al., 2007 and Goh and Koren, 2008). IFAS is a major strategy to reduce iron deficiency anaemia in pregnancy as well as risk of congenital malformations on the newborn.

Iron has several vital functions in the body. It serves as a carrier of oxygen in red blood cells from the lungs to the tissues, as a transport medium for electrons within cells, and as an integrated part of important enzyme systems in various tissues. Folic acid, a B vitamin (B_9), plays a vital role in the development of neural tube in the growing embryo, in the production of red blood cells, synthesis of DNA, repair of DNA, and it acts as a cofactor in certain biological reactions (Weinstein et al., 2013). It is especially important in aiding rapid cell division and growth, such as in infancy and pregnancy. Birth defects occur within the first 3-4 weeks of

pregnancy, usually before a woman even knows she's pregnant. So it's important to have folic acid in the system during those early stages when the baby's brain and spinal cord are developing (Folate: Dietary Supplement Fact Sheet, 2013).

1.2 Problem Statement

In Kenya, the prevalence of anaemia among pregnant women is 55.1%. If the prevalence of anaemia among pregnant women is 40.0% or more, it is considered as a severe public health problem (McLean et al., 2008). Anaemia is a major cause of morbidity and mortality in pregnant women and increases the risks of foetal, neonatal and overall infant mortality (Akhtar and Hassan, 2012). In 2013, an estimated 289,000 women died worldwide. Developing countries account for 99% (286 000) of the global maternal deaths with sub- Saharan Africa region alone accounting for 62% (179 000). About 800 women a day are still dying from complications in pregnancy and childbirth globally (WHOa, 2015). Anaemia during pregnancy contributes to 20% of all maternal deaths (WHOb, 2015).

According to the KDHS 2008-09, maternal deaths increased from 414/100,000 in 2003 to 488/100,000 in 2008-09 far from meeting MDG target goals for maternal mortality. From this information it can be estimated that the high prevalence of anaemia among pregnant women in Kenya is considered to be the main factor for maternal death.

Anaemia during pregnancy is also a major risk factor for low birth weight, preterm birth and intrauterine growth restriction (Banhidy F et al., 2011and Haggaz et al., 2010). Deficiency in folic acid during pregnancy can result in serious neural tube defect (Wolff et al., 2009), heart defects and cleft lips (Wilcox et al., 2007), limb defects, and urinary tract anomalies (Goh and Koren, 2008).

Pregnant women attending antenatal clinics in Kenya are routinely put on iron supplementation throughout their pregnancy. However, the prevalence of anaemia among pregnant women is still high. Moreover the available data concerning prevalence and specific ethologic factors of anaemia during pregnancy in Kenya are limited.

1.3 Justification

Anaemia is a significant maternal problem during pregnancy, associated with a negative outcome for both the woman and the new-born. For this reason, WHO adopted reducing maternal mortality as one of the three health-related millennium development goals.

Epidemiology of anaemia during pregnancy is important for deciding control strategies. Data on prevalence and associated factors of anaemia remain important indicators of public health since anaemia is related to morbidity and mortality in the population especially pregnant women. For example, a community based trial from China found that a 47% reduction in neonatal mortality in women who received IFA supplements compared with those who took folic acid alone (Zeng et al., 2008). The management and control of anaemia in pregnancy is therefore enhanced by the availability of local prevalence statistics which is however not adequately provided in Kenya.

In view of the problems caused by anaemia, more research is required to identify the risk factors so as to come up with appropriate strategies that will ensure its reduction. Therefore, this study aims at providing prevalence and factors associated with anaemia among pregnant women who attended ANC at Pumwani Maternity Hospital, Nairobi.

1.4 Hypothesis

H_O: There are no factors associated with anaemia among pregnant women attending ANC during the second and third trimesters at Pumwani Maternity Hospital

H_1: There are factors associated with anaemia among pregnant women attending ANC during the second and third trimesters at Pumwani Maternity Hospital

1.5 Research Questions

What is the prevalence of anaemia among pregnant women attending antenatal clinic during the second and third trimesters at Pumwani Maternity Hospital?

What are the factors associated with anaemia among pregnant women attending antenatal clinic during the second and third trimesters at Pumwani Maternity Hospital?

1.6. Objectives

1.6.1. Broad objective

To determine prevalence and factors associated with anaemia among pregnant women attending antenatal clinic during the second and third trimesters at Pumwani Maternity Hospital, Nairobi.

1.6.2. Specific objectives

To determine the prevalence of anaemia among pregnant women attending antenatal clinic during the second and third trimesters at Pumwani Maternity Hospital

To identify factors associated with anaemia among pregnant women attending antenatal clinic during the second and third trimesters at Pumwani Maternity Hospital

CHAPTER TWO: LITERATURE REVIEW

2.1 Introduction

Anaemia during pregnancy is defined as a condition where there is less than 11g/dl of haemoglobin (Hb) concentration in the blood of pregnant women, which decreases oxygen-carrying capacity of the blood to the body tissues. The importance of good haemoglobin concentration during pregnancy for both the woman and the growing foetus cannot be overemphasized. Being a driving force for oxygen for the mother and foetus, a reduction below acceptable levels can be detrimental to both (Agan et al., 2010). Anaemia affects 1.62 billion (24.8%) people globally (WHO, 2008). Globally, almost half of all preschool children (47.4%) and pregnant women (41.8%) and close to one-third of non-pregnant women (30.2%) are anaemic (De Benoist et al., 2008; Badham et al., 2007). Anaemia affects more than 500 million women in developing countries where 4 of every 10 pregnant women are anaemic (USAID, 2011). Although reports exist about what is being done and what should be done globally to address prevention and treatment of maternal anaemia, prevalence of anaemia and maternal mortality around the world remains high (USAID, 2011). About half of this anaemia burden is a result of iron deficiency anaemia (IDA). IDA is most prevalent among preschool children and pregnant women. Among women, iron supplementation improves physical and cognitive performance, work productivity, and well-being. Moreover iron supplementation during pregnancy improves maternal, neonatal, infant, and even long-term child outcomes (Sant-Rayn Pasricha et al., 2013). Although dietary deficiency may be contributory, the etiology of the vast majority of cases of iron deficiency anaemia in infancy and childhood is maternal iron deficiency anaemia in pregnancy.

WHO has categorized and emphasized on the significant health consequences based on the prevalence of the anaemia. If the prevalence of anaemia is 4.9% or less, it is considered as no public health problem for that country. Prevalence of anaemia between 5.0% and 19.9% indicates a mild public health problem. Moderate public health problem is been considered when the prevalence is between 20.0% and 39.9%. If the prevalence is 40.0% or more, it is considered as a severe public health problem (McLean et al., 2008).

2.2 Prevalence of anaemia during pregnancy

Anaemia affects 24.8% of the world's population (WHO, 2008). Worldwide, the prevalence of anaemia during pregnancy has been estimated at 41.8%, corresponding to 56.4 million women (McLean et al., 2006). Prevalence of anaemia among pregnant women is around 24.1% in the Americas, 48.2% in South East Asia, 25.1% in Europe, 44.2% in East Mediterranean, 30.7% in West Pacific and highest in Africa at 57.1% (de Benoist *et al*., 2008). Studies in Africa have shown a high prevalence of anaemia in pregnancy ranging from a low of 41% to a high of 83% in different settings (Haggaz *et al*., 2010; Kidanto *et al*., 2009). Sub-Saharan Africa is the most affected region, with anaemia prevalence estimated to be 17.2 million pregnant women, which corresponds to approximately 30% of total global cases (WHO, 2008).

A cross-sectional study conducted in northern Tanzania revealed that the prevalence of anaemia among pregnant women was 47.4% (Sia *et al*., 2013). A study which was conducted in the University of Uyo Teaching Hospital, Uyo, Nigeria revealed that the prevalence of anaemia among pregnant women was 54.5% and majority (61.0%) of the anaemic women had mild anaemia, 38.5% had moderate anaemia, while 0.5% had severe anaemia (Olujimi *et al.,* 2014). A study which was conducted in 2014 to determine the prevalence of anaemia in pregnancy in an urban area of eastern Ethiopia found that 56.8% of pregnant women were anaemic. 1.2% of them were severely anaemic, 26.7% were moderately anaemic, and 28.9% were mildly anaemic (Kefyalew and Abdulahi, 2014). In Kiboga district, Uganda, the prevalence of anaemia among pregnant women was 63.1% (Mbule *et al*., 2013). A cross-sectional study which was conducted in Egypt revealed that the prevalence of anaemia among pregnant women was 62.2% (Zakia et al., 2011). In Kenya the most recent micronutrient survey in the country indicated that the prevalence of anaemia among pregnant women is 55.1% (MOH, 2013). A study which was conducted in Kakamega County, Kenya revealed the prevalence of anaemia among pregnant women was 40% (Mulambalah et al., 2014).Unpublished report which was conducted at Mbagathi District Hospital, Nairobi revealed that the prevalence of anaemia among pregnant women attending antenatal clinic was 36.2% (Carolyne Wanjiru,2013). A prospective study conducted on severe anaemia during pregnancy in Kisumu District of Kenya; showed that out of 59% women who experienced obstetric related complications, 22% were suffering from severe anaemia.

2.3 Consequences and burden of anaemia in pregnancy

Anaemia has significant adverse health consequences, as well as adverse impacts on social and economic development (WHOc, 2015). It is one of the most intractable public health problems in developing countries and the commonest complication in pregnancy in sub-Saharan Africa (Buseri et al., 2008). In developing countries, anaemia in pregnancy is a major cause of maternal and foetal morbidity and mortality (Akhtar and Hassan, 2012). It is estimated that anaemia causes more than 115,000 maternal and 591,000 perinatal deaths globally per year (Salhan et al., 2012). Anaemia during pregnancy contributes to 20% of all maternal deaths (WHOb, 2015). Anaemia increases risk of maternal morbidity and mortality, abortion, poor intrauterine growth, preterm birth and low birth weight. These effects in turn result in higher perinatal morbidity and mortality and higher infant mortality rate (Bodeau et al., 2011).

Anaemia in pregnancy causes low birth weight (Banhidy *et al*., 2011), fetal impairment and infant deaths (Kalaivani, 2009).It also causes preterm birth, low APGAR score, intrauterine growth restriction (Adam *et al*., 2007; Haggaz *et al*., 2010; Kidanto *et al*., 2009). Deficiency in folic acid during pregnancy can result in a serious neural tube defect (severe abnormalities of the central nervous system) that develop in embryos during the first few weeks of pregnancy leading to malformations of the spine, skull, and brain (Wolff *et al.,* 2009), heart defects and cleft lips (Wilcox *et al*., 2007), limb defects, and urinary tract anomalies (Goh and Koren, 2008). When the pregnant women are anaemic, the odds for fetal growth restriction and low birth weight are tripled. The odds for preterm delivery are more than doubled. Even a moderate hemorrhage in an anaemic pregnant woman can be fatal (Olujimi *et al*., 2014)**.** A basic principle of fetal/neonatal iron biology is that iron is prioritized to red blood cells at the expense of other tissues, including brain. When iron supply does not meet iron demand, the fetal brain may be at risk even if the infant is not anaemic. Anaemia adversely affects cognitive performance, behavior and physical growth of infants, preschool and school-aged children. Anaemia depresses the immune status and increases the morbidity from infections in all age groups. The high prevalence of anaemia among pregnant women in Kenya has significant adverse health effects, as well as adverse impacts on social and economic development which requires aggressive attention to identify the specific etiologic factors so as to come up with appropriate strategies that will ensure its reduction.

2.4 Factors associated with anaemia in pregnancy

Anaemia during pregnancy has a variety of causes and contributing factors including socio-economic conditions, abnormal demands like multiple pregnancies, teenage pregnancies, malnutrition, maternal illiteracy, unemployment, short pregnancy intervals, age of gestation, primigravida and multigravida, loss of appetite and excessive vomiting in pregnancy (Haniff *et al*., 2007; Noronha *et al.,* 2010). Low socio-economic condition is main factor associated with anaemia in pregnancy (Nwizu et al., 2011 and Leyla et al., 2010). Multiparity may induce anaemia by reducing maternal iron reserves at every pregnancy and by causing blood loss at each delivery (Leyla et al., 2010). Multigravida women are more at risk to develop anaemia than primigravidae. Increasing number of pregnancies and deliveries are positively associated with the risk of developing anaemia (Mulugeta et al., 2014, Vivek et al., 2012 and Elzahrani, et al., 2012, Nwizu et al., 2011). Single pregnant women are more prone to develop anaemia than married women (Nwizu et al., 2011).Tea consumption is also associated with anaemia by reducing iron absorption capacity (Baig-Ansari., et al 2008).

Infectious diseases such as malaria, helminthes infestations and HIV are implicated with high prevalence of anaemia in sub-Saharan Africa (Ouédraogo et al., 2012 and Tolentino and Friedman, 2007). Febrile illness in the index pregnancy is significantly associated with anaemia (Nwizu et al., 2011). Infection causes gastrointestinal blood loss resulting in depletion of the iron stores and consequently impaired erythropoiesis. Other factors which put pregnant women at a higher risk of acquiring anaemia are: folate and vitamin B_{12} deficiencies, acute or chronic blood loss (gastrointestinal bleeding/heavy periods), smoking, excessive alcohol consumption, poor sanitation, (Moosa and Zein, 2011; Esmat et al., 2010). Eating soil during pregnancy is also another risk factor for development of anaemia (Leyla et al., 2010).

Physiological adaptation in pregnancy leads to physiological anaemia of pregnancy. This is because the plasma volume expansion is greater than red blood cell (RBC) mass increase which causes haemodilution. It has been estimated that the daily iron requirements of a 55-kg pregnant woman increases from approximately 0.8 mg in the first trimester to 4–5 mg during the second trimester and more than 6 mg in the third trimester. Pregnant women need iron to cover their basic losses, increased RBC mass and demand from fetoplacental unit. This requirement is not

met by food alone in developing countries therefore oral iron supplementation is justified (Olujimi et al., 2014).

Previous studies have found several factors associated with the use of antenatal IFA supplements. These are: the age of the woman, her educational status, her working status, the socio-economic status of her family, her parity, the number of IFA supplements received, her use of ANC services, her place of residence and her partner's occupation (Ogundipe *et al*., 2012; Lutsey et al., 2008; Forster *et al*., 2009; Lacerte *et al*., 2011; Knudsen et al., 2007; Agarwal *et al*., 2008). A study has shown that education beyond high school is positively associated with adherence to IFA (Jasti *et al*., 2007). Knowledge of anaemia and its prevention has also been identified as an important factor for taking iron/folate supplements (Lacerete *et al*., 2011).

The causes and contributing factors of anaemia during pregnancy are multiple and varied depending on geographical location, socio-demographic and economic characteristic, obstetric history, cultural and health conditions and health seeking behaviours. Hence it is important to identify the specific etiologic factors in specific environment or community. Therefore, this study aims at identifying specific factors associated with anaemia among pregnant women who attended ANC at Pumwani Maternity Hospital, Nairobi.

2.5 Diagnosis of anaemia in pregnancy

In measuring the status of anaemia in the population, haemoglobin (Hb) concentration is the most reliable indicator as opposed to clinical assessments. A haemoglobin (Hb) level less than 11 g/dl or hematocrit less than 33% can be considered for diagnosis of anaemia in pregnancy. Anaemia in pregnancy is divided into mild anaemia (Hb 10.0 – 10.9 g/dl), moderate anaemia (Hb 7.0 – 9.9 g/dl) and severe anaemia (Hb less than 7.0 g/dl) (WHO, 2000). An accepted standard of practice is that all women have at least one Hb measurement during pregnancy. This is usually carried out by automated (Coulter) counter. However, in developing countries, a portable Hb photometer (HemoCue) has been widely used as a simple and accurate alternative (van den Broek, 2003). Hb is measured with a finger-prick sample of whole blood drawn up directly into a disposable microcuvette by capillary action and inserted into a HemoCue photometer. The HemoCue has been found to have a sensitivity of between 80% and 97% and specificity between 79% and 99% depending on the cut-off points for Hb used.

2.6 Prevention and treatment of anaemia

A key component of a safe motherhood initiative is to reduce maternal mortality by half through the eradication of anaemia during pregnancy (Hogue et al., 2007).Control of anaemia among pregnant women is done through micronutrient supplementation of iron and folic acid during the ANC attendance. Correction of iron deficiency in pregnancy involves appropriate diet and oral iron supplementation. WHO recommends that all pregnant women in areas where anaemia is prevalent should receive supplements of iron and folic acid (WHO, 2008). In spite of the WHO recommendations, the use of IFAS among pregnant women is still low in Kenya. The KDHS (2008-09) showed that 54% of women reported taking iron tablets or syrup for less than 60 days during the pregnancy (MoH, Republic of Kenya, 2013). Daily oral iron (60 mg) and folic acid (400 µg) should be commenced as soon as a woman becomes pregnant, and continued up to 6 months' postpartum.

Most countries in Sub-Saharan Africa, including Kenya, have a national policy to prevent and treat anaemia in pregnancy. This includes the provision of haematinics (ferrous sulphate and folic acid) to all pregnant women. In Kenya, routine iron supplementation is the current cornerstone of efforts to reduce iron-deficiency anaemia during pregnancy (KNBS and ICF Macro, 2010). According to the Kenya national guidelines (MOH, 2008), all pregnant women should receive free iron and folic acid supplements through the essential drug kit of the Ministry of Public Health and Sanitation. National recommendations are for women to begin supplementation during the first month of pregnancy with 60 mg of iron sulphate and 400 µg of folic acid daily (MOPHS, 2008).

Pregnant women need iron to cover their basic losses, increased RBC mass and demand from fetoplacental unit. It is recommended to take iron with orange juice to enhance its absorption. Parenteral iron can be administered intramuscular (IM) or intravenous (IV). Studies have shown that low or moderate dose of iron/folate supplementation in early pregnancy has a positive effect on foetal growth in women with both adequate and deficient iron status (Rodriguez-Bernal, Rebagliato and Ballester, 2012). Patients with mild anaemia (haemoglobin level, 9.0–10.5 g/dl) should receive oral iron at 160 to 200 mg of elemental iron daily, with an expected increase in haemoglobin levels of 1 g/dl after 14 days of therapy (Breymann *et al.*, 2010). Compared to oral iron, parenteral iron demonstrates faster haematologic recovery, likely because of variations in

oral iron tolerability, absorption, and compliance (Reveiz *et al*., 2007; Milman, 2006). Severe anaemia in pregnancy (Hb less than 7 g/dL) requires urgent medical treatment and Hb less than 4 g/dl is an emergency carrying a risk of congestive cardiac failure, sepsis and death.

Folate deficiency is seen in 5% cases of anaemia in pregnancy. A dose of 5 mg oral folic acid daily is recommended for correction of anaemia. In cases of vitamin B12 deficiency, 250 µg cynacobalamin administered parenterally every week is recommended for anaemia treatment. In cases of severe anaemia near term – daily vitamin B12 in a dose of 100 µg should be administered for a week. A community based trial from China found a 47% reduction in neonatal mortality in women who received IFA supplements compared with those who took folic acid alone (Zeng et al., 2008). Therefore, to reduce the risk of maternal anaemia, iron deficiency and poor pregnancy outcomes, the WHO guidelines recommend a standard daily oral dose of 60 mg iron and 400 µg folic acid supplements throughout pregnancy, to begin as early as possible as a part of antenatal care (ANC) programs.

Pre-pregnancy counseling, dietary advice and therapy are very important for ensuring best pregnancy outcomes. It is recommended that full blood count should be checked at the booking visit in pregnancy and repeated at 28 weeks to screen for anaemia. In high risk mothers and multiple pregnancies, an additional haemoglobin check should be performed near term. Dietary advice should be given to all mothers to improve intake and absorption of iron from food (Olujimi et al., 2014). Rich sources of iron include heme iron (in meat, poultry, fish and egg yolk), dry fruits, dark green leafy vegetables (spinach, beans, legumes, lentils) and iron fortified cereals. Certain foods which may inhibit iron absorption should not be taken with iron rich foods. These include polyphenols (in certain vegetables, coffee) and tannins (in tea). Weekly iron (60 mg) and folic acid (2.8 mg) should be given to all menstruating women including adolescents, periodically, in communities where IDA is considered a problem (Goonewardene et al., 2012). Besides increased intake, treatment of underlying conditions and deworming (anti-helminthic therapy) are important preventive measures. These vitamins play an important role in embryogenesis and hence any relative deficiencies may result in congenital abnormalities. Finding the underlying cause is crucial to the management of these deficiencies. From a neonatal perspective, delayed clamping of the umbilical cord at delivery (by 1–2 min) is important step in prevention of neonatal anaemia (Olujimi et al., 2014).

2.7: Conceptual Framework

The conceptual framework used for this study is adopted and modified from UNICEF's conceptual framework on the determinants of malnutrition (UNICEF, 1998).This conceptual framework demonstrates the relationship between independent variables (participant's demographic and socio-economic characteristics, obstetric history, ANC visits and taking of iron and folic (IFA) supplementation, health condition of the current pregnancy, awareness on causes and consequences of anaemia during pregnancy and the dietary habits and nutritional status and dependent variables (anaemic state or non-anaemic state of the pregnant women).

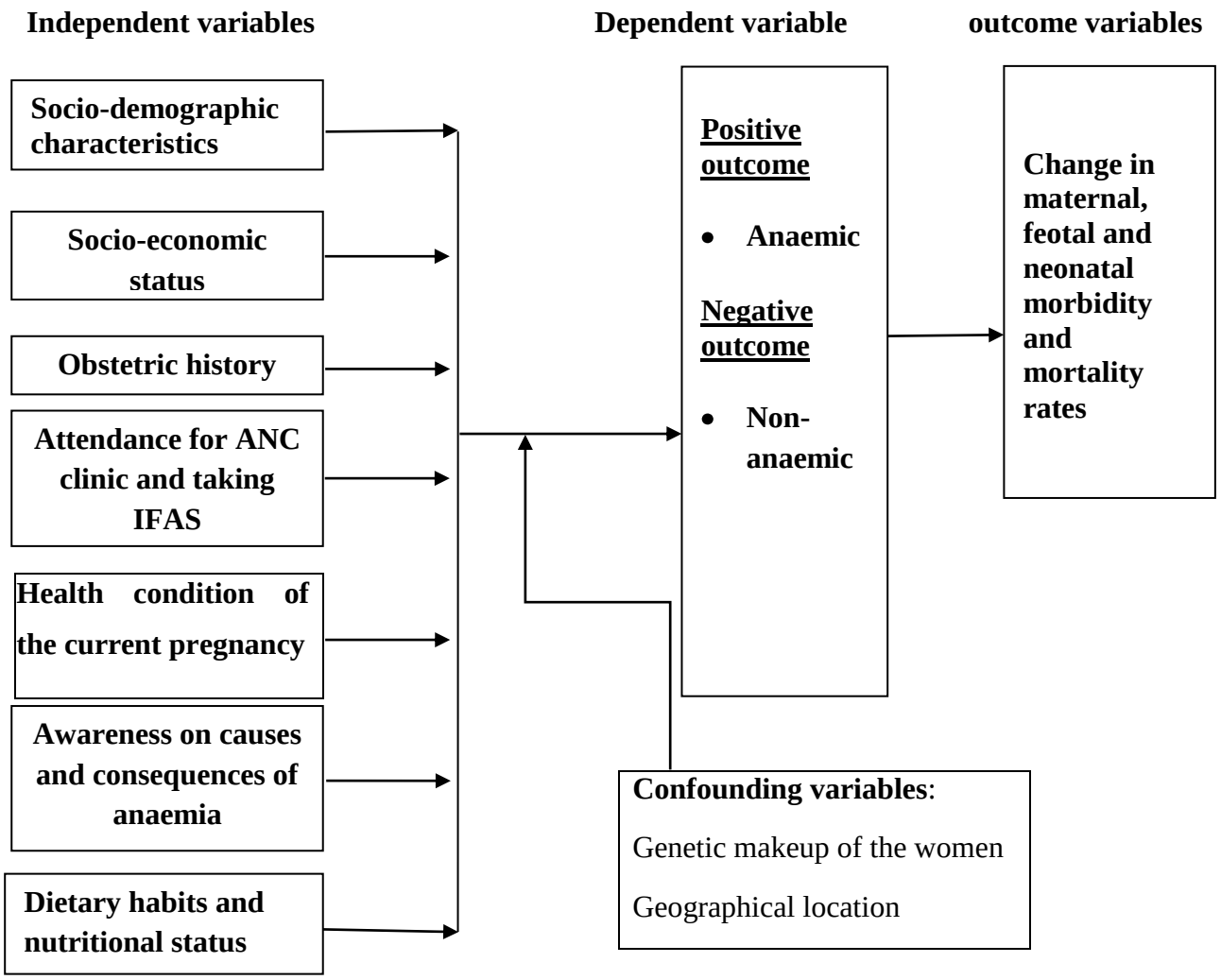

Figure 1.1: Conceptual framework on factors associated with anaemia in pregnancy

Source: Adopted from the state of the World's children UNICEF, 1998.

CHAPTER THREE: RESEARCH METHODS

3.1 Study Design

A cross-sectional study was conducted from 8th June to 18th August, 2015, on 258 pregnant women who attended antenatal clinic at Pumwani Maternity Hospital in Nairobi. Researcher-administered questionnaire, anthropometric measurements and laboratory tests for haemoglobin were used to obtain data.

3.2 Study Area

This cross-sectional study was carried out in the antenatal clinic of Pumwani Maternity Hospital in Nairobi, Kenya. Pumwani Maternity Hospital was purposively selected as the study site since it remains the largest maternity hospital in Kenya and Sub-Saharan Africa (savethecradle.org/pumwani-maternity-hospital/). It is a maternity hospital for Nairobi County. It also serves as a referral center for other health facilities within Nairobi County and adjoining districts. The institution has a bed capacity of 350 and 150 baby cots. The hospital has one antenatal ward, one labor ward, two theatres, four postnatal wards, a special newborn unit and maternal/child health unit. Daily normal deliveries in the hospital range between 50 and 100 and Caesarean Sections between 10 and 15.

It also serves as a teaching hospital for Pumwani Midwifery Nursing School, Nairobi University, Kenyatta University, Daystar University, University of Eastern Africa, Baraton and Kenya Medical Training College. It is about 10 kilometers from the Central Business District (CBD), Nairobi, in the eastern side within Kamukunji constituency and it is surrounded by low income residential areas of Eastleigh, Mathare, Muthurwa and Majengo. The hospital is served by 186 nurses, 20 medical officers, 4 obstetrics/gynaecology consultants, 3 paediatric consultants and 14 clinical officers.

To date the Hospital remains the largest maternity hospital in the country and Sub-Saharan Africa. It is equivalent to a Provincial Hospital in status and is reported to be third busiest maternity hospital in the African continent (savethecradle.org/pumwani-maternity-hospital/).

3.3 Study population

The study population was pregnant mothers attending antenatal care (ANC) between 8th June and 18th August, 2015 at Pumwani Maternity Hospital, Nairobi.

3.4 Inclusion and Exclusion Criteria

3.4.1 Inclusion Criteria

Pregnant women in the second and third trimester of pregnancy attending MCH clinic at Pumwani Maternity Hospital

Pregnant women who consent to participate in the study

3.4.2 Exclusion Criteria

Pregnant women in the first trimester of pregnancy

Pregnant women in the second and third trimester of pregnancy who fail to consent to participate in the study

3.5 Estimation of the Sample Size

Sample size was calculated using the formula below (Fisher, et al., 1998)

$$\boldsymbol{n = \frac{Z^2 P(1-P)}{d^2}}$$

Where:

n = the desired sample size

Z = the standard normal deviate usually set at 1.96, which corresponds to the 95% confidence interval.

P = the proportion of pregnant women with anaemia, which is 55.1%.

d = the degree of accuracy desired (absolute precision), which is 5.0% (0.05).

The proportion of anaemia during pregnancy was taken at 55.1% from the study carried out by Ministry of Health, Republic of Kenya, 2013.

$$\boldsymbol{n = \frac{Z^2 P(1-P)}{d^2}} \qquad \mathbf{n} = \frac{[1.96]^2\,[0.551]\,[0.449]}{[0.05][0.05]} = 380$$

Since the population during the study period was below 10,000, the sample adjusting formula was applied. Sample size adjustment was done using the following formula.

$$\boldsymbol{nf = \frac{n}{1 + \frac{n}{N}}}$$

Where:

nf = The desired sample size (when population is less than 10,000)

N = Total population (around 800 antenatal mothers, in the second and third trimester in 10 weeks period as the data collection took 10 weeks)

n = The desired sample size (when population is more than 10,000) =380

$$nf = \frac{380}{1 + \frac{380}{800}} = 257.6 = 258$$

Hence 258 subjects were needed for the study. Since follow up was not needed in the study, attrition rate was not necessary.

3.6. Sampling method and recruitment process

A review of ANC attendance register showed that about 16 pregnant women in the second and third trimester attend ANC at Pumwani Maternity Hospital daily. Accordingly the study was designed to be performed for 10 weeks during which time an estimated 800 women in second and third trimester were expected to visit for antenatal care. Systematic random sampling method was used to select study participants. The estimated number of 800 pregnant women (2^{nd} and 3^{rd} trimester) in 10 weeks period was divided by the minimum adjusted sample size (258) to give the sampling interval of 3. The first pregnant woman included in the sample was chosen randomly by blindly picking one of three pieces of paper named for the first three visitors of second or third trimester in each day. After that, every third pregnant woman coming for antenatal care was recruited in the study until the desired sample size was attained. To avoid double participant recruitment, the research assistants confirmed whether the participants had previously visited the ANC at the hospital and participated in the study during the data collection period.

Recruitment of the study participants was done at the waiting room of the antenatal care unit of the hospital. After the participants consented to participate in the study, they were interviewed using questionnaire. The interview was conducted in a private room of the MCH to ensure confidentiality of the participants. After the interview, anthropometric and haemoglobin measurements were done respectively.

3.7. Data collection tools and procedures

3.7.1 Questionnaire

A face-to-face interview using a pre-tested semi-structured questionnaire (appendix II) was conducted to obtain data about participant's demographic and socio-economic characteristics, obstetric history, ANC visits and taking of iron and folic (IFA) supplementation, health condition of the current pregnancy, awareness on the causes and consequences of anaemia and the dietary habits and nutritional status.

The questionnaire was pretested at Mbagathi District Hospital ANC clinic to assess it for reliability, clarity and simplicity. Mbagathi hospital has almost similar characteristics with Pumwani hospital since both hospitals are in an urban environment, in the same county, serve urban slums. Twenty five (25) pregnant women (10% of the sample size) were interviewed by the researcher and then data were analyzed. The results guided the appropriate adjustments to the study tool. The data collection was done by three Bachelor of Sciences in Nursing (BScN) fourth year students who were trained on how to use the tools to ensure the necessary information was obtained. They trained regarding the importance of good communication skills with the participants in order to capture the necessary information as much as possible. Before they started asking the questionnaire to the participants, they must greet them and ask about their general health condition. This would create a welcoming atmosphere so that the participants can convey the necessary information openly. They also trained how to measure weight, height and and Hb concentration.

3.7.2: Anthropometric measurements

Weight: Salter scale with calibrations of 100g-unit was used. It was adjusted to zero before weighing participants. The participants were requested to dresses lightly before weighing. Two readings were taken for each participant and the average weight was recorded on the questionnaire.

Height: For height, a vertical measuring board reading a maximum of 200 **c**m and capable of measuring to 0.1cm was used. The participants stood on the measuring board barefooted; heels, buttocks, shoulders and back of the head touching the board. The headpiece of the measuring board was then pushed gently, crushing the hair and making contact with the top of the head.

Height was then read to the nearest 0.1cm. Two readings were recorded and the computed average was used in the analysis.

Middle Upper Arm Circumference (MUAC): MUAC in cm was taken using tape-measure. The midpoint of the upper arm was located and the circumference was measured at that point. Then the reading was recorded in the questionnaire for each participant.

3.7.3 Haemoglobin measurement

The status of anaemia was determined by measuring the level of haemoglobin. Haemoglobin concentration was measured using portable HEMOCUE B-Hb photometer. One drop of capillary blood via finger prick was used to estimate haemoglobin level.

The procedure for taking blood and measuring Hb was as follows. Participant's fingertip was warmed, cleaned with alcohol, and punctured with a lancet. The first two drop of blood was discarded; the micro-cuvette then was filled with a single drop of blood. The filled micro-cuvette was placed into the HemoCue micro-cuvette holder within one to three minutes of taking the sample, and a reading was obtained within 45 sec. The haemoglobin value that appeared on the display was recorded in the questionnaire. Based on WHO guideline, Hb level less than 11g/dl during pregnancy was considered as anaemia. The HemoCue has been found to have a sensitivity of between 80% and 97% and specificity between 79% and 99% depending on the cut-off points for Hb used.

3.8 Data management

All questionnaires were stored in locked cabinets throughout the study and accessed only by the researcher so as to ensure confidentiality and to avoid data loss. After data collection, a double entry of the same data was done for accuracy purposes. Data was entered using Microsoft Excel. The data was stored in the computer under password. Data cleaning was done whereby missing values, extreme values and inconsistencies were identified and corrected. After cleaning, the data were then exported to SPSS software version 20.0 for analysis. Coding and verification of the data was done for easy manipulation, analysis and presentation. Data was presented using tables and graphs showing frequency distribution for independent and dependent variables.

3.9 Data Analysis

Quantitative data was analyzed using SPSS version 20. Descriptive statistics were computed for all relevant variables. Descriptive analysis was done using means, proportions and frequencies. Pearson's chi-square test and odds ratio (OR) with corresponding 95% confidence intervals (CI) computed to find association between independent and dependent variable (anaemia). A P-value of 0.05 was considered statistically significant. Multivariate analysis was done to determine factors independently causing anaemia during pregnancy.

3. 10 Ethical Considerations

The study was approved by the University of Nairobi- Kenyatta National Hospital Ethics and Research Committee. Permission to conduct the study at Pumwani Maternity Hospital was obtained from Pumwani Maternity Hospital administration. The details of the study were explained to each study participants. An informed consent was obtained in writing before recruiting each subject into the study. The participants retained the absolute right and freedom to decline from participating or withdrawing from the study at any time with no consequence to them. They were assured that opting out would not compromise the quality of care they receive from the antenatal clinic.

To ensure confidentiality of participants, information, anonymous typing was used whereby the name of the participants and any participants' identifier were not written on the questionnaire, and, also to keep privacy, they were interviewed alone. The participants had the benefit of early diagnosis of anaemia when present. Those pregnant women who found anaemic were assisted by the research assistants to seek proper treatment and follow-up based on the severity of the anaemia (see appendix I). This help for early treatment and ultimate prevention of the consequences of anaemia in the index pregnancy.

3.11 Expected outcome and dissemination plan

The findings of the study will be presented to the University of Nairobi, School of Nursing. It will also be published and presented in conferences and workshops of relevant stakeholders in this topic. Moreover, in part, this study can serve as a baseline for those who may wish to make further research on this research topic.

3.12 Study Limitations

One of the limitations of this study is the nature of the study design, being as a cross-sectional study design, it does not show which preceded anaemia or the risk factors. Second, due to constraint of resource (money), it was not possible to classify the types of anaemia based on red blood cell morphology. Morphologic classification would give us clear picture on the types of anaemia and therefore we could determine the magnitude of iron deficiency anaemia simultaneously. Third, as the current study was conducted entirely within one hospital and all the participants were from Nairobi County, differences of geographic location were not assessed. Therefore, generalizability to other hospitals and rural areas in the country may not be possible.

CHAPTER FOUR: RESULTS

4.0 Introduction

This chapter presents the analysis of the study findings. It is organized as follows; descriptive information of the study variables, bivariate analysis of factors associated with anaemia and finally multivariate analysis summarizing the independent predictors of anaemia among pregnant women. The results are presented in tables and graphs forms. Two fifty eight (258) pregnant women were recruited to participate in the study. Of these women, 93 were in the second trimester and 165 were in the third trimester of pregnancy.

4.1 Socio-demographic characteristics of participants

The socio-demographic characteristics of the participants are shown below in Table 4.1. The mean age of the women was 26.4 years with a SD of ±4.7 years. Out of the 258 participants, 104(40.3%) and 102(39.5%) were in the age group of 18-24 years and 25-30 years respectively. The remaining 52(20.2%) were 31 years and above. All of the participants were from Nairobi County. Majority of the women were married, employed and Christian. Regarding educational level of the participants, 54 (21%), 121(46.9%) and 78(30.3%) attended primary, secondary and tertiary level of education respectively.

Table 4. 1: Socio-demographic characteristics of pregnant women

Variables	N	Percent (%)
Age in years		
18-24	104	40.3
25-30	102	39.5
31 and above years	52	20.2
Residence		
Nairobi	258	100.0
Marital status		
Married	219	84.9
Single	38	14.7
Divorced	1	0.4
Occupation		
Self-employed (Business)	105	40.7
Government or private employed	69	26.7
Housewife	84	32.6
Religion		
Christian	233	90.3

Muslim	25	9.7
Level of education		
None	5	1.9
Primary	54	21
Secondary	121	46.9
tertiary	78	30.3

4.1.1 Family income

Nearly half, 127(49.2%), of the participants had monthly income of 10,000 -30,000 Kenya shilling (Ksh). About a quarter, 68 (26.4%), of them had monthly income of less than 10,000 Ksh as shown in Figure 4.1.

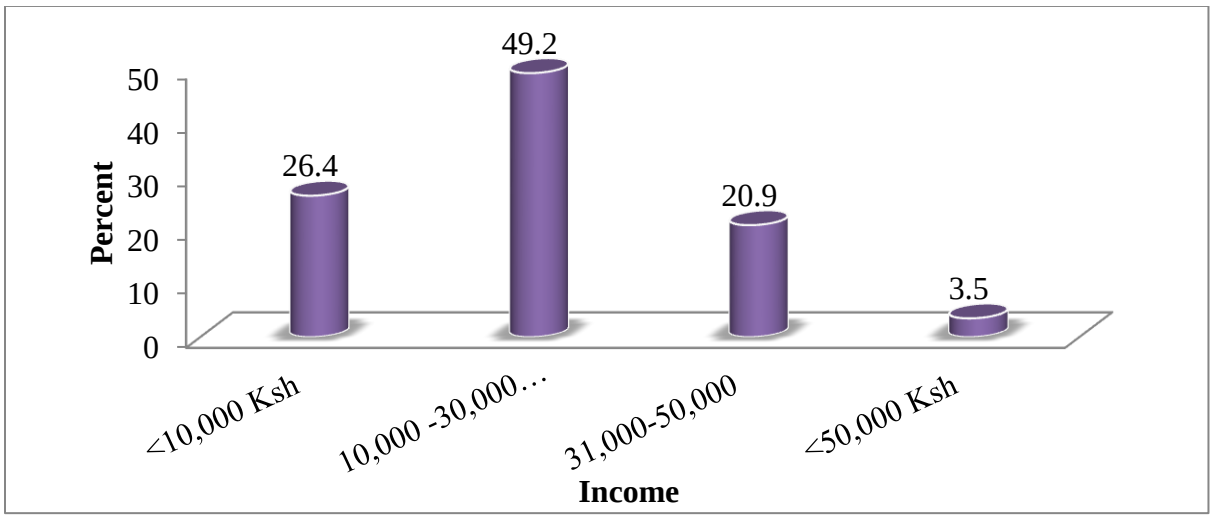

Figure 4. 1: Income of the participants

4.2: Spouse's characteristics among the married women

Nearly half, 108(49.3%), of the 219 married women's spouse ages were between 25 and 30 years and 98(44.7%) in the age group of 31 years or above. The mean age of the spouses was 31.3 years with a SD of ±4.7 years. More than half, 121(55.3%), of them were employed by the government and private sectors while the remaining 98(44.7%) were self-employed. Majority, 116 (53%) and 76(34.7%), of the spouses attended secondary and tertiary level of education respectively as illustrated in Table 4.2.

Table 4. 2: Spouse's characteristics among the married women, N=219

Variables	N	Percent (%)
Spouse's age in years		
18-24	13	5.9
25-30	108	49.3
31 years and above	98	44.7
Occupation of spouse		
Self-employed (Business)	98	44.7
Employed (government or private)	121	55.3
Spouse's level of education		
None	1	0.5
Primary	26	11.9
Secondary	116	53
tertiary	76	34.7
Spouse's religion		
Christian	202	92.2
Muslim	17	7.8

4.3: Obstetric history of the participants

Table 4.3 below shows the Obstetric history of the participants. The mean gestational age was 28.2 weeks with a SD of ±8.1 weeks. The majority, 165(64.0%), of the women were in third trimester of pregnancy and 93(36.0%) were in second trimester of pregnancy. One hundred and fifty one (58.5%) of the women were multigravida while 107 (41.5%) were primigravida. Of the multigravida women, 121 (80.1%) had an inter-pregnancy interval of two years or more. The remaining, 30(19.9%), had birth interval of less than two years.

Table 4. 3: **Obstetric history of the participants**

Variables	N	Percent (%)
Number of pregnancy (gravida)		
First pregnancy	107	41.5
Second pregnancy	72	27.9
Third pregnancy	53	20.5
Fourth and above pregnancy	26	10.1
Gestational age (Trimester)		
Second trimester	93	36
Third trimester	165	64
Number of children		
One child	70	56.0%
Two children	40	32.0%)
Three and above	15	12.0%
Inter-pregnancy interval (n=151)		
< 2 years	30	19.9
≥ 2 years	121	80.1

4.3.1: Number of children among the multigravida women

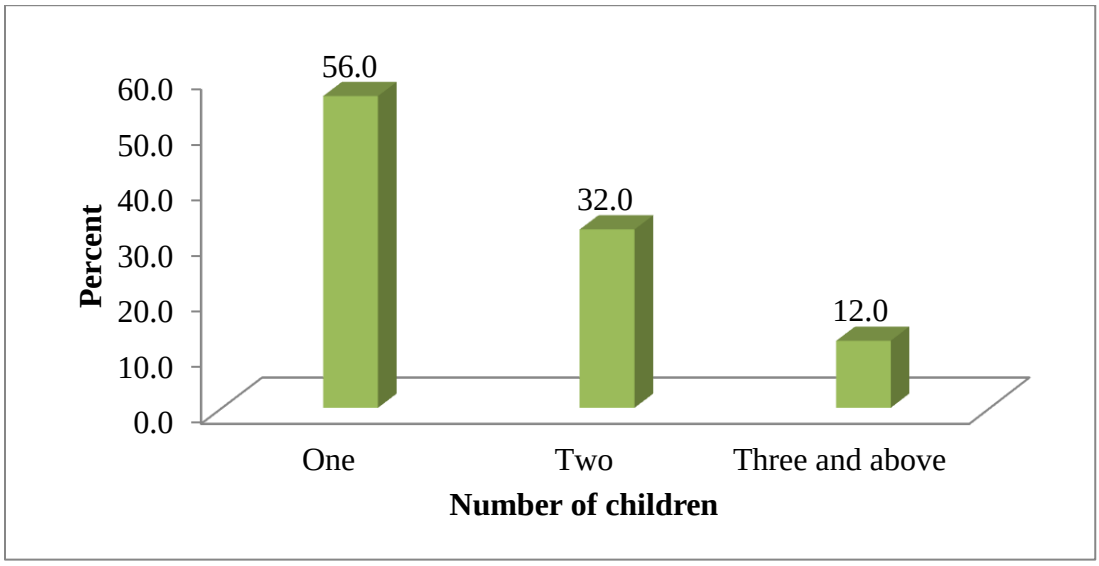

Figure 4. 2: **Number of children among the multigravida women**

4.4: Ante natal clinic (ANC) visits of the participants

Table 4.4 below shows ANC visits and taking of IFAS during the current pregnancy. Majority, (92.2%), of the participants started attending ANC after 12 weeks of gestation. The highest number, 217 (84.1%), of the participants attended ANC for the first time between 12 and 24 weeks of their gestational age. Regarding frequency of ANC clinic visits, 76(29.5%) attended once, 50(19.4%) attended twice, 57(22.1%) attended thrice and 75(29.1%) attended four or more times. Almost half, 89(50.9%), of the women started taking IFAS at 19-24 weeks of gestation. And sixty seven (38.3%) of them started taking IFAS at 12-18 weeks of their gestation. Only 13(7.4%) of the women had started taking IFAS before 12 weeks of their gestation.

Table 4. 4: Ante natal clinic (ANC) visits of the participants

Variables	N	Percent (%)
Gestational age at first ANC visit		
<12 weeks	20	7.8
12 - 18 weeks	116	45.0
19-24 weeks	101	39.1
25-32 weeks	21	8.1
Frequency of ANC visits		
Once	76	29.5
Twice	50	19.4
Thrice	57	22.1
4 times and above	75	29.1
Iron/folic acid supplementation		
Yes	175	67.8
No	83	32.2
Gestational age when the women started taking IFAs (n=175)		
<12 weeks	13	7.4
12-18 weeks	67	38.3
19-24 weeks	89	50.9
25-32 weeks	6	3.4
Frequency of IFA supplementation per week, n=175		
Taking less than 4 days per week	7	4
Taking ≥ 4 days per week	168	96

4.5: Source of iron and folic acid supplementation

As indicated in Figure 4.3, the main source for iron/folic acid supplementation was public ANC clinic 170(97.1%). Only 5(2.9%) of the women used private pharmacies as a source of IFAs.

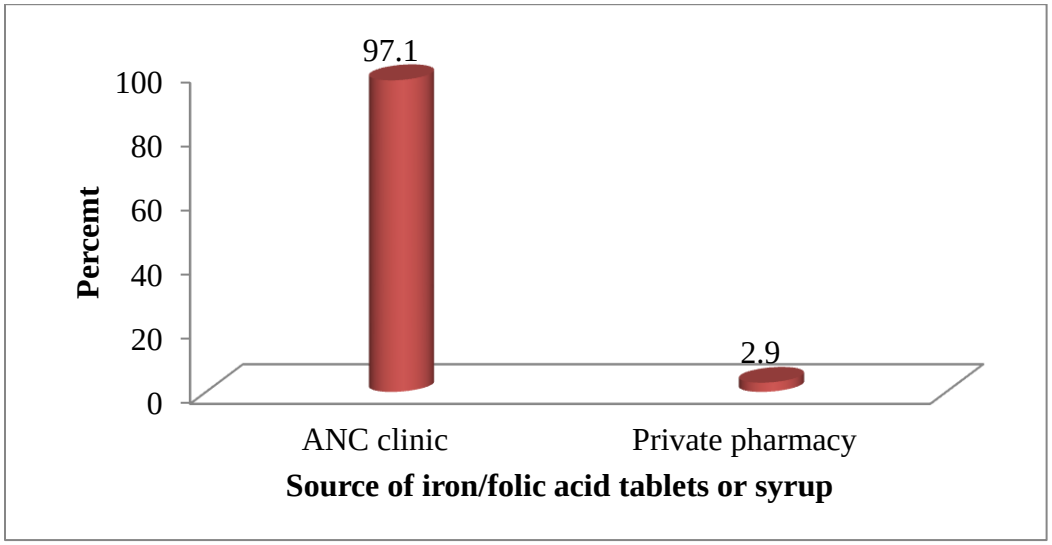

Figure 4. 3: **Sources of iron/folic acid**

4.6. Side effects of iron and folic acid supplementation

Thirty eight (21.7%) women reported that they experienced side effect of IFAS. The most reported side effects were nausea/vomiting (73.7%), dizziness (10.5%) and heart burn (7.9%) as shown in the table 4.5 below.

Table 4. 5: Side effects of IFAS experienced by the pregnant women

Variables	N	Percent (%)
If any side effects encountered by the women by taking IFAs (n=175)		
Yes	38	21.7
No	137	78.3
Type of side effects (n=38)		
Vomiting/nausea	28	73.7
Dizzeness	4	10.5
heart burn	3	7.9
Others	3	7.9

4.7 Challenges in attending ante natal clinic

Majority, 251(97.3%), of the participants said that they did not experience any challenge to attend ANC clinic. Nearly half, 120(46.5%) and 96(37.2%) of the women reported they take less than or 30 minutes and 30-60 minutes to reach the ANC clinic from their place of residence respectively. *Matatus* (minibus) were the main means of transportation by majority of the participants (83.3%) as indicated in table 4.6. Forty four percent of the participants spent between Kenya shilling (ksh) 50 and 100 and 33.5% spent between Ksh 100 and 200 for transportation to visit ANC clinic.

Table 4. 6 Challenges in attending ANC

Variables	N	Percent (%)
Any challenge in attending ANC clinic		
Yes	7	2.7
No	251	97.3
Duration of time taken to travel to and from ANC clinic		
≤ 30 minutes	120	46.5
30-60 minutes	96	37.2
61-90 minutes	15	5.8
≥ 120 minutes	27	10.5
Means of transportation		
Walking	40	15.5
Private car	2	0.8
Matatu	215	83.3
Motor cycle	1	0.4
Cost spent for transportation to visit ANC clinic		
≤50	32	14.7
51-100	96	44
101-199	17	7.8
≥200	73	33.5

4.8 Awareness of pregnant women on causes and consequences of anaemia during pregnancy

Table 4.7 below summarizes the awareness of pregnant women on causes and consequences of anaemia during pregnancy. A few, 56(36.8%), of the participants were aware about the causes of anaemia during pregnancy. Although more than half, 152(58.9%), of the women had awareness about an illness when a person is said to have little blood (anaemia); considerable number, 106(41.1%), were not aware about anaemia. Among those who had awareness about anaemia, majority, 96(63.2%), were not aware of its causes. Only 20.2% of the women had awareness about consequences of anaemia during pregnancy. Of these who had awareness about consequences of anaemia during pregnancy, 53.9% said maternal and foetal complications, 21.2% said dizziness/weakness and 13.5% said miscarriage.

Table 4. 7 Awareness of pregnant women on causes and consequences of anaemia

Variables	N	Percent (%)
Whether the women know an illness when a person has little blood		
Yes	152	58.9
No	106	41.1
Awareness on causes of having little blood, (n=152)		
Yes	56	36.8
No	96	63.2
Awareness on consequences of anaemia during pregnancy		
Yes	52	20.2
No	206	79.8
Awareness on consequences of having little blood (anaemia), n=52		
Foetal complications	12	23.1
Death (Mother or Foetal)	16	30.8
Dizziness/weakness	11	21.2
Miscarriage	7	13.5
Others	6	11.5

4.8.1. Awareness of the women on causes of anaemia during pregnancy

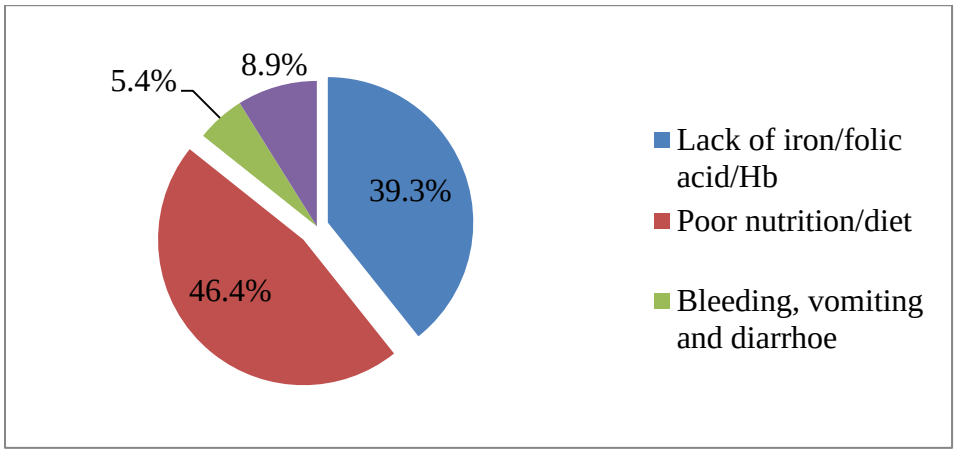

Figure 4. 4: Awareness of the women on causes of anaemia during pregnancy

4.9: Health conditions during the current pregnancy

Majority, 213(82.6%), of them reported they did not experience any health problem. Very small number, 8 (3.1%) and 23(8.9%), of the women reported they had diarrhoea and febrile illnesses for the last one month preceding the study respectively. Majority of the women were sero-negative while 20(7.8%) were sero-positive (Table 4.8).

Table 4. 8: Health conditions during the current pregnancy

Variables	N	Percent (%)
Any health problems during the current pregnancy		
Yes	55	21.3
No	213	78.7
Occurrence of diarrhoea for the last one month preceding the study		
Yes	8	3.1
No	250	96.9
Occurrence of febrile illnesses for the last one month preceding the study		
Yes	23	8.9
No	235	91.1
Treating for worms in the last 6 month preceding the study		
Yes	66	25.6
No	192	74.4
Treating for malaria in the last 6 month preceding the study		
Yes	24	9.3
No	234	90.7
HIV status of the women		
Sero-positive	20	7.8
Sero-negative	238	92.2

4.9.1: Reported types of pregnancy related health problems during the current pregnancy

Thirty eight (38) women reported that they had pregnancy related health problems during the current pregnancy. The most reported health problems were abdominal pain 11(28.9%), vomiting 7(18.4%), hypertension 7(18.4%), vaginal bleeding 5(13.2%) and headache 5(13.2%) as depicted in Figure 4.5.

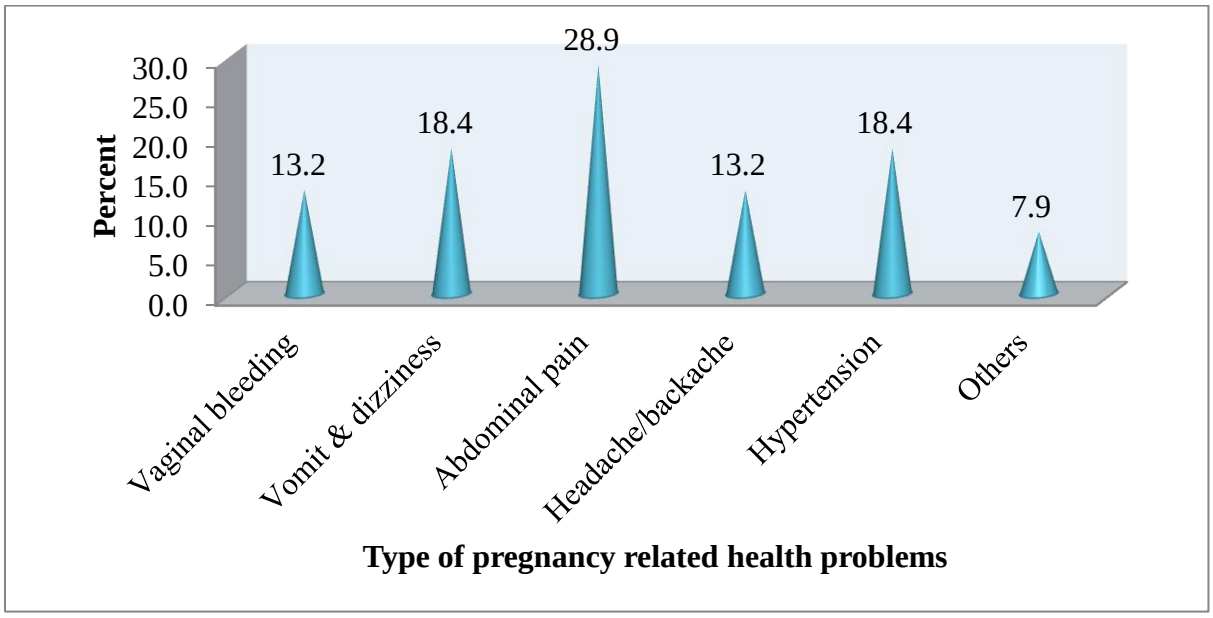

Figure 4. 5: **Type of pregnancy related health problems during the current pregnancy**

4.10: Nutritional assessment of the pregnant women

4.10.1: Anthropometric measurements

An assessment of weight, height and MUAC was done for all the pregnant women. The mean weight for the women was 68.7 Kilograms (kg) with a SD of ± 12.8 Kgs. About 30% of the women weighed between 45-60 Kgs. A few number, 16(6.2%), of them weighed greater than 90 kgs. The mean height for the women was 159.4 cm with a SD) ± 6.5 cm. The height of a few women was measured between 140 and 150 cm. The mean BMI for the women was 26.97 with a SD of ± 4.59. Majority, 250 (96.9%), of the women had a BMI of 20 or above. The mean MUAC for the women was 25.1 cm with SD ± 3.5 cm. About three quarter, 187 (72.5%), of the women had MUAC of 23 cm or above and about a quarter, 71(27.5%), of the women had MUAC of less than 23 cm (Table 4.9).

Table 4. 9: Anthropometric measurements

Variables	n=258	%
Weight		
45-60 Kg	76	29.5
61-75 Kg	103	39.9
76-90 Kg	63	24.4
>90 Kg	16	6.2
Height		
140-150 cm	30	11.6
151-160 cm	105	40.7
161-175 cm	123	47.7
BMI		
<18.5	1	0.4
18.5- 24.9	88	34.1
>24.9	169	65.5
MUAC		
<23 cm	71	27.5
≥ 23 cm	187	72.5

4.10.2 Dietary assessment

4.10.2.1: Food consumption of pregnant women based on 24 hours re-call

These findings are presented in frequencies and proportions in Table 4.10. Almost all, 252(97.7%) and 253(98.1%), the women had eaten cereals/cereal products (like maize, rice, bread, porridge) and oils/fats (cooking oils, margarine, butter) respectively. Similarly, most of the participants, 230(89.1%), 239(92.6%), 238(92.2%) and 213(82.6%) had taken milk and milk products (such as goat/cow fermented milk, cheese, yoghurt), sweets (like sugar, honey, sweetened soda or sugary foods such as chocolates, cake) and fruits (like water melons, mangoes, lemon, bananas, oranges, avocadoes) respectively. Moreover, 161(62.4%), 178(69.0%) and 155(60.1%) consumed meat/poultry, pulses/legumes and root and tubers (like potatoes, arrow roots, cassava, pumpkin, carrots, sweet potatoes) respectively. However, more than half, 148 (57.4%), of the women did not consume fish.

Table 4. 10: Food consumption of pregnant women based on 24 hours re-calls

Types of foods	N	Percent (%)
Cereals and cereal products		
Yes	252	97.7
No	6	2.3
Milk and milk products		
Yes	230	89.1
No	28	10.9
Sweets		
Yes	239	92.6
No	19	7.4
Oils/fats (e.g.		
Yes	253	98.1
No	5	1.9
Meat, poultry, organ meat and offal (e.g. goat, beef, chicken)		
Yes	161	62.4
No	97	37.6
Pulses/legumes, nuts and seeds (e.g. beans, lentils, green grams, peanuts)		
Yes	178	69
No	79	30.6
Root and tubers		
Yes	155	60.1
No	103	39.9
Eggs		
Yes	128	49.6

No	130	50.4
Fish and sea foods		
Yes	110	42.6
No	148	57.4

4.10.2.2: Consumption of iron and folic acid source of foods per week

The frequency of iron and folic acid sources of foods consumption per week is presented in Table 4.11. The majority, 147(57.0%) and 146(56.6%), of the pregnant women consumed citrus fruits and dark green leafy vegetables five or more days per week respectively. Half, 129(50%), and 100 (38.8%) of the women had taken beef/goat meat and cabbage once or twice per week respectively. However, the highest number of participants 122(47.3%) and 108(41.9%) never consumed liver and fish per week respectively.

Table 4. 11: Frequency of iron and folic acid source foods consumption per week

Food item	Never, n(%)	1-2 day, n(%)	3-4 days, n(%)	≥5 days, n(%)
Dark green leafy vegetables	12(4.7%)	61(23.6%)	39(15.0%)	146(56.6%)
Cabbage	75(29.1%)	100 (38.8%)	40(15.5%)	43(16.7%)
Liver	122(47.3%)	90(34.9.0)	42(16.3%)	4(1.6%)
Beef/goat meat	30(11.6%)	129(50%)	63(24.4%)	36(14.0%)
Chicken	111(43.0%)	106(41.1%)	38(14.7%)	3(1.2%)
Fish	108(41.9%)	101(39.1%)	33(12.8%)	8(3.1%)
Beans and legumes	37(14.3%)	98(38%)	91(35.3%)	32(12.4%)
Citrus fruits	16(6.2%)	46(17.8%)	49(19%)	147(57.0%)
Vegetables	1(0.4%)	28(10.9%)	46(17.8%)	193(74.8%)
Whole grain cereals	5(1.9%)	80(31%)	76(29.5%)	97(37.6%)

4.10.2.3: Life style habits of participants

The majority, 241(93.4%), of the women said they drink beverages (tea, cocoa or coffee) and 66.0% of them drink these beverages in less than 20 minutes before/after meals. More than half, 143(55.4%), of the women ate meals three times per day. One third, 86(33.3%), of the women avoided certain foods such as red meat 28(32.6%) and green vegetables 26(30.2%) due to vomiting 37(43.0%) and heart burn 19.8% as illuminated in Figure 4.6. A few mothers, 51(19.8%), craved for non-food substances and the common type of craving was stone 44(86.3%). All of the women reported they never smoke cigarettes and almost all, (98.4%), of the women said never taken alcohol (Table 4.12).

Table 4. 12: **Life style habits of participants**

Variables	N	%
Whether the women had taken beverages (tea, cocoa, or coffee)		
Yes	241	93.4
No	17	6.6
Time when the women had taken these beverages		
<20 min before/after meals	159	66.0
≥20 min before/after meals	82	34.0
Not applicable	17	
Number of meals per day		
Twice	63	24.4
Thrice	143	55.4
Four or more times	52	20.2%
Foods avoided during the current pregnancy		
Yes	86	33.3
No	172	66.7
Reasons for avoiding the foods, n=86		
Heart burn	17	19.8
Vomiting	37	43.0
Loss of appetite	8	9.3
Don’t know	11	12.8
Others	13	15.1
Craving for non-food substances		
Yes	51	19.8
No	207	80.2
Type of craving		
Stones	44	86.3
Charcoal	1	2.0
Soil	4	7.8
Tooth paste	2	3.9

4.10.2.3.1.Types of foods avoided during pregnancy

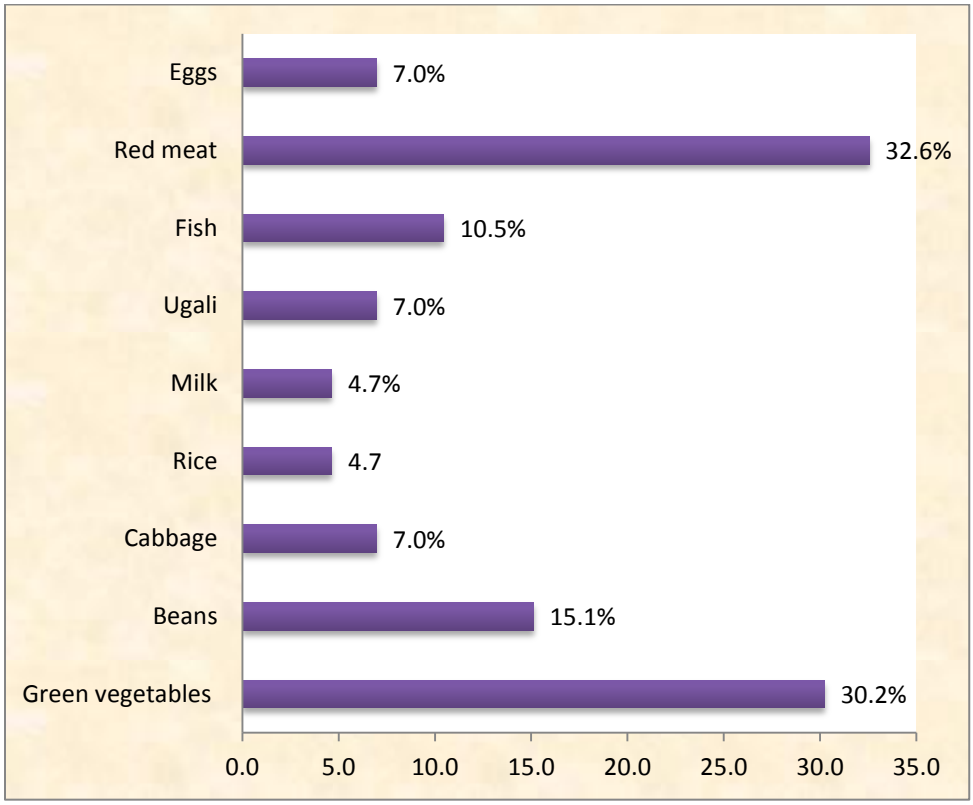

Figure 4. 6: **Types of foods avoided during pregnancy**

4.10.2.4 Biochemical assessment (haemoglobin)

Laboratory assessment was done for haemoglobin (Hb) concentration. The mean Hb concentration was 10.32 gram/deciliter (g/dl) with a SD of ± 1.72 g/dl. Majority, one hundred eleven (111) women presented with Hb concentration of 11 g/dl or above. Thirty nine (39), one hundred four (104) and four (4) women presented with Hb concentration of 10-10.9 g/dl, 7-9.9g/dl and less than 7g/dl respectively.

4.11`: Prevalence of anaemia

The cut-off point of Hb concentration to diagnosis of anaemia during pregnancy was taken at 11g/dl (McLean et al., 2008). As shown in Figure 4.7 below, the overall prevalence rate of anaemia (Hb < 11 g/dl) was 57.0% (95% CI: 51.0 - 63.0%).

4.11.1`: Prevalence of anaemia

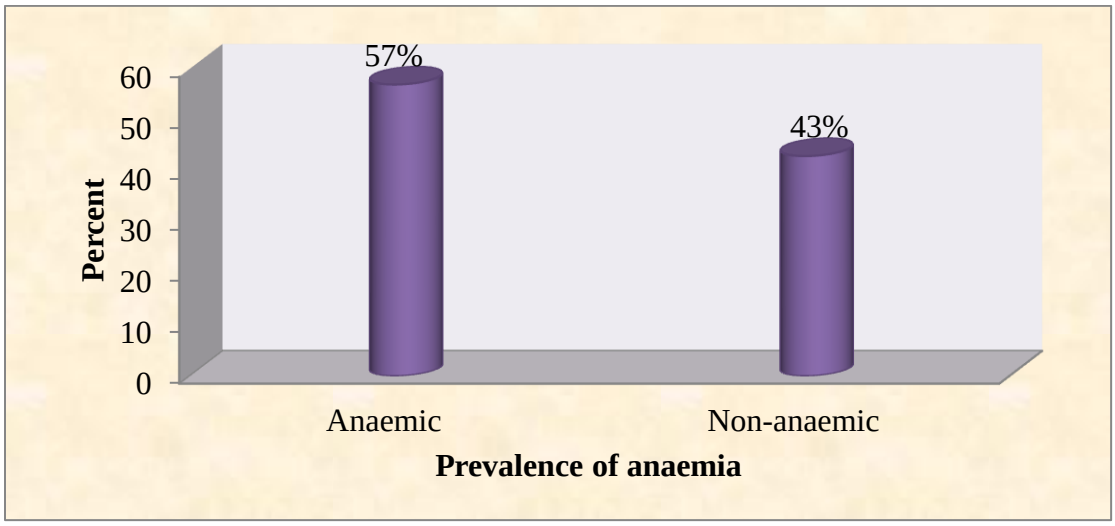

Figure 4. 7: **Prevalence of anaemia**

4.11.2: Severity of anaemia

In terms of severity, mild anaemia was 26.5% (Hb= 10-10.9 g/dl), moderate anaemia was 70.7% (Hb= 7-9.9g/dl) and severe anaemia was 2.7% (Hb <7g/dl) as indicated in **Figure 4.8.**

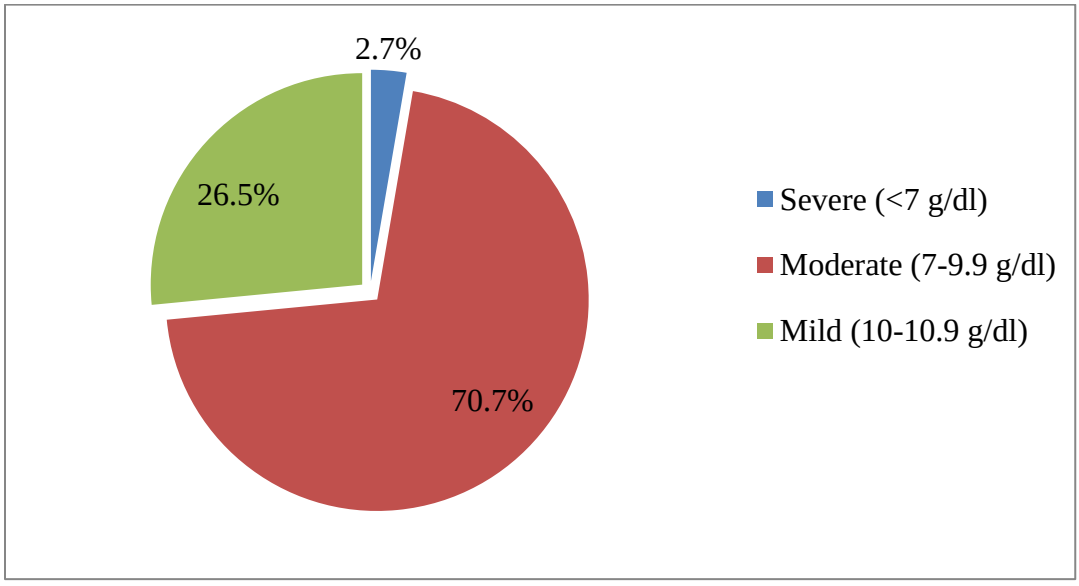

Figure 4. 8: **Severity of anaemia**

4.2 Bivariate analysis

4.2.1 Relationship between socio-demographic characteristics and occurrence of anaemia

The relationship between socio-demographic characteristics of the pregnant women and anaemia is shown below in Table 4.13. Pregnant women aged 31 years and above were significantly more anaemic 38(73.1%) [OR=2.33; 95%CI=1.13-4.80; P=0.022] compared to those women aged below 31 years old 56(53.3%). Single pregnant women had significantly higher proportion of anaemia 28(73.7%) [OR=2.40; 95%CI=1.11-5.17; P=0.023] compared to those who were married 131(59.8%). The proportion of anaemia was significantly more among self-employed women 65(61.9%) [OR=2.17; 95%CI=1.21-3.89; P=0.010] and government or private employed women 46(66.7%) [OR=2.67; 95%CI=1.38-5.17; P=0.004] than to those who were housewives 36(42.9%).

Table 4. 13: Relationship between socio-demographic characteristics and occurrence of anaemia

Socio-demographic attributes	Anaemia		OR(95%CI)	χ2 test
	Anaemic, n(%)	Non-anaemic, n(%)		P value
Age in years				
18-24	56(53.8%)	48(46.2%)	1.00	
25-30	53(52.0%)	49(48.0%)	0.93(0.54-1.60)	0.786
31 years and above	38(73.1%)	14(26.9%)	2.33(1.13-4.80)	**0.022**
Religion				
Christian	134(57.5%)	99(42.5%)	1.25(0.55-2.86)	0.597
Muslim	13(52.0%)	12(48.0%)	1.00	
Marital status				
Single	28(73.7%)	10(26.3%)	2.40(1.11-5.17)	**0.023**
Married	118(53.9%)	101(46.1%)	1.00	
Level of education				
Primary	32(59.3%)	22(40.7%)	1.18(0.59-2.39)	0.638
Secondary	69(57.0%)	52(43.0%)	1.08(0.61-1.92)	0.792
University/college	43(55.1%)	35(44.9%)	1.00	
Occupation				
Self-employed (business)	65(61.9%)	40(38.1%)	2.17(1.21-3.89)	**0.010**
Government employed	46(66.7%)	23(33.3%)	2.67(1.38-5.17)	**0.004**
House wife	36(42.9%)	48(57.1%)	1.00	
Household income in Ksh				
<10,000	40(58.8%)	28(41.2%)	0.88(0.44-1.77)	0.719
10,000 -30,000	68(53.5%)	59(46.5%)	0.71(0.38-1.31)	0.275
>30,000	39(61.9%)	24(38.1%)	1.00	
Abbreviations: OR= Odds Ratio, CI= Confidence Interval, *Significant P Value Bolded				

4.2.2: Relationship between spouse's socio-demographic characteristics and anaemia

Table 4.14 below shows the bivariate analysis of relationship between spouse's socio-demographic characteristics and occurrence of anaemia among the pregnant women. However, there was no significant association at ($P<0.05$) observed between spouse's socio-demographic characteristics and occurrence of anaemia.

Table 4. 14: Relationship between spouse's socio-demographic characteristics and anaemia

Variables	Anaemia		OR(95%CI)	$\chi 2$ test
	Anaemic, n(%)	Non-anaemic, n(%)		P value
Spouse's age in years				
18-24	5(38.5%)	8(61.5%)	0.58(0.18-1.88)	0.362
25-30	66(61.1%)	42(38.9%)	1.44(0.83-2.52)	0.19
31 years and above	51(52.0%)	47(48.0%)	1.00	
Occupation of spouse				
Self-employed (Business)	54(55.1%)	44(44.9%)	0.98(0.56-1.64)	0.871
Employed	68(56.2%)	53(43.8%)	1.00	
Spouse's level of education				
Primary	16(61.5%)	10(38.5%)	1.52(0.61-3.76)	0.368
Secondary	66(56.9%)	50(43.1%)	1.25(0.60-2.24)	0.448
University/college	39(51.3%)	37(48.7%)	1.00	
Spouse's religion				
Christian	113(55.9%)	89(44.1%)	1.13(0.40-3.05)	0.835
Muslim	9(52.9%)	8(47.1%)	1.00	

Abbreviations: OR= Odds Ratio, CI= Confidence Interval

4.2.3: Relationship between obstetric history and development of anaemia

Table 4.15 below shows the bivariate analysis of relationship between obstetric history of the women and prevalence of anaemia. Although the association was not significant at (P<0.05), difference was observed between obstetric history of the women and occurrence of anaemia. The occurrence of anaemia was higher among women with two or more children compared to primigravida and women with only one child. Anaemia was also slightly higher during the second trimester (60.2%) than during the third trimester (55.2%) of pregnancies. In this study however, there was no association between inter-pregnancy space and occurrence of anaemia.

Table 4. 15: Relationship between obstetric history and development of anaemia

Variables	Anaemia		OR(95%CI)	χ2 test
	Anaemic, n(%)	Non-anaemic, n(%)		P value
Number of pregnancy (Gravida)				
1st (Primigravidae)	62(57.9%)	45(42.1%)	1.01(0.42-2.41)	0.981
2	37(51.4%)	35(48.6%)	0.78(0.31-1.91)	0.581
3	33(62.3%)	20(37.7%)	1.21(0.47-3.15)	0.696
4 and above	15(57.7%)	11(42.3%)	1.00	
Number of children				
None (1st pregnancy)	79(59.4%)	54(40.6%)	0.98(0.33-2.90)	0.964
One	35(50.0%)	35(50.0%)	0.67(0.21-2.07)	0.484
Two	24(60.0%)	16(40.0%)	1.00(0.30-3.36)	1.000
Three and above	9(60.0%)	6(40.0%)	1.00	
Gestational age (Trimester)				
Second trimester	56(60.2%)	37(39.8%)	1.23(0.73-2.06)	0.430
Third trimester	91(55.2%)	74(44.8%)	1.00	
Child spacing				
First pregnancy	68(63.6%)	39(36.4%)	1.50(0.88-2.55)	0.134
< 2 years	14(46.7%)	16(53.3%)	0.75(0.34-1.68)	0.490
≥ 2 years	65(53.7%)	56(46.3%)	1.00	

Abbreviations: OR= Odds Ratio, CI= Confidence Interval, *Significant P Value Bolded

4.2.4: Relationship between ANC visits and taking of IFAS and development of anaemia

Table 4.16 below shows the bivariate analysis of relationship between ANC visits and taking of IFAS and development of anaemia. Pregnant women who did not take IFAS during the current pregnancy were more significantly had anaemia 56(67.5%) [OR=1.92; 95%CI=1.11-3.31; P=0.020] compared to those who had taken IFAS 91(52.0%). Although it was not significant, pregnant women who attended ANC for the first time at 25-32 weeks of their gestation were more anaemic (76.2%) compared to those who attended ANC for the first time at less than 12 weeks (60%), at 12 - 18 weeks (50%) and at 19-24 weeks (60.4%).

Table 4. 16: Association between ANC visits and taking of IFAS and development of anaemia

Variables	Anaemia		OR(95%CI)	χ2 test P value
	Anaemic, n(%)	Non-anaemic, n(%)		
Gestational age at first ANC visit				
<12 weeks	12(60.0%)	8(40.0%)	0.66(0.25-1.75)	0.411
12 - 18 weeks	58(50.0%)	58(50.0%)	1.02(0.38-2.71)	0.974
19-24 weeks	61(60.4%)	40(39.6%)	2.13(0.56-8.19)	0.269
25-32 weeks	16(76.2%)	5(23.8%)	1.00	
Taking IFAS during the current pregnancy				
Yes	91(52.0%)	84(48.0%)	**1.00**	
No	56(67.5%)	27(32.5%)	**1.92(1.11-3.31)**	**0.020**
Frequency of ANC visits in the current pregnancy				
Once	49(64.5%)	27(35.5%)	1.35(0.70-2.60)	0.369
Twice	29(58.0%)	21(42.0%)	1.02(0.50-2.12)	0.941
Thrice	26(45.6%)	31(54.4%)	0.62(0.31-1.25)	0.183
4 times and above	43(57.3%)	32(42.7%)	1.00	

Abbreviations: OR= Odds Ratio, CI= Confidence Interval

4.2.5: Relationship between participants' awareness on consequences of anaemia during pregnancy and development of anaemia

Table 4.17 below shows the bivariate analysis of relationship between awareness of the pregnant women on consequences of anaemia and development of anaemia. Even though not statistically significant, anaemia prevalence was slightly higher among women who did not have awareness on the consequences of anaemia during pregnancy (58.3%) compared to those who had awareness about the consequences of anaemia (51.9%). Similarly, the occurrence of anaemia was higher among women who did not know the importance of taking IFAS during pregnancy (61.1%) compared to those who know the importance of taking IFAS (56.7%).

Table 4. 17: **Association between awareness of participants on consequences of anaemia during pregnancy and development of anaemia**

	Anaemia			**χ2 test**
Variables	**Anaemic, n(%)**	**Non-anaemic, n(%)**	**OR(95%CI)**	**P value**
Knowledge about an illness when a person has little blood				
Yes	89(58.6%)	63(41.4%)	1.12(0.71-1.99)	0.503
No	58(54.7%)	48(35.3%)	1.00	
Awareness on consequences of anaemia during pregnancy				
Yes	27(51.9%)	25(48.1%)	0.77(0.34-1.16)	0.410
No	120(58.3%)	86(41.7%)	1.00	
Knowledge about importance of taking IFAS during pregnancy				
Yes	136(56.7%)	104(43.3%)	0.83(0.31-2.23)	0.713
No	11(61.1%)	7(38.9%)	1.00	

Abbreviations: OR= Odds Ratio, CI= Confidence Interval

4.2.6: Relationship between dietary habits and life style and occurrence of anaemia

An analysis of the relationship between dietary habits and life style and occurrence of anaemia is presented in Table 4.18. There was more proportion of anaemia among women who ate soil 32(62.7%) than those who did not eat soil 115(55.6%). However, the difference was not significant [OR=1.35; 95%CI=0.71-2.53; P=0.353]. Moreover, there was no significant association observed between taking tea, cocoa, or coffee (beverages) and occurrence of anaemia.

Table 4. 18: Relationship between dietary habits and life style and occurrence of anaemia

Dietary habits and life style	Anaemia		OR(95%CI)	χ2 test
	Anaemic, n(%)	Non-anaemic, n(%)		P value
Taking tea, cocoa, or coffee (beverages)				
Yes	136(56.4%)	105(43.6%)	0.71(0.23-1.96)	0.505
No	11(64.7%)	6(35.3%)	1.00	
Time when these beverages had taken				
<20 min before/after meals	86(54.1%)	73(45.9%)	0.75(0.44-1.30)	0.307
>20 min before/after meals	50(61.0%)	32(39.0%)	1.00	
Number of meals consumed per day				
Twice	41(65.1%)	22(34.9%)	2.33(0.61-10.30)	0.241
Thrice	78(54.5%)	65(45.5%)	1.50(0.32-5.77)	0.558
4 times	24(55.8%)	19(44.2%)	1.358(0.37-6.70)	0.536
5 times	4(44.4%)	5(55.6%)	1.00	
Foods avoided during the current pregnancy				
Yes	45(52.3%)	41(47.7%)	0.75(0.44-1.23)	0.286
No	102(59.3%)	70(40.7%)	1.00	
Craving for non-food substances during the current pregnancy				
Yes	32(62.7%)	19(37.3%)	1.35(0.71-2.53)	0.353
No	115(55.6%)	92(44.4%)	1.00	
Abbreviations: OR= Odds Ratio, CI= Confidence Interval				

4.2.7: Relationship between food consumption based on 24 hours re-call and anaemia

Table 4.19 shows the association between food consumption based on 24 hours re-call and occurrence of anaemia. However, there was no significant association observed between these variables.

Table 4. 19: Relationship between food consumption based on 24 hours re-call and anaemia

Types of foods	Anaemia		OR(95%CI)	χ2 test
	Anaemic, n(%)	Non-anaemic, n(%)		P value
Cereals and cereal products				
Yes	143(56.7%)	109(43.3%)	0.66(0.11-3.65)	0.628
No	4(66.7%)	2(33.3%)	1.00	
Milk and milk products				
Yes	133(57.8%)	97(42.2%)	1.37(0.63-3.01)	0.430
No	14(50.0%)	14(50.0%)	1.00	
Meat, poultry, organ meat and offal (e.g. goat, beef, chicken or their products, liver, kidney, heart)				
Yes	86(53.4%)	75(46.6%)	0.68(0.44-1.27)	0.137
No	61(62.9%)	36(37.1%)	1.00	
Pulses/legumes, nuts and seeds (e.g. beans, lentils, green grams, peanuts)				
Yes	100(56.2%)	78(43.8%)	0.90(0.55-1.63)	0.700
No	47(58.8%)	33(41.2%)	1.00	
Root and tubers				
Yes	87(56.1%)	68(43.9%)	0.92(0.58-1.64)	0.736
No	60(58.3%)	43(41.7%)	1.00	
Vegetables				
Yes	138(58.0%)	100(42.0%)	1.69(0.67-4.22)	0.260
No	9(45.0%)	11(55.0%)	1.00	
Fruits				
Yes	123(57.7%)	90(42.3%)	1.20(0.63-2.28)	0.587
No	24(53.3%)	21(46.7%)	1.00	
Eggs				
Yes	71(55.5%)	57(44.5%)	0.87(0.52-1.42)	0.627
No	76(58.5%)	54(41.5%)	1.00	
Fish				
Yes	57(51.8%)	53(48.2%)	0.69(0.42-1.14)	0.149
No	90(60.8%)	58(39.2%)	1.00	

Abbreviations: OR= Odds Ratio, CI= Confidence Interval

4.2.8: Relationship between health conditions of the participants and anaemia

The relationship between health conditions of the pregnant women and anaemia is presented in **Table 4.20.** Pregnant women who had febrile illness in the last one month preceding the study were significantly more anaemic 18(78.3%) [OR=2.96; 95%CI=1.06-8.23; P=0.031] compared to those who reported otherwise 129(54.9%). HIV positive pregnant women also significantly had higher prevalence of anaemia 16(80.0%) [OR=3.27; 95%CI=1.06-10.06; P=0.030] compared to HIV negative women 131(55.0%).

Table 4. 20: Relationship between health conditions of the participants and anaemia

Variables	Anaemia		OR(95%CI)	χ2 test
	Anaemic, n(%)	Non-anaemic, n(%)		P value
Health problems during the current pregnancy				
Yes	25(55.6%)	20(44.4%)	0.93(0.49-1.78)	0.832
No	122(57.3%)	91(42.7%)	1.00	
Occurrence of diarrhoea for the last one month preceding the study				
Yes	3(37.5%)	5(62.5%)	0.44(0.13-1.89)	0.258
No	144(57.6%)	106(42.4%)	1.00	
Occurrence of febrile illness for the last one month preceding the study				
Yes	18(78.3%)	5(21.7%)	2.96(1.06-8.23)	**0.031**
No	129(54.9%)	106(45.1%)	1.00	
Treating for worms in the last 6 month preceding the study				
Yes	33(50.0%)	33(50.0%)	0.68(0.39-1.21)	0.184
No	114(59.4%)	78(40.6%)	1.00	
Treating for malaria in the last 6 month preceding the study				
Yes	14(56.0%)	11(44.0%)	0.96(0.42-2.20)	0.917
No	133(57.1%)	100(42.9)	1.00	
HIV status of the women				
Positive	16(80.0%)	4(20.0%)	**3.27(1.06-10.06)**	**0.030**
Negative	131(55.0%)	107(45.0%)	1.00	

Abbreviations: OR= Odds Ratio, CI= Confidence Interval, *Significant P Value Bolded

4.2.9: Relationship between anthropometric measurements and anaemia

Table 4.21 below shows the bivariate analysis of relationship between anthropometric measurements and development of anaemia. Pregnant women with MUAC of less than 23cm were significantly more likely to be anaemic 50(70.4%) [OR=2.21; 95%CI=1.23-3.97; P=0.007] compared to those with MUAC of ≥ 23cm 108(57.8%). Although not significant, anaemia prevalence was higher among women with weight of less than 50 kg (71.4%) compared to those with weight of 50kg - 60 kg (60.9%) and to those with weight of above 60 kg (54.9%) respectively.

Table 4. 21: **Relationship between anthropometric measurement and anaemia**

Variables	Anaemia		OR(95%CI)	χ2 test
	Anaemic, n(%)	Non-anaemic, n(%)		P value
Weight				
< 50 Kg	5(71.4%)	2(28.6)	2.05(0.38-10.75)	0.398
50-60 Kg	42(60.9%)	27(39.1%)	1.28(0.73-2.24)	0.398
> 60 Kg	100(54.9%)	82(45.1%)	1.00	
Height				
<150 cm	15(68.2%)	7(31.8%)	1.69(0.66-4.29)	0.267
≥150 cm	132(55.5%)	104(44.1%)	1.00	
MUAC				
<23 cm	54(76.1%)	17(23.9%)	**2.32(1.25-4.30)**	**0.007**
≥23 cm	108(57.8%)	79(42.2%)	1.00	

Abbreviations: OR= Odds Ratio, CI= Confidence Interval, *Significant P Value Bolded

4.3: Multivariate analysis

4.3.1 Factors independently associated with anaemia among pregnant women

Binary logistic regression analysis was performed in order to identify factors independently associated with anaemia**.** Seven (7) factors that associated with anaemia at P<0.05 during bivariate analysis were subjected all together in a multiple regression analysis. These include participants': (1) age, (2) Marital status, (3) Occupation status, (4) iron and folic acid supplementation during the current pregnancy, (5) Febrile illness (6) HIV status, and (7) MUAC. Upon fitting these factors using binary logistic regression and by specifying *'backward LR* method with removal at P<0.05, four (4) factors remained in the reduced model **(Table 4.22).**

Pregnant women aged 31 years and above were about 3 fold more likely to be anaemic **[AOR=2.71; 95%CI=1.25-5.88; P=0.012]** compared to those aged 18-24 years. Pregnant women who were employed by government or private sectors had 2.9 times **[AOR=2.94; 95%CI=1.47-5.88; P=0.002]** and those who were self-employed had 1.9 times **[AOR=1.91; 95%CI=1.03-3.53; P=0.039]** more likely to be anaemic compared to housewives. Pregnant women who did not take iron supplementation during the current pregnancy were 2 times more likely to develop anaemia **[AOR=2.04; 95%CI=1.14-3.64; P=0.016]** than those who took the supplements. Pregnant women with MUAC of less than 23cm were about 2.5 fold more likely to be anaemic **[AOR=2.52; 95%CI=1.36-4.67; P=0.003]** compared to those who had MUAC of 23.cm and above.

Table 4. 22: Factors associated with anaemia among pregnant women

Predictors	AOR	(95%CI)		χ2 test
		Lower	Upper	* P value
Full model				
Age in years				
18-24	**1.00**			
25-30	1.11	0.61	2.02	0.742
31 years and above	2.93	1.32	6.51	**0.008**
Marital status				
Single	2.00	0.86	4.65	0.105
Married	1.00			
Occupation				
Self-employed	1.65	0.87	3.11	0.123
Government or private employed	2.90	1.43	5.88	**0.003**
House wife	1.00			
Taking IFAS during the current pregnancy				
Yes	1.00			
No	1.86	1.03	3.37	**0.041**
Whether the women had febrile illness for the last one month				
Yes	2.30	0.76	6.92	0.139
No	1.00			
HIV status of the women				
Sero-positive	2.68	0.82	8.75	0.103
Sero-negative	1.00			
Nutritional status (MUAC) of the women				
<23 cm	2.37	1.27	4.43	**0.007**
≥23 cm	1.00			
Reduced model				
Age in years				
18-24	**1.00**			
25-30	1.00	0.56	1.78	0.995
31 and above	**2.71**	**1.25**	**5.88**	**0.012**
Occupation				
Self-employed	**1.91**	**1.03**	**3.53**	**0.039**
Government or private employed	**2.94**	**1.47**	**5.88**	**0.002**
House wife	**1.00**			
Taking IFAS during the current pregnancy				
Yes	**1.00**			
No	**2.04**	**1.14**	**3.64**	**0.016**
MUAC				
<23 cm	**2.52**	**1.36**	**4.67**	**0.003**
≥23 cm	**1.00**			
Abbreviations: AOR= Adjusted odds Ratio, CI= Confidence Interval				

CHAPTER FIVE: DISCUSSION

5.1 Prevalence of anaemia during pregnancy

Worldwide, the prevalence of anaemia during pregnancy has been estimated at 41.8%, (McLean et al., 2006). In developing countries, the prevalence of anaemia during pregnancy is 60.0% (Agan et al., 2010). In Africa 57.1% of pregnant women are anaemic (de Benoist et al., 2008). In Kenya the national prevalence of anaemia in pregnancy is 55.1% (MOH, 2013). In this study, the overall prevalence of anaemia among pregnant women in Nairobi, Pumwani Maternity Hospital was 57%. According to WHO classification of the public health importance of anaemia, (McLean et al., 2008), it is a severe public health problem among the pregnant women in this study. This finding is slightly higher than the `Kenya national prevalence of anaemia in pregnancy. And also much higher than that of Kakamega County finding which was 40% (Mulambalah et al., 2014) and unpublished finding from Mbagathi District Hospital, Nairobi 36.2% (Carolyne Wanjiru, 2013). This variation can be due to the fact that the participants of this study did not include pregnant women in the first trimester as anaemia is more common in the second and third trimesters. However, the figure is relatively comparable to other studies conducted in African countries such as Nigeria at 54.5% (Olujimi et al., 2014) and Ethiopia at 56.8% (Kefyalew and Abdulahi, 2014) and Malaysia at 57.4% (Nik et al., 2012). But it is much lower than the findings from Uganda at 63.1% (Mbule et al., 2013) and Egypt at 62.2% (Zakia et al., 2011) and higher than Tanzanian finding at 47.4% (Sia *et al*., 2013).

Since majority, 75.6%, of the participants had monthly income of less than 30,000 Ksh, the high prevalence of anaemia in this study was mostly related to the low socioeconomic status of the women, which have impact on their nutritional status and health seeking behaviour (Bukar et al., 2009). Women in low socio-economic classes are likely to be poorly educated and often have financial constraints. These women cannot afford good health services or they might not have access to health services. The result is that they suffer the deleterious effects of poor nutrition, HIV, chronic infections and worm infestations. Moreover, participants' booking time for ANC in this study was late. Only 13(7.4%) of the pregnant women started attending ANC before 12 weeks of gestation. This late booking may also play a role for the observed high prevalence.

5.2 Factors associated with anaemia during pregnancy

Relationship between maternal age and anaemia: The odds of anaemia were observed to rise as maternal age advances. Pregnant women aged 31 years and above were significantly more anaemic compared to those mothers below 31 years old. This result is in agreement with the previous studies such as in Kisumu District of Kenya (Kennedy Nyabuti Ondimu, 2000), Ethiopia (Samson et al., 2014), Tanzania (Sven Gudmund, 2001) and Egypt (Noha and Sakina, 2014) which found that late pregnancy is significantly increased risk of developing anaemia. It is generally believed that anaemia in pregnancy increases with rising parity and maternal age. Besides the general body weakness with advanced maternal age, older women are expected to be multigravidae. Multigravida may induce anaemia by reducing maternal iron reserves at every pregnancy and by causing blood loss at each delivery (Adinma et al., 2002).

Association between marital status and anaemia: Even though it was not statistically significant in multivariate logistic regression (but significant in bivariate analysis), single pregnant women had significantly higher proportion of anaemia compared to the married women. This result is in agreement with other previous studies in Northern Nigeria (Nwizu et al., 2011) and Brasil (Claudia et al., 2013) which found that women without a partner is significantly increased risk of developing anaemia. This can be due to the fact that married women are in a better position to get emotional, physical and economic support from their husbands. Women without a partner usually tend to have greater financial difficulties.The low socioeconomic status of the women may have a significant impact on their nutritional status and health seeking behavior.

It is suggested that women in low socioeconomic classes are likely to be poorly educated and often have financial constraints. Such women are likely to find it difficult to access and afford good health services. Women with low socioeconomic status tend to consume diets that are low in micronutrients, animal proteins and vitamins but high in carbohydrate and phytates which interfere with intestinal uptake of iron and other trace minerals such as zinc and calcium (Vander Jagt et al., 2007). They are therefore more likely to suffer the adverse effects of poor/inadequate nutrition, acute/chronic infections and worm infestations associated with anaemia. This indicates that economic empowerment of women would play a very important role in reducing the prevalence of anaemia in our community.

Association between participant's employment and anaemia: The proportion of anaemia was significantly more among employed participants compared to the housewives. This finding is in line with studies conducted in Pakistan (Baig-Ansari et al., 2014) and Brasil (Claudia et al., 2013).This was not unexpected, where women often need to work outside the home because of low family income. These women could not have enough resting time as a pregnant and attending ANC compared to housewives. Furthermore, most of these women would be considered underemployed, i.e., employed but with jobs that were unsteady and low-paying. Housewives on the other side could have high family income which makes them remain in the house. This is probably because their husbands had jobs with high income. Being a housewife has advantages of having adequate resources like good housing, clean water and sanitation and eating nutritious diet. Also these housewives can have enough resting time as well as time to attend ANC clinic more frequently than the employed pregnant women. This can greatly contribute to the well-being of the women and the positive outcome of the pregnancy.

Association between obstetric history of the women and prevalence of anaemia: Although it was not statistically significant, anaemia was slightly higher at second trimester (60.2%) than at third trimester (55.2%) of pregnancy. This finding is in agreement with a study carried out in Benin (Smaila Oue´draogo et al., 2012). In contrast to this study, a cross-sectional study done in Turkey revealed that anaemia was more frequent at the third trimester than at the second trimester (Leyla Karaogl et al., 2010). The higher prevalence of anaemia in second trimester coincides with the period when haemodilution is at its peak. This may have contributed to the high prevalence recorded in the second trimester, indicating that anaemia is further aggravated by haemodilution. However, more studies are required to prove these contrasting findings.

Association between iron and folic acid supplementation and anaemia: This study revealed that the risk of developing anaemia was significantly more among pregnant women who did not take iron and folic acid supplements compared to those who took these supplements. This finding is in line with other previous studie``s such as Ethiopia (Kefyalew and Abdulahi, 2014, Abel Gebre and Afework Mulugeta, 2015), Uganda (Sam et al., 2014), Nigeria (Nwizu et al., 2011), Vietnam (Vivek et al., 2012, and Fujimori et al., 2011) and India (Zahara, 2010, Khan et al., 2010 and Aikawa et al., 2006) which indicated that lack of iron supplementation is among the most significant risk factors for developing anaemia during pregnancy.

The reason for this might be pregnant women who take their iron tablets which can help them to increase their hemoglobin level and prevent anaemia during pregnancy time. Even if the woman had a normal amount of iron before pregnancy, more is needed during pregnancy. This is due to the growth of the foetus, the uterus, the placenta, increased RBC mass and many other changes taking place in a pregnant mother that require many nutrients, especially iron and folic acid (Royston and Armstrong, 1989). This requirement is not met by food alone in developing countries, and therefore oral iron supplementation is justified (Olujimi et al., 2014).Therefore, to reduce the risk of maternal anaemia, iron deficiency and poor pregnancy outcomes, the WHO guidelines recommend a standard daily oral dose of 60 mg iron and 400 μg folic acid supplements throughout pregnancy, to begin as early as possible as a part of antenatal care (ANC) programs.

In this study, the time of the first ANC visit was late among these pregnant women as only 7.4% booked for ANC in the first trimester of pregnancy. Therefore these mothers are likely to get iron and folic acid supplementation for a shorter duration during pregnancy as compared to those who started attending ANC earlier. This may have contributed to the high prevalence of anaemia recorded in this study. Moreover, the result revealed that the awareness of pregnant women on the consequences of anaemia during pregnancy was poor. Only 20.2% of the participants were aware about the consequences of anaemia during pregnancy. This late booking time for ANC can be due to inadequate information about benefits of taking iron and folic acid, cultural and health beliefs and undesirable side effects associated with intake of iron and folic acid supplements (Timmermans et al., 2008; Seck and Jackson, 2008).

Relationship between awareness of participants on consequences of anaemia during pregnancy and development of anaemia: Even though not statistically significant, anaemia prevalence was slightly higher among women who did not have awareness on the consequences of anaemia during pregnancy (58.3%) compared to those who had awareness about the consequences of anaemia (51.9%). This is due to the fact that women who had awareness about the consequences of anaemia are more likely to have health seeking behavior including ANC visits compared to those women who did not have awareness about the consequences of anaemia.

Relationship between dietary habits and life styles and anaemia: In the present study, the relationship between dietary habits and life styles and development of anaemia was not significant. However, majority, 93.4%, of the pregnant women said they drink beverages (tea, cocoa or coffee) and 66.0% of them take these beverages within less than 20 minutes before or after meals. Tea consumption is associated with anaemia by reducing iron absorption (Baig-Ansari et al., 2008). Drinking tea at breakfast and just after the meal are common unhealthy dietary habits in our community. Therefore, dietary advice should be given to all mothers to improve intake and absorption of iron from food. Thus, continuous nutrition education and monitoring programs should be developed to combat anaemia. The frequency of taking iron and folic acid rich foods twice or more days per week by the participants were as follows: dark green vegetables (84%), cabbage (44.6%), liver (33.8%) and beef/goat meat (64.7%).

Also, the study showed that one pregnant woman out of five was eating soil. Although it was not significant, anaemia was more prevalent among those who ate soil (62.7%) compared to those who did not eat soil 115(55.6%). This finding is in agreement with the study conducted in Turkey (Leyla et al., 2010). Soil eating (pica) is known to be an old problem in developing countries. However it is still debatable whether soil eating causes anaemia or anaemia leads soil eating (Leyla et al., 2010). Thus further studies are required to justify this debate.

Anthropometric measurements and anaemia: The present study showed that pregnant women with MUAC of less than 23 cm had higher prevalence of anaemia. This finding is consistent with previous studies in Western Kenya (Alysse et al., 2014), Ethiopia (Kefyalew and Abdulahi, 2014), India (Bechuram et al., 2006) and Nepal (Makhoul et al., 2012), which found that MUAC of less than 23 cm significantly increased risk of developing anaemia. This can be explained by the fact that undernourished pregnant women have a higher probability of being deficient of micronutrients and therefore more likely to develop anaemia. Pregnancy is the most nutritionally demanding period in a woman's life. Consequently, pregnant women are advised to eat more diversified diet than usual (Gebremedhin and Enquselassie, 2005).

Relationship between health problems during the current pregnancy and anaemia: Although they are not significant in the multivariate analysis (but significant in the bivariate analysis) women with febrile illness and HIV infection had higher likelihood of having anaemia. Pregnant women with febrile illness in the previous one month preceding the study had higher

proportion of anaemia. This finding is in line with previous studies in Oromia Region of Ethiopia (Niguse et al., 2013) and in Northern Nigeria (Nwizu et al., 2011). Fever can be a sign for any infection like malaria, a major cause of anaemia especially in malaria endemic areas. Infection can lead to mal-absorption and inhibition of appetite, thereby worsening micronutrients deficiency and maternal anaemia.

The present study showed that the proportion of anaemia among pregnant women who had been infected with HIV was significantly higher compared to those non-infected. This is in line with previous studies such as in Nairobi (Pumwani Maternity Hospital), Kenya (Waweru, 2006), Nigeria (Adesina et al., 2011, Buseri et al., 2008), Tanzania (Sia *et al*., 2013), Ethiopia (Mulugeta et al., 2014) and Uganda (Sam et al., 2014) Which found that HIV infection is the main factors for development of anaemia. HIV infection is implicated with high prevalence of anaemia in sub-Saharan Africa (Ouédraogo *et al.,* 2012; Tolentino and Friedman, 2007). This is not unexpected as HIV infection is a recognized risk factor for anaemia. Suggested mechanisms of anaemia causation by HIV include bone marrow suppression due to cytokine release, and anaemia as a result of chronic inflammation or opportunistic infections which may be further exacerbated by antiretroviral drugs like zidovudine, a component of highly active antiretroviral therapy. Zidovudine causes bone marrow suppression and thus increases the risk of anaemia. HIV infection is also associated with lower serum levels of folate, vitamin B12, and ferritin in pregnancy (Olujimi et al., 2014). In addition, Anemia in HIV/AIDS patients may arise from deregulation of the host immune system leading to destruction or inhibition of hematopoietic cells (Henry and Hoxie, 2008).

Other independent variables which are not significant factors in this study but found to be significant by other studies include birth interval, number of pregnancies, parity and level of education (Abrehet et al., 2014, Samson et al., 2014, Geraldine and Paul, 2012 and Bechuram et al., 2006).This could be due to differences between sociocultural and behavioral characteristics of the community in this study and previous studies.

CONCLUSION AND RECOMMENDATIONS

Conclusion

The present study revealed that the prevalence of anaemia among pregnant women was 57% which is a severe public health problem. The foregoing discussion has indicated that anaemia during pregnancy is a result of many factors, including late pregnancy, lack of formal employment and economic autonomy, poor nutritional status and late ANC booking and not taking IFAS during the current pregnancy. All these factors lead to poor health condition of the pregnant women thus by the time such mothers attend for ANC, they are already in anaemic state.

In Kenya, the current strategy for reducing anaemia during pregnancy includes the provision of iron and folic acid tablets, advice on dietary intake, diagnosis and treatment of malaria and hookworms. IFAS is the most common and cost-effective strategy used to control anaemia in the developing countries including Kenya and is used as both a preventive measure and a treatment option. However, in spite of the WHO and Kenya national guidelines recommendations, the study revealed that ANC booking and starting to take IFAS was too late. This late ANC booking is probably due to the fact that women with low socioeconomic situation have lack of access to education and understanding about health related issues which can contribute to delays in seeking antenatal care and makes them prone to different health problems like anaemia.

To reduce this high prevalence of anaemia during pregnancy, therefore, interventions for prevention and control of anaemia should be strengthened by encouraging early ANC booking. Early ANC booking provides opportunities for early detection and treatment of any health problem that can arise during pregnancy and initiation of IFAS as recommended. There is need, therefore, for the government of Kenya, through the relevant ministries, to address these risk factors by encouraging female education and enhance their autonomy through economic empowerment.

Recommendations

This study has shown that anaemia in pregnancy is still prevalent in pregnant women at Pumwani Maternity Hospital identifying not taking IFAS, late pregnancy, employed women and nutritional status (MUAC less than 23 cm) as risk factors. In the light of this, it is recommended that:

1. Continuous reproductive advice and education should be given to all reproductive age women to create awareness about the risk of developing anaemia with late pregnancy. This will help to limit the child bearing age up to where the women can give birth without compromising their health.
2. Employed pregnant women should be given time from their employers to attend ANC and enough maternity leave before delivery to get adequate resting time and time for birth plan and after delivery to recover fully.
3. Since pregnancy is the most nutritionally demanding period in a woman's life, pregnant women should be encouraged and educated to eat more diversified extra meal and iron-rich foods during pregnancy than usual to reduce the incidence of anaemia during pregnancy.
4. There is a need for interventions such as mass media campaigns, outreach education on the importance of early ANC booking and compliance with the use of prescribed medications. Late ANC booking should be eliminated through appropriate health education and community mobilization.
5. Community based study needs to be done to determine the prevalence and specific predictors of anaemia as well as the types of anaemia based on red blood cell morphology in the population of pregnant women. This would aid in planning health care services, reducing maternal morbidity and mortality and help improve the wellbeing of women in the society in general.

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APPENDICES

APPENDIX I: Participants Information Sheet and Consent Form

Title of study: Factors associated with anaemia among pregnant women attending antenatal clinic (ANC) during the second and third trimesters at Pumwani Maternity Hospital, Nairobi.

Investigator: Okubatsion Tekeste Okube
School of Nursing Sciences,
University of Nairobi
P.O. Box 19676, Nairobi.

Part I: Participants' Information

I am carrying out a study to determine factors associated with anaemia among pregnant women attending antenatal clinic during the second and third trimesters at Pumwani Maternity Hospital, Nairobi.

I am kindly requesting you to participate in this study. This form provides you with information that you need to know so that you can decide whether to take part in the study or not. This consent form gives you information about the procedure, purpose, benefits, risks, confidentiality and the process that will be used during the study. Your participation is wholly voluntary.

Purpose of the study

The purpose of this study is to identify factors associated with anaemia during pregnancy. Knowledge on the factors contributing to anaemia during pregnancy will enhance early detection and timely management of anaemia in pregnancy. Therefore, the burden of the disease will be reduced.

Procedure of Study

If you agree to participate in the study, you will be asked questions about demographic and socio-economic characteristics, adherence to iron and folic acid, general health history, knowledge on causes and consequences of anaemia, dietary practices and use of ANC services. Your Haemoglobin level will be measured directly from one drop of capillary blood via finger

prick from the middle finger. Moreover, anthropometric measurements of weight, height and MUAC will be included in the data collection process.

Risks

The information that you will provide cannot be identified with you. The interviews will take place in private room and the information you provide will be coded so that you cannot identified. The finger prick may cause some temporary pain in your finger. The procedure is routinely used and presents almost no risk. The amount of blood that will be taken is very little.

Benefits

This study may or may not benefit you immediately. However, the information you provide will help increase the understanding on factors causing anaemia among pregnant women. Knowledge of the contributing factors of anaemia during pregnancy will help investigate and manage anaemia in pregnancy and therefore reduce the burden of disease. The result of the test will be communicated to you immediately after the blood sample is taken. If you are anaemic, the research assistant will assist you or connect you with the right health provider for proper treatment and follow-up based on the severity of the anaemia.

Confidentiality

I assure you that all the information collected from you will be kept strictly confidential. Only people working in this study will have access to the information. We will not put your name or other identifying information on the records of the information you provide.

Rights

Participation in the study is wholly voluntary. You may decline to participate or withdraw your consent at any point during the study. If you withdraw, your care will not be affected in any way. You have a right to ask any question or clarifications any time during the study.

Contacts:

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Part II: Participants Declaration and Consent Form:

I hereby consent to participate in this study. I have been informed of the nature of the study being undertaken and potential risks explained to me. I have understood its purpose and my rights as a participant in the study. I have been given a chance to ask questions and have been assured that if in future I have any concerns about the study or my rights as a subject, I can ask the investigator. I understand that I can withdraw from the study at any time. I voluntarily agree to participate in the study. I have also been reassured that my personal details and the information I will relay will be kept confidential.

Participant's signature (or thumbprint)……Date……

I confirm that I have clearly explained to the participant the nature of the study and the contents of this consent form in detail and the participant has decided to participate voluntarily without any coercion or undue pressure.

Research assistant's signature …… Date:……

Principal investigator's Signature…… Date:……

APPENDIX II: Study Questionnaire

Questionnaire on factors associated with anaemia among pregnant women in the second and third trimesters attending antenatal clinic at Pumwani Maternity Hospital, Nairobi.

Serial Number _____Interviewer's ID _____Date of Interview ____/____/_____
Your honest responses on the following questionnaire will greatly assist in the attempt to identify factors that contribute to the occurrence of anaemia during pregnancies and hence improve recognition and management of anaemia in pregnancies.

Section 1: Demographic Information of Participants

1. Age in years: _____

2. Residence: [1] Nairobi [2] If not Nairobi, where do you live: _____

a. if Nairobi, state the place of residence_____

3. Marital status: [1] single [2] married [3] divorced [4] widowed

4. Occupation status:

[1] Self-employed (Business) [2] Government or private employed [3] Housewife

5. Religious affiliation: [1] Christian [2] Muslim [3] none [4] Others (specify): _____

6. Educational level: [1] none [2] primary (1-4 years) [3] primary (5-8 years)

[4] form 1-2 [5] form 3-4 [6] Certificate- diploma [7] Degree

7. Family's monthly income (Ksh):

[1] <10,000 [2] 10,000 -30,000 [3] 30,000- 50,000 [4] 50,000- 70,000 [5] 70,000- 90,000
[6] 90,000- 100,000 [7] 100,000 – 120,000 [8] >120,000 [9] I do not know

Section 2. Spouse information:

1. Age in years: _____

2. Occupation: [1] Self-employed (Business) [2] Government or private employed

[3] Others: _____

3. Educational level: [1] none [2] primary (1-4 years) [3] primary (5-8 years)

[4] form 1-2 [5] form 3-4 [6] Certificate- diploma [7] Degree4.

Religious affiliation: [1] Christian [2] Muslim [3] none

[4] Others (specify) _____

Section 3: Obstetric history of the participants

1. Number of pregnancies (gravida): _____
2. Parity_____
3. Number of children: _____
4. Age of the youngest child: _____
5. Gestational age of the current pregnancy (in weeks): _____
6. History of abortion

1 .Yes 2. No

a. If yes, how long a go_____

Section 4: Ante natal clinic (ANC) visits of the participants

1. Gestational age in weeks at first ANC visit_____
2. How many times have you attended ANC during this pregnancy? _____
3. Have you ever been given of iron/folate tables since you became pregnant?

1. Yes 2. No

a. If yes, when did you start taking these tablets? In Weeks_____

b. If No, what are the reasons? _____

c. are you taking these tablets currently? 1. Yes 2. No

d. If yes to (c), in the past 1 week have you taken any iron/folate tablets or syrup?

1. Yes 2. No

e. if yes to (c),in how many days have you taken iron/folate tablets or syrup in the last 1 week?_____

f. If no to (c), why are you not taking them? _____

4. Frequency (number of days) of IFA supplementation per week_____
5. What was your source for the iron/folate tablets or syrup?
   1. Public pharmacy 2. Private pharmacy 3. N/A

Section 5: Side effects of iron and folic acid supplementation

6. a. have you experienced any health problem by taking these tablets? 1.Yes 2. No

   b.if yes, state the problem(s)_____

Section 6: Challenges in attending ante natal clinic

1. a. Is there any challenge that has hindered your attendance to ANC? 1. Yes 2. No

   b. If yes, state the challenge(s)

_____

2. How long does it take you to travel from your place of residence to this health facility in minutes? _____

3. What means of transport do you use to get to this health facility?

   1. Walking 2.Private car 3.Matatu 4. Motor cycle

4. How much money, if any, does it cost you to get to this facility and go back your home? _____Ksh

5. For how long were the tablets or syrup you were given to last? _____

Section 7: Awareness of pregnant women on causes and consequences of anaemia during pregnancy

1. Have you ever heard of an illness where the person is said to have little or no blood?

1. Yes 2. No a. If yes, do you know what causes the disease?

1. Yes 2. No

b. If Yes for (a), state the causes? _____

_____

c. Do you know what the consequence(s) of this disease in pregnancy is/are?

1. Yes 2. No

d. If Yes for (c), state the consequence(s): _____

_____

2. Do you think it is important to take iron/folate tablets during pregnancy? 1. Yes 2. No

a. If Yes, why? _____

b. If No, why? _____

Section 8.Health conditions during the current pregnancy

1. a. Have you suffered from any illness during the current pregnancy?

1. Yes 2. No

b. If yes, what type of disease? _____

c. If yes to (a), how long ago? _____

d. If yes to (a), for how long did the disease last? _____

2. a. Have you had a diarrhoeal illness in the past four weeks? 1. Yes 2. No

b. If yes, how many attacks of diarrhoeal illnesses have you suffered in the past four weeks?

_____

3. a. Have you had any episodes of fever in last 4 weeks? 1. Yes 2. No

b. If yes, how many times have you had fever in the past four weeks? _____

4. a. Do you have any pregnancy related problems? 1. Yes. 2. No

b.If yes, state the health problem:

_____

5. In the past 6 months, have you ever been treated for?

a. Worms 1. Yes 2. No

b. Malaria 1. Yes 2. No

6. HIV status (refer to the ANC booklet for this question): 1. Seropositive 2. Seronegative

7. a. Do you have any pregnancy related health problem during the current pregnancy?

1.Yes 2. No

b.if yes, state the pregnancy related problem(s)

_____

Section 9: Nutritional assessment of the pregnant women

9.1. Food consumption based on 24 hours dietary recall

What food did you consume in the last 24 hours (from this time yesterday to now? Include snacks) **Food group**	Did you consume food from any of these food groups in the last 24 hours? 1**. Yes 2. No**
1.Cereals and cereal products (e.g. maize, spaghetti, rice, bread, wheat, porridge, noodles, foods from millet or sorghum)	
2. Milk and milk products (e.g. goat/cow fermented milk, milk powder, cheese, yoghurt or other milk products)	
3. Sweets (e.g. sugar, honey, sweetened soda or sugary foods such as chocolates, cake, sweets or candies)	
4. Oils/fats (e.g. cooking fat, margarine, butter, ghee)	
5. Meat, poultry, beef, goat etc…	
6. Pulses/legumes, nuts and seeds (e.g. beans, lentils, green grams, peanuts)	
7. Root and tubers (e.g. potatoes, arrow roots, cassava,	

pumpkin, carrots, sweet potatoes)	
8. Vegetables (tomatoes, carrots, onions, green leafy vegetables, cabbages)	
9. Fruits (e.g. water melons, mangoes, lemon, bananas, oranges, avocadoes)	
10. Eggs	
11. Fish and sea foods	
12. Miscellaneous (e.g. spices, salt, sauce, coffee, tea, alcoholic beverages)	

9.2. Frequency of iron and folic acid rich foods consumption

Below is a list of foods rich in iron, folate and vitamin C. Please tick **(√)** how often you have eaten these foods in the last (7) days.

Food Item	**Never**	**1 Day**	**2 Days**	**3 days**	**4 days**	**5 days**	**6 days**	**7 days**
1. Dark green leafy vegetables (sukuma, spinach, terere)								
2. Cabbage								
3. Liver								
4. Beef/goat meat								
5. Chicken								
6. Fish								
7. Beans and legumes (pigeons peas, cow peas, chick peas, lentils)								
8. Citrus fruits(Orange, tangerines, lime, lemon, guava, grape fruits, passion fruit, strawberries)								
9. Vegetables such as tomatoes, pepper and parsley								
10. Whole grain cereals (finger millet) and fortified cereal products								

9.3. Anthropometric and haemoglobin measurements

(Refer to the mother's antenatal clinic card and record for previous weight and Hb level)

1. Current weight (Kgs): _____

2. Current height (cm): _____

3. Current MUAC (cm):_____

4. a. Previous haemoglobin level (g/dl): _____

b. Current haemoglobin level (g/dl): _____

Section 10. Cultural and life style habits of participants

1. Do you take tea, cocoa, or coffee? 1. Yes 2. No

2. At what times do you take these beverages?

1. During meals 2. <20 min before/after meals 3. >20 min before/after meals

3. How many meals do you take in a day? _____

4. a. Are there foods you avoid? 1. Yes 2. No

b. If yes, what type(s) of food do you avoid?

_____

c. If yes, to (a) why do you avoid these foods?

_____

5. a. Do you crave for or eat any non-food substances? 1. Yes 2. No

b. If yes, which ones? 1. Stones 2. Charcoal 3. Soil 4. Burnt matches 5. Tooth paste

6. Other (specify) _____

c. Why do you think you crave/ eat these substances? _____

6. a.Do you smoke cigarette? 1. Yes 2. No

b.If yes, how many cigarettes do you smoke per day? _____

7. a.Do you take alcohol? 1. Yes 2. No

b.If yes, which type of alcohol? _____

c. Specify the amount per day?_____

8. a. Are there any food taboos during pregnancy in your culture? 1.Yes 2. No

b.If yes, state the taboos (s) _____

APPENDIX III: Approval Letter from KNH/UON, Research and Ethics Committee

UNIVERSITY OF NAIROBI
COLLEGE OF HEALTH SCIENCES
P O BOX 19676 Code 00202
Telegrams: varsity
(254-020) 2726300 Ext 44355

KNH/UON-ERC
Email: uonknh_erc@uonbi.ac.ke
Website: http://erc.uonbi.ac.ke
Facebook: https://www.facebook.com/uonknh.erc
Twitter: @UONKNH_ERC https://twitter.com/UONKNH_ERC

KENYATTA NATIONAL HOSPITAL
P O BOX 20723 Code 00202
Tel: 726300-9
Fax: 725272
Telegrams: MEDSUP, Nairobi

KENYATTA NATIONAL HOSPITAL APPROVED 19 MAY 2015 KNH/UoN-ERC P.O.Box 20723-00202 NRB.

Ref: KNH-ERC/A/235

19th May, 2015

Okubatsion Tekeste
Reg. H56/67556/2013
School of Nursing Sciences
College of Health Sciences
University of Nairobi

Dear Okubatsion

Research Proposal : Factors associated with anemia among pregnant women attending Antenatal clinic (ANC) during the second and third trimesters at Pumwani Maternity Hospital, Nairobi (P134/03/2015)

This is to inform you that the KNH/UoN-Ethics & Research Committee (KNH/UoN-ERC) has reviewed and **approved** your above proposal. The approval periods are 19th May 2015 to 18th May 2016.

This approval is subject to compliance with the following requirements:

a) Only approved documents (informed consents, study instruments, advertising materials etc) will be used.
b) All changes (amendments, deviations, violations etc) are submitted for review and approval by KNH/UoN ERC before implementation.
c) Death and life threatening problems and severe adverse events (SAEs) or unexpected adverse events whether related or unrelated to the study must be reported to the KNH/UoN ERC within 72 hours of notification.
d) Any changes, anticipated or otherwise that may increase the risks or affect safety or welfare of study participants and others or affect the integrity of the research must be reported to KNH/UoN ERC within 72 hours.
e) Submission of a request for renewal of approval at least 60 days prior to expiry of the approval period. (*Attach a comprehensive progress report to support the renewal*).
f) Clearance for export of biological specimens must be obtained from KNH/UoN-Ethics & Research Committee for each batch of shipment.
g) Submission of an *executive summary* report within 90 days upon completion of the study
This information will form part of the data base that will be consulted in future when processing related research studies so as to minimize chances of study duplication and/or plagiarism.

For more details consult the KNH/UoN ERC website **www.erc.uonbi.ac.ke**

Protect to discover

APPENDIX IV: Approval Letter from Pumwani Maternity Hospital

NAIROBI CITY COUNTY

Telephone: 020 344194
Web.www.nairobi.go.ke

City Hall
P. O. Box 30075 - 00100
Nairobi
Kenya

COUNTY HEALTH SERVICES:
PUMWANI MATERNITY HOSPITAL

PMH/DMOH/75/0389/2015

4TH JUNE 2015

TO:
Okubatsion Tekeste
School of Nursing Science
College of Health Science
University of Nairobi

RE: APPROVAL OF RESEARCH PROPOSAL

This is to inform you that the research entitled "**Factors Associated with Anemia among Pregnant Women attending Antenatal Clinic (ANC) during the Second and Third Trimesters at Pumwani Maternity Hospital, Nairobi**" has been approved.

You are expected to pay Kshs. 6000/- only.

You are hereby allowed to collect data. We look forward to receiving a summary of the research findings upon completion of the study.

Yours sincerely,

PUMWANI MATERNITY HOSPITAL
P. O. Box 42849-00100, NAIROBI.
TEL. NRB. 6763291-4/ 6762965

DR. L.O. KUMBA
MEDICAL SUPERINTENDENT