
**FACTORS ASSOCIATED WITH ADHERENCE TO IRON/FOLATE SUPPLEMENTATION
AMONG PREGNANT WOMEN ATTENDING ANTENATAL CLINIC AT THIKA DISTRICT
HOSPITAL IN KIAMBU COUNTY, KENYA**

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**A Dissertation submitted in partial fulfillment of the requirements for the degree of
Master of Science in Applied Human Nutrition in the Department of Food Science,
Nutrition and Technology, Faculty of Agriculture, University of Nairobi**

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DECLARATION

I hereby declare that this dissertation is my original work and has not been presented for a degree in any other University.

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DEDICATION

I would like to dedicate this work to my parents Mr. Aloys Dinga and Mrs. Rose Dinga for always being my pillar of support throughout my academic journey; Sylus Owiti, my husband, for his encouragement and advice; my brothers Kenneth, Eric and Phillip have been my source of inspiration. Thank you all for being a blessing in my life.

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ACRONYMS AND ABBREVIATIONS

- ACC:** Administrative Committee on Coordination
- ANC:** Antenatal Clinic
- APGAR:** Appearance, Pulse, Grimace, Activity, Respiration.
- ASAL:** Arid and Semi-Arid Land
- CBOs:** Community Based Organizations
- CBS:** Central Bureau of Statistics
- CHW:** Community Health Worker
- DNA:** Deoxyribonucleic Acid
- FGD:** Focused Group Discussion
- Hb:** Hemoglobin
- IDDS:** Individual Dietary Diversity Score
- INACG:** International Nutritional Anemia Consultative Group
- KDHS:** Kenya Demographic Health Survey
- KEML:** Kenya Essential Medical List
- KEMSA:** Kenya National Medical Supplies Agency
- KII:** Key Informant Interview
- LBW:** Low Birth Weight
- NCAPD:** National Coordinating Agency for Population and Development
- NGOs:** Non-Governmental Organizations
- NHANES:** National Health and Nutrition Examination Survey
- SCN:** Sub-committee on Nutrition
- SPSS:** Statistical Package for Social Sciences
- WHO:** World Health Organization

OPERATIONAL DEFINITION OF TERMS

Adherence: The act or condition of sticking to dose and time for taking iron/folate supplements as per recommendations.

Anemia: A condition where the hemoglobin (Hb) level in the body is less than 11g/dl which depicts decreased oxygen-carrying capacity for pregnant women.

Antenatal Care Clinic (ANC): A section in the hospital where a pregnant woman receives regular check-ups, nutritional supplements (iron/folate) and medical and nutritional information throughout her 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.

Dietary Diversity Score (DDS): The number of food groups consumed over a reference period by index pregnant woman.

Faithful: Adhering firmly and devotedly to taking of iron/folate supplements as per recommendations.

History of Access: Taking of iron/folate supplements at any one time during the period of current pregnancy.

Household: Consists of the pregnant woman's nuclear family only excluding any other person living in the household who is not a member of the nuclear family.

Iron Deficiency Anemia (IDA): A condition in which blood lacks adequate healthy red blood cells due to lack of iron necessary for formation of hemoglobin.

Iron deficiency (ID): A situation in which iron levels in the body is less than 3g in the whole body.

Multigravidae: A woman who is or has been pregnant for at least a second time.

Perinatal: Period that starts at the 20th to 28th week of gestation and ends 1 to 4 weeks after birth.

Periconceptual: Period from before conception to early pregnancy.

Pica: Pattern of eating non-food items such as stones and soil as a result of unusual craving.

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

Supplement: Something added to make up for a deficiency.

Thalassemia: A group of genetic disorders that involve underproduction of hemoglobin.

ABSTRACT

Iron deficiency anemia is the most widespread nutritional problem among women and has severe consequences for both their productive and reproductive roles. Iron supplementation is a major strategy to reduce iron deficiency anemia in pregnancy. However, issues of adherence remain unresolved. According to the National Policy in Kenya, pregnant women should be supplemented with 60mg/day for 180 days for Iron and 400 µg of folic acid daily. In Kenya, however, adherence to the intake of the supplements has been very low with only 2.5% of pregnant women taking iron supplements > 90 days of the recommended 180 days. In Central Province only 0.7% took the supplements for \geq 90 days. The concept of how best to assist women to adhere to a daily regimen of supplement consumption is not fully understood. The objective of this study was to assess the level of adherence and determine the factors associated with adherence to iron-folate supplements among pregnant women attending antenatal clinic at Thika district hospital, Kiambu County, Kenya.

A total of 200 pregnant women were recruited to a cross-sectional survey. Using a pre-tested semi-structured questionnaire, data were collected on the women's socio-demographic and economic characteristics, adherence rate, factors hindering and those associated with adherence to iron/folate supplements, dietary diversity, frequency of consumption of iron and folate rich foods, frequency of antenatal care attendance and nutritional status (mid-upper arm circumference). Key informant interviews were conducted among four health care workers from the district hospital, and a focus group discussion among mothers with infants (< 6 months) at the community level, to collect in-depth data on the iron/folate supplementation program. Data were analyzed using statistical package for social sciences. Descriptive statistics (frequency, percentages and mean) including graphs and tables were used to analyze demographic, socio-economic, frequency of food consumption and mid-upper arm circumference data.

Impact of variables on non-adherence was estimated using logistical regression analyses. One sample t-test was used to compare differences in weight gain and mid-upper arm circumference, while relationships between categorical data were analyzed using the Chi-square.

Adherence rate (defined as use of supplements for ≥ 4 days in a week) was 24.5%. Positive significant associations were found between adherence and place of residence ($X^2=6.77$, $p=0.009$), pregnancy trimester ($X^2= 7.86$, $p=0.01$), history of low hemoglobin level in current pregnancy ($X^2=16.45$, $p=0.00$), Hb level at first ANC visit ($X^2=14.3$, $p=0.00$), knowledge on anemia ($X^2=9.89$, $p=0.00$) and number of antenatal clinic visits ($X^2=17.56$, $p=0.00$). No associations were found between adherence and age ($p= 0.64$), education level ($p= 0.41$), marital status ($p= 0.08$), household size ($p=0.11$), proportion of income spent on food ($p=0.91$) and number of previous pregnancies ($p=0.63$). Logistical regression analysis showed awareness on anemia and place of residence as predictors to adherence based on the Wald criterion. Studies have generally shown a lack of awareness on anemia among pregnant women and that when consumers are informed, the compliance rate for taking iron tablets increases.

In conclusion adherence rate to iron/folate supplements is low among pregnant women attending antenatal clinic at Thika district hospital. Factors positively significantly associated with adherence include: place of residence, gestational age, history of low hemoglobin level in current pregnancy, knowledge on anemia and number of ante natal care visits by pregnant woman. Recommendations are: sensitization of pregnant women by health professionals on the need to continuously take supplements throughout pregnancy, provision of health education to pregnant women on anemia and importance of visiting antenatal clinic at least four times during the pregnancy period, and establishment of mobile clinics to increase access to antenatal care.

CHAPTER ONE: INTRODUCTION

1.1 Background

Anemia is a global public health problem affecting both developing and developed countries with major consequences for human health as well as social and economic development. It occurs at all stages of the life cycle, but is more prevalent in pregnant women and young children. In 2002, iron deficiency anemia (IDA) was considered to be among the most important contributing factors to the global burden of disease (WHO, 2002). Nutrition related iron deficiency is the main cause of anemia throughout the world. It is especially common in women of reproductive age and particularly during pregnancy. The need for iron increases about six to seven times from early pregnancy to the late pregnancy (Christensen and Ohls, 2004).

The World Health Organization (WHO) estimates the number of anemic people worldwide to be very high (2 billion) and that approximately 50% of all anemia can be attributed to iron deficiency (WHO, 2001). The prevalence of anemia during pregnancy differs greatly from 18% in developed countries to 75% in South Asia (Christensen and Ohls, 2004). Currently the global prevalence of anemia is estimated to be 30.2% in non-pregnant women rising to 41.8% during pregnancy. Anemia prevalence 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 anemia in pregnancy ranging from a low of 41% to a high of 83% in different settings (Meda *et al.*, 1999; Antelman *et al.*, 2000; TDHS, 2005; Uneke *et al.*, 2007; Haggaz *et al.*, 2010; Kidanto *et al.*, 2009).

According to the National Micronutrient Survey of 1999, in Kenya the total anemia prevalence was 74% among children under five years and 55% among women (Mwaniki *et al.*, 1999). Iron deficiency affected 43% of both women and children. The prevalence of moderate to severe anemia was higher among pregnant women, and increased with gestation as follows: 25% during first trimester, 37.8% during second trimester and 39.4% during third trimester (Mwaniki *et al.*, 1999). Recent studies on anemia and iron deficiency in Kenya are scanty. Anemia in pregnancy is usually associated with a negative outcome for both the woman and the neonate. Foetal anemia, low birth weight (LBW), preterm birth, low APGAR (**A**ppearance, **P**ulse, **G**rimace, **A**ctivity, **R**espiration) score, intrauterine growth restriction, and perinatal mortality have been associated with anemia (Scholl and Hediger 1994; Msolla and Kinabo, 1997; Allen, 2000; Lone *et al.*, 2004; Adam *et al.*, 2007; Haggaz *et al.*, 2010; Kidanto *et al.*, 2009).

Most countries in Sub-Saharan Africa, including Kenya, have a national policy to prevent and treat anemia in pregnancy. This includes the provision of haematinics (ferrous sulphate and folic acid) to all pregnant women. The recommended dose by the Ministry of Public Health and Sanitation in Kenya is 60mg/day for 180 days for iron and 400µg of folic acid daily (MoH, 2008). Factors influencing adherence to these supplements, however, remain unknown. This study aimed at providing information to this effect.

1.2 Problem Statement

According to the Demographic Health Survey of 2008, adherence to iron/folate supplements by pregnant women in Kenya is low. Nationally only 2.5% of the pregnant women take Iron supplements more than 90 days of the recommended 180 days. In Central Province 28.5% of pregnant women do not take any iron tablets or syrup during pregnancy, while 56.3% take for less than 60 days, 2.6% take for 60-89 days and

only 0.7% take for 90 days or more (KNBS and ICF Macro, 2010). The recommended dose by the Ministry of Public Health and Sanitation of iron in pregnancy is 60 mg/day and 400µg/day respectively for 180 days. This applies for all pregnant women irrespective of their hemoglobin levels. How best to assist the women to adhere to a daily regimen of supplement consumption is not fully understood. This underscores the need to study the factors influencing adherence to iron/folate supplements to facilitate initiatives towards strengthening the iron/folate supplementation programs and reduce negative maternal birth outcomes associated with iron/folate deficiencies.

1.3 Justification of the Study

Iron deficiency anemia is the most widespread nutritional problem among women and has severe consequences for both their productive and reproductive roles. Maternal mortality rates, infant mortality rates and the incidence of prematurity among anemic women are significantly higher. Iron deficiency anemia is often associated with inadequate maternal weight gain and labor and delivery complications with an increased risk of maternal mortality (Allen, 2000). Iron supplementation has been a major strategy to reduce iron deficiency anemia in pregnancy. However, issues of adherence remain unresolved. The strategies used for control of nutrition problems need regular review to maintain and improve their effectiveness.

1.4 Aim of the Study

This study aimed at contributing towards the improvement of adherence to iron-folate supplementation in order to mitigate anemia status of pregnant women.

1.5 Purpose of the Study

The purpose of this study was to provide information on the current situation on adherence to iron-folate supplementation to serve as a basis for improving the supplementation program for pregnant women.

1.6 Objectives of the Study

The general objective of this study was to assess the level of adherence and determine the factors associated with adherence to iron-folate supplements among pregnant women in Thika Municipality, Kiambu County.

SPECIFIC OBJECTIVES

The specific objectives were to:

1. Determine the Socio-demographic and economic characteristics of pregnant women in Thika Municipality, Kiambu County.
2. Determine adherence rate and reasons for non-adherence and/or adherence in study population.
3. Assess knowledge on anemia causes and consequences in the study population.
4. Determine Dietary Diversity and frequency of consumption of iron/folate rich foods of study population.
5. Assess use of antenatal clinic (ANC) among the study population.
6. Determine the nutritional status, trends in weight gain and MUAC of the pregnant women.

1.7 Study Hypotheses

Adherence to iron/folate supplements is significantly associated with gestational age, lack of knowledge of anemia, number of previous pregnancies and number of visits to ANC by the pregnant mother.

CHAPTER TWO: LITERATURE REVIEW

2.1 Introduction

Iron deficiency is the most common nutritional disorder in the world, affecting approximately 25% of the world's population (WHO, 2002). Pregnant women are particularly at high risk for iron deficiency and iron-deficiency anemia because of increased iron needs during pregnancy. The prevalence of iron-deficiency anemia in pregnant women is estimated to be an average of 56% in developing countries whereas in industrialized countries the average prevalence is 18% (WHO, 2002). Anemia is defined as a condition where there is less than 11g/dl hemoglobin (Hb) level in the pregnant female body, which decreases oxygen-carrying capacity with levels for the pregnant female at $Hb < 11g/dL$. Severe anemia is defined as having $Hb < 7.0 g/dL$ (WHO, 2001).

Anemia during pregnancy has been shown to double the risk for preterm delivery and increase by three-fold the risk for low birth-weight as well as maternal mortality (WHO, 2001; Scholl *et al.*, 1992). There are multiple causes of anemia during pregnancy, including inadequate diet (mostly inadequate iron supply but also folate and vitamin B₁₂ deficiencies), impaired micronutrient absorption, blood loss resulting from hemorrhage, and helminth infestation (Li *et al.*, 1994). Non-nutritional causes include thalassemia, malaria and sickle cell disease. Repeated pregnancies, too, are a source of blood loss. It is generally estimated that half of the anemia cases in pregnancy are related to iron deficiency (Li *et al.*, 1994). Iron-folate supplementation can be effective in correcting and preventing iron deficiency anaemia in pregnant women but effectiveness of the programme is limited by adherence of pregnant women to the iron-folate supplements.

2.2 History of Anemia and Iron/Folate Supplementation During Pregnancy

Anemia in pregnancy was first accurately described by a German physician Herman Nasse in 1836 (Fahreus, 1921). In the 1920s, scientists believed folate deficiency and anemia were the same condition. In the 1950s and 1960s, scientists began to discover the biochemical mechanisms of action for folate. In 1960, folate deficiency was first linked to neural tube defects (Lanska, 2009). In the late 1990s, US scientists realized that despite the availability of folate in foods and in supplements, there was still a challenge for people to meet their daily folate requirements, as a result the United States implemented the folate fortification program (Lanska, 2009). The first iron pills were commonly known as Blaud's pills, named after the French physician who introduced and started their use in the treatment of patients with anemia (Robinson, 1939).

In Kenya, routine iron supplementation is the current cornerstone of efforts to reduce iron-deficiency anemia during pregnancy (KNBS and ICF Macro, 2010). WHO recommends a 6-month regimen of a daily supplement containing 60 mg of elemental iron along with 400 µg of folic acid for all pregnant women. In settings where anemia prevalence is high (>40%), WHO has recommended postpartum treatment for three additional months (WHO, 2001).

2.3 Pregnancy and Need for Iron and Folate

There is a marked increase in folate use during pregnancy, due to the acceleration of reactions requiring single-carbon transfer, the rapid rate of cell division in maternal and fetal tissues, and deposition in the fetus. Randomized, controlled trials have shown that taking folic acid supplements before conception and

through about the first four weeks of pregnancy lowers risk of genetically predisposed women having a baby with a neural tube defect (Scholl and Johnson, 2000). In China, the occurrence of neural tube defects was greatly reduced up to 80% by a supplement providing only 400µg/d of folic acid (Berry *et al.*, 1999). Taking a daily supplement of 400µg folic acid reduced the risk by 70% in New England (Werler *et al.*, 1993).

On average, an additional 6mg/d of iron needs to be absorbed during pregnancy. Iron is retained by the fetus (300mg), deposited in the placenta (60mg) and used for synthesis of additional maternal red blood cells (450mg). On the other hand blood loss during delivery and mother's retention in the increased red cell mass parturition accounts for 200mg respectively (Hallberg, 1988). Iron absorption increases greatly during second and third trimester (Barret *et al.*, 1994). Because of the pattern of hemodilution, the hemoglobin cut offs that signify anemia are 11g/dl in first and third trimester and 10.5g/dl in second trimester (Institute of Medicine, 1992). The current recommendation is for pregnant women to take an additional 30mg of iron daily during pregnancy, starting around 12th week. Because this amount of iron cannot be readily obtained from food, it is recommended that iron supplements should be taken between meals, and without coffee or tea which can impair iron absorption (Institute of Medicine, 1998).

2.4 Etiology of Anemia

The first stage of iron deficiency, known as iron depletion, occurs when iron stores are low and serum ferritin concentrations drop. The second stage, iron-deficient erythropoiesis, occurs when iron stores are depleted and the body does not absorb iron efficiently. Iron-deficient erythropoiesis is characterized by a decrease in transferrin saturation and increases in transferrin receptor expression and free erythrocyte protoporphyrin (FEP) concentration. Iron-deficiency anemia (IDA) is the third and most severe stage of iron

deficiency and is characterized by low hemoglobin and hematocrit values. Erythrocytes are hypochromic and microcytic during IDA and hemoglobin concentration falls below –2 standard deviations of the age- and sex-specific normal reference (Ramankrishnan, 2001). Anemia is the most widely used indicator of iron deficiency in most settings. The World Health Organization (WHO) reference values for anemia are hemoglobin < 11 g/dl for pregnant women and children under 5, < 12 g/dl for nonpregnant women, and < 13 g/dl for men (WHO, 2001). Iron deficiency is the most common cause of anemia although there are other nutritional and non-nutritional causes of anemia (Allen and Casterline-Sabel, 2001). As illustrated in Fig. 1, not all anemia is caused by iron deficiency, and not all iron deficiency results in anemia. For example, inadequate intakes of folate and vitamin B12 can also cause anemia. Infections and genetic abnormalities such as thalassemia may also contribute to anemia in some populations (Ramankrishnan, 2001).

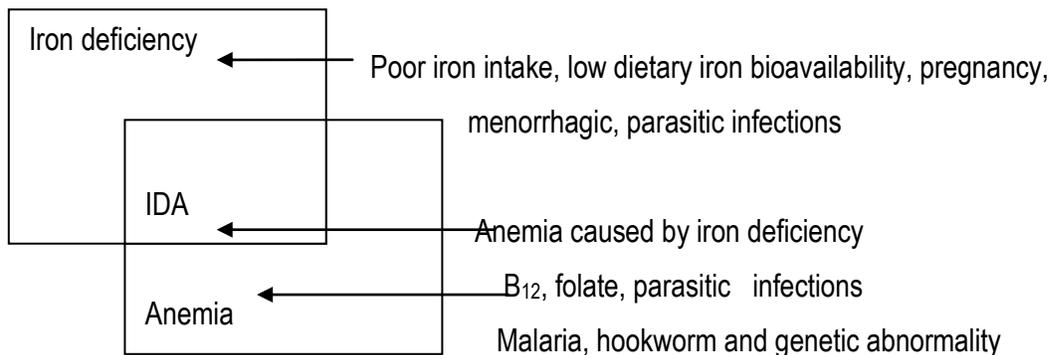


Figure1: Etiology of anemia

Source: (Ramankrishnan, 2001)

2.4.1 Mechanism of nutritional causes of anemia

There are several mechanisms that control human iron metabolism and safeguard against iron deficiency. The main regulatory mechanism is situated in the gastrointestinal tract. When loss of iron is not sufficiently compensated by adequate intake of iron from the diet, a state of iron deficiency develops over time. When this state is uncorrected, it leads to iron deficiency anemia. Most of the iron in the body is hoarded and recycled by the reticuloendothelial system, which breaks down aged red blood cells. However, people lose a small but steady amount by sweating and by shedding cells of the skin and the mucosal lining of the gastrointestinal tract. Iron absorption from diet is enhanced in the presence of vitamin C and diminished by excess calcium, zinc, or magnesium (Conrad and Umbreit, 2000). Functional or actual iron deficiency can result from increased demand for iron such as in pregnancy, which the diet cannot accommodate due to nutritional deficiency. This can result due to a lack of dietary iron, consumption of foods that inhibit iron absorption, including calcium, phytates and tannins and inability to absorb iron because of damage to the intestinal lining. Examples of causes of this kind of damage include surgery involving the duodenum which severely reduces the surface area available for absorption (Conrad and Umbreit, 2000).

Vitamin B12 (cobalamin) or folic acid deficiencies result in megaloblastic anemia whose etiology is impaired DNA synthesis and assembly (Harmening, 2001). Cobalamin and folic acid are essential in the DNA synthesis pathway. Cobalamin is also necessary for normal function of cells of the nervous system. Cobalamin and folate metabolisms are related and deficiency of either results in the deoxyuridylate–deoxythymidylate pathway impairment. This pathway forms deoxythymidylate from deoxyuridylate and methionine from homocysteine. Folic acid is required for synthesis of thymidylate. Since thymidylate is the precursor to thymine, essential for DNA, a limitation in the supply of thymidylate impairs DNA synthesis and leads to the morphologic manifestation of megaloblastic maturation. Cobalamin catalyzes the conversion of

homocysteine to methionine. When this reaction is impaired, folate metabolism is deranged. Since folic acid is required for synthesis of thymidylate, this derangement underlies the defect in DNA synthesis and the megaloblastic maturation in patients who are cobalamin deficient. Impairment in the conversion of homocysteine to methionine may also be partly responsible for the neurologic complications of cobalamin deficiency. Methionine is needed for the production of choline and choline-containing phospholipids, which are required in the nervous system (Harmening, 2001).

Deficiency of vitamin B12 is almost always due to malabsorption. Several different conditions may cause mal absorption namely: decreased production of Intrinsic Factor (IF) (pernicious anemia) due to atrophy of the gastric mucosa or autoimmune destruction of the parietal cells; disorders of the terminal ileum such as ileitis and surgical resection of the small intestine; and competition in the intestinal tract for vitamin B12 such as by *D. latum*, the fish tapeworm, blind loops and other intestinal anatomic lesions may harbor bacteria that consume cobalamin before absorption . Folic acid deficiency can be due to dietary deficiency, increased requirement such as in pregnancy, or defective absorption (Harmening, 2001).

2.4.2 Mechanism for non-nutritional causes of anemia

Plasmodium falciparum is a protozoan parasite that causes the most virulent form of human malaria. Malaria, especially from the protozoan *Plasmodium falciparum*, causes anemia by rupturing red blood cells and by suppressing the production of new red blood cells (WHO, 2001). Helminths such as hookworms and flukes such as schistosomes can cause blood loss and therefore iron loss. Adult hookworms attach themselves to the gut wall, where the mature larvae and adult worms ingest both the gut wall and blood. Hookworms change feeding sites every 4–6 hours and during feeding secrete anticoagulant, resulting in

secondary blood loss from the damaged gut wall after the worms have stopped feeding. The number of adult hookworms and the fecal egg count which is an indirect estimate of the number of worms, are strongly correlated with the amount of blood lost; which if chronic can result in iron deficiency anemia (WHO, 2001). Blood loss can be short term or persist over time. Heavy menstrual periods or bleeding in the digestive or urinary tract can cause blood loss. Surgery, trauma, or cancer also can cause blood loss. If a lot of blood is lost, the body may lose enough red blood cells to cause anemia. When blood is lost, the body quickly pulls water from tissues outside the bloodstream in an attempt to keep the blood vessels filled. As a result, the blood is diluted, and the hematocrit (the percentage of red blood cells in the total blood volume) is reduced. Eventually, increased production of red blood cells by the bone marrow may correct the anemia. However, over time, bleeding reduces the amount of iron in the body, so that the bone marrow is not able to increase production of new red blood cells to replace those lost (Grantham-McGregor and Ani, 2001).

Various genetic mechanisms as a result of hereditary conditions cause anemia. These include:

- *Sickle cell anemia* which is a disease where the body makes red blood cells that are shaped like a crescent moon or the letter “C” when they are depleted of oxygen. These abnormally-shaped cells do not flow as well through the circulatory system and last for only 10-20 days compared to about 120 days for healthy, normal-shaped red blood cells. The body continually makes new red blood cells, but anemia develops because sickle cells do not last very long (Weatherall and Clegg, 2001).
- *Thalassemia* is a condition where the body does not properly construct one of the proteins needed to make hemoglobin. Moderate to severe anemia can occur if one of these proteins is defective or missing (Weatherall and Clegg, 2001).

- *Fanconi anemia* is a condition in which the bone marrow can fail to produce red blood cells, white blood cells and platelets. The lack of enough red blood cells will lead to anemia (Weatherall and Clegg, 2001).

2.4.3 Consequences of iron deficiency and anemia in pregnancy

It has been clearly demonstrated that the anemic pregnant woman is at greater risk of death during the perinatal period. Close to 500,000 maternal deaths ascribed to childbirth or early post-partum occur every year, the vast majority taking place in the developing world. Anemia is the major contributory or sole cause in 20-40% of such deaths. In many regions anemia is a factor in almost all maternal deaths, it increases the overall risk of maternal death related to pregnancy and delivery by five times. The risk of death increases dramatically in severe anemia (WHO, 1962).

A prospective study showed that all anemic pregnant women had a higher risk of pre-term delivery in relation to non-anemic women. The iron-deficient, anemic group had twice the risk of those with anemia in general (Scholl *et al.*, 1992). These results were obtained after controlling for maternal age, parity, ethnicity, prior low birth-weight or pre-term delivery, bleeding at entry to health care, gestational age at initial blood draw, number of cigarettes smoked per day, and pre-pregnancy body mass index (BMI). Inadequate weight gain during pregnancy was significantly higher for all anemic cases, particularly among those that were iron-deficient. Inadequate weight gain has also been associated with pre-term delivery (Scholl *et al.*, 1992).

Two large studies in developed countries involving over 100,000 pregnancies clearly indicated that favorable pregnancy outcomes are less frequent among anemic mothers (Garn *et al.*, 1981; Murphy *et al.*,

1986). Both studies found higher rates of fetal deaths and abnormalities, premature deaths, and low birth weight newborns among anemic mothers. These risks were evident even among mothers who had anemia only in the first half of pregnancy. Significant correlations between the severity of anemia, premature birth, and low birth weight were very evident.

2.4.4 Consequences of folic acid deficiency in pregnancy

Folate is very important for foetal development as well as being a cofactor essential in the nucleotide biosynthesis and in the metabolism of homocysteine to methionine. Methionine is used in the methylation process of DNA, proteins and lipids with the production of homocysteine as end product (Botto and Yang, 2000). Interference with DNA synthesis gives rise to abnormal cell division. Rapidly dividing cells, such as those in the haematopoietic system, are the most susceptible to irregularities in DNA production. A significant clinical manifestation of folate deficiency is macrocytic anaemia (Scholl and Johnson, 2000).

Folic acid deficiency has been directly linked to neural tube defects without a doubt. A review studied 35 published studies and found in concordance with a Cochrane review (Lumley *et al.*, 2000) that periconceptual folate supplementation reduced the incidence of neural tube defects by as much as 70%. The reduction is similar for occurring as well recurring defects. The relationship of folate with risk of abortions, preterm delivery and birth weight is not very clear. Many observational studies of folate during pregnancy suggest that there is a potential benefit of good folate status with improvement of birth weight and gestational age. However, randomized trials of folic acid supplementation have shown less uniform benefit (Scholl and Johnson 2000, Lumley *et al.*, 2000).

Folate deficiency increases homocysteine concentrations. Women with habitual abortions were found to have a higher prevalence of hyperhomocysteinemia as compared to controls (Wouters *et al.*, 1993; Nelen *et al.*, 1998), also confirmed by other studies (Scholl and Johnson, 2000). Folate supplements reduced significantly the homocysteine concentrations. Homocysteine levels are also higher in women who have given birth to offspring with neural tube defects.

2.5 Strategies to Combat Iron Deficiency and Anemia

2.5.1 Supplementation

Many women in developing countries are often already iron deficient and/or anemic before they become pregnant, and thus supplementation has been considered a preventive strategy for all women of reproductive age. WHO has recommended a 6-month regimen of a daily supplement containing 60 mg of elemental iron along with 400 µg of folic acid for all pregnant women. In areas with a higher prevalence of anaemia, it is recommended that supplementation continue for three months postpartum (WHO, 2001).

Though there is considerable evidence that treatment of Iron deficiency with supplements is effective in improving hemoglobin levels during pregnancy, intervention programs have not been very successful. Some of the major problems are linked to the distribution and utilization of iron supplements during pregnancy at the level of both the supplier and consumer of the iron/folate supplements (Ellis, 1998).

Determinants of compliance to iron/folate supplements

1. Side effects

While the nausea, vomiting and constipation that sometimes accompany early pregnancy may be exacerbated by iron supplementation, there is little evidence that side effects are the major cause of non-adherence. A study in Bangladesh confirmed that side effects of iron tablets had very limited influence on adherence and recommended that efforts to reduce side effects may not be a successful strategy for improving adherence (Ziauddin *et al.*, 2002). In Burma a small proportion (3%) of the women stated that side effects were the reason they stopped taking iron supplements (Charoenlarp *et al.*, 1988). Similarly another study found side effects from iron therapy caused poor adherence in 1% of women (Blot *et al.*, 1981). In Thailand, 30% of women complained of side effects while taking iron, however researchers found that the side effects did not contribute to poor adherence because women were counseled that side effects would subside (Valyasevi, 1988). This research aimed to find out if side effects of the supplements have a significant influence on compliance.

2. Dose and form

Past studies have reported that the acceptability of supplements does not have significant effects on the adherence (Galloway *et al.*, 2002; Ritsuko *et al.*, 2006). Another study has shown that most women were satisfied with the size, color, packaging, and instructions of iron/folate tablets (Lacerete *et al.*, 2011). Some studies have however shown that the form in which iron tablets are given affects adherence (color, injection, tablet, liquid, taste, etc.) For example, women in Mexico felt that iron injections were more effective than tablets and that red iron pills were more effective than white or brown ones because the color red is thought to strengthen and purify the blood (Morrow, 1990). Sugar-coated pills were more acceptable in Indonesia than uncoated tablets, probably because sugar disguises the iron taste (Favin and Griffiths,

1991). In Kenya the ministry of public health and sanitation has introduced a combined iron and folate pill which is sugar coated and thought to increase adherence.

3. Utilization of health services and personal beliefs

Physical distance to the clinic, economic constraints (cost of travel or the supplements) and inconvenience of clinic hours have been thought to affect utilization of health services (Beratis, 1989). In many developing countries, use of any antenatal care service is often quite low (below 50%), hence access to iron supplementation, usually delivered through the health care system can be equally low. Beliefs about health and treatment may also interfere with iron adherence. Some women in Thailand decided not to take supplements because they thought iron caused bigger babies and difficult deliveries (Valyasevi, 1988). Compliance with iron supplementation was better in Mexico when women sought early prenatal care because many of the late comers felt that iron was only absorbed during the first third of pregnancy and was not effective after the first trimester (Scrimshaw *et al.*, 1990).

4. Fluctuation in supplies

Inadequate and sporadic supplies of iron tablets as well as the failure to distribute them emerge as barriers to adherence (Galloway *et al.*, 2002; Ritsuko *et al.*, 2006; Lacerete *et al.*, 2011). Although it is a policy in most developing countries to give iron supplements to pregnant women, clients are often not given enough pills to effectively improve their iron status. This may be due to the following reasons: lack of overall government resources, a low priority for health expenditures within the government, and a lack of awareness of policy makers about the importance of iron supplements (ACC/SCN, 1991). Supplies seems to have also been found to be a problem in Indonesia where 83% of participants in the Nutrition Development Program said they had never seen iron tablets (Griffiths, 1980). On further investigation, it was found that the health care professionals had not distributed iron because they did not understand its

importance. This was also true in India where only 37.6% of healthcare professionals knew the objectives of the iron supplementation program, 58.4% had incomplete knowledge and 4% had no idea at all about the objectives. This research analyzed if these factors have an influence on iron/folate supplementation compliance.

5. Education and knowledge

A study has shown that education beyond high school is positively associated with adherence (Jasti *et al.*, 2007). Knowledge of anemia and its prevention has also been identified as an important factor for taking iron/folate supplements (Lacerete *et al.*, 2011). When the level of knowledge about anemia and its prevention among pregnant women is very low then there is less compliance to the supplements.

2.5.2 Dietary diversification and modification

Dietary diversification and modification includes home gardening, food processing techniques; reducing consumption of foods that inhibit non-heme iron absorption and increasing consumption of foods that enhance non-heme iron absorption. These serve as methods to increase dietary intake and bioavailability of iron. Iron in food exists in two forms: non-heme iron and heme iron. Plant foods and dairy products contain non-heme iron which is less bio available while animal foods, such as meat and fish contain heme iron which is more bio available (Scrimshaw, 1997). Education about foods that enhance and inhibit iron absorption should potentially result in practices that improve the bioavailability of dietary iron.

FAO has developed dietary diversity guidelines to obtain data on the food consumption of individuals or households. Dietary diversity is a qualitative measure for food consumption that serves as a proxy of the

nutrient adequacy of the diet of an individual. The dietary diversity score is created by summing up the number of food groups consumed over a specified reference period of time such as 24hours (FAO, 2007).

2.6 Strategies Towards Control of Iron Deficiency Anemia in Kenya

Among the micronutrient deficiency disorders in Kenya, iron deficiency anemia is a major public health problem among children under five and women in the reproductive age group. Statistics show that 43% of women in the reproductive age group are affected by iron deficiency anemia (Mwaniki *et al.*, 1999). The Ministry of health hence adopted the strategy advocated by WHO (WHO, 2001), of supplementation with iron and folate tablets to pregnant and postpartum mothers. Supplementation of iron and folate tablets in the country is done at different health facilities operated by the government, NGOs, church, private sector or CBOs. Other strategies employed include: nutrition education with a focus to advocate for consumption of foods rich in dietary iron and avoidance of foods that interfere with bioavailability of iron. Another strategy is the control of helminthes and other parasites that reduce availability of iron physiologically (UNICEF, 2005).

2.7 Method of Compliance Data Collection

There are both direct and indirect measures of adherence. Direct measures are usually thought to be the most accurate since they involve expensive biochemical tests that detect physiologic change (Cromer *et al.*, 1989). Hemoglobin or hematocrits are the most common direct measures of iron status although serum ferritin is better since it detects iron stores. The major disadvantage of direct measures of adherence is that they tend to be intrusive which may compromise the overall treatment program and bias results by

inconveniencing the patient (Chaulet, 1987). Another disadvantage is the accuracy which may be affected by lifestyle changes such as changes in exercise, diet, disease, and stress (Cromer *et al.*, 1989).

Indirect measures of adherence include direct observation or supervision of pill taking by the health care professional; patient reporting; the health care professional monitoring the number of pills or medication utilized; duration of participation of the client in the program or study; the patient keeping appointments; interviews with the patient to discuss adherence; and utilization of educational materials such as a calendar that is primarily used to remind beneficiaries to take their iron but which they also use to record the intake of iron (Cromer *et al.*, 1989; Beratis, 1989). Patient self-reporting is the least reliable of the indirect measures since patients tend to over-report how well they comply (Reichman, 1987). The accuracy of counting residual pills is variable. Home pill counts for iron therapy are highly correlated with biochemical assessments (Cromer *et al.*, 1989). On the other hand the number of pills missing does not necessarily equate to the number of pills consumed by the patient (Kolton and Piccolo, 1988).

2.8 Knowledge Gap

Conducting iron supplementation programs has been a major strategy to reduce iron deficiency anemia in pregnancy. In Kenya the adherence rate is reported to be very low with regard to iron supplementation during pregnancy; that is over half of women (54 percent) according to the demographic health survey of 2008 were reported taking iron tablets or syrup for less than 60 days during the pregnancy of their most recent birth. Almost one-third (31 percent) did not take any iron supplements during pregnancy. At the national level, there has been a notable increase since 2003 in the proportion of women who reported taking iron supplements during pregnancy (KNBS and ICF Macro, 2010).

A comparison with 2003 KDHS data indicates that the proportion of women who took iron supplements increased from 41 percent in 2003 to 60 percent in 2008-09. Although this is a sizeable increase, almost all of the women who took iron supplements took them for less than 60 days during the pregnancy (KNBS and ICF Macro, 2010). The reasons for this poor adherence was not clearly articulated thus this study aims to find out the factors contributing to low adherence rate to help in improving the effectiveness of the Iron-folate supplementation program for pregnant women.

CHAPTER THREE: METHODOLOGY

3.1 Study Area and Study Site

The study was conducted in Thika District Hospital located in Thika municipality, Thika District, Kiambu County in Kenya. Thika District Hospital is a level 5 facility providing services such as antenatal, basic emergency, obstetric care, curative, out-patient and in-patient services, family planning and growth monitoring among others.

Thika District covers an area of 1,960.2 Km². It borders Nairobi City to the south, Kiambu District to the west, Maragua District to the north and Machakos District to the east. It lies between latitudes 3°53' and 1°45' south of Equator and longitudes 36°35' and 37°25' east and has a diverse topography ranging from 1060 m to 3550 m above the sea level. The district has a bi-modal rain pattern with long rains occurring in the months of May and June and short-rains in the months of October and November (AOP 5, 2005).

Approximately 43% of households in Thika District rely on agriculture, growing both food and cash crops. The sector employs an estimated 189,072 people directly or indirectly, 70% of them women. The private sector as a whole is estimated to employ roughly 16,232 people, with another 12,564 people counted as wage laborers. The total productive labour force in Thika District is approximately 267,000 people or 56% of the population. Thika District has 1,135 primary schools with an enrollment rate of 83% for both boys and girls, 373 secondary schools with an enrollment rate of 70% for both boys and girls. Tertiary schools are more than 15 and 9,337 adult literacy classes (AOP 5, 2005).

In the 2009 census, Kiambu county had a total population of 1.6 million (KNBS, 2010). Thika District population for 2009 was projected to be 544,166 with 3.24% (14,715) being pregnant women and 25.9%

(117,629) women of child bearing age according to MOH Thika District annual operating plan (AOP 5, 2005). Respiratory tract infection was the leading cause of morbidity in the District (42.1%) followed by malaria (30.4%) and intestinal worms (6.0%) according to MOH Thika District annual operating plan (AOP 5, 2005). Malaria and intestinal worms mostly affect young children and pregnant mothers. Pregnant women suffering from malaria or those infested by intestinal worms are likely to suffer from iron deficiency.

3.2 Study Design

The survey adopted a descriptive and analytical cross-sectional study design to determine the adherence rate and factors affecting adherence to Iron-folate supplements among pregnant women in Thika Municipality.

3.3 Study Population

The study population comprised of 200 pregnant women aged 15-49 years attending antenatal clinic at Thika District Hospital. A focused group discussion (FGD) was conducted among mothers with infants (less than 6 months) staying in Gacagi, an informal settlement area within Thika Municipality. Key informant interviews (KII) were conducted among health staff working at Thika District Hospital.

3.4 Sampling

3.4.1 Sample size determination

The sample size was determined using Fischer et al's (1991) formula with the degrees of accuracy set at 0.05.

$$n = \frac{Z^2 pq}{d^2}$$

Where:

n- Estimated sample size

Z-z value for the chosen confidence interval (usually 0.95 $\alpha=0.05=1.96$)

p- Prevalence estimate (87.4% of those who did not take iron-folate supplements and those who took them for <90 days in Central Province (KNBS and ICF Macro, 2010)

q- 1-p

d²-the precision required for the estimate (usually 0.05 used)

Hence $n = (1.96^2 * 0.874 * 0.126) / 0.05^2 = 169$

When a 10% attrition rate was considered the total sample size was 186 pregnant women. This was rounded off to 200 pregnant mothers.

3.4.2 Sampling procedure

Thika District Hospital was chosen purposively because it had ANC where pregnant mothers received Iron/folate supplements. Systematic random sampling was used to select the study group of pregnant women who were attending ANC in Thika District Hospital. Ten questionnaires were administered per day. From a daily attendance to ANC of sixty pregnant women every 2nd pregnant woman was selected, with randomization of the first pick. A total of 200 pregnant women were sampled.

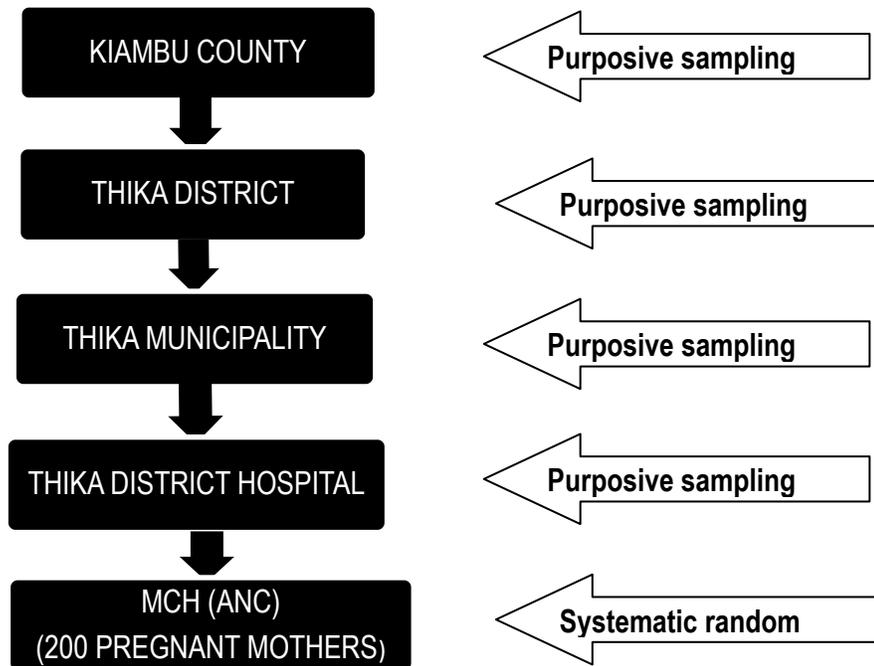


Figure 2: Sampling procedure schema

At the community level, eight women with infants less than 6 months old were randomly chosen to participate in the focus group discussion. Key Informant Interviews were conducted at the health facility on four key informants who included the nurse in charge at MCH, nutritionist at the MCH, a pharmacist and a community health worker (CHW) attached to the facility. They were purposively selected.

3.4.3 Inclusion and exclusion criteria

Those who were included in the survey were pregnant women and attendees of ANC clinics. Exclusion to the survey were of women who were pregnant but not attending ANC, pregnant but attending ANC at private health facilities and pregnant women who were very sick. Inclusion criteria for the FGD included mothers with infants (less than 6 months) and attendees of ANC clinics. Four health personnel working in the district hospital (level 5) were included in the KII.

3.5 Data Collection Tools

A semi-structured questionnaire was used for quantitative data collection among the pregnant women. A question guide was used for qualitative data collection during the focused group discussions among the mothers with infants less than 6 months old, and interviews with the key informants. An adult MUAC tape was used to measure the mid-upper arm circumference among the pregnant women and a record sheet was used to record their weight changes.

3.6 Pretesting of the Tools

The questionnaire was pre-tested on a small sample size of ten pregnant women. This was to help in making modifications to the questionnaire and give the research assistants an opportunity to practice on how they would collect data before the actual survey.

3.7 Recruitment and Training of Research Assistants

Two research assistants with training in nutrition were recruited and trained. They were trained on interviewing and measuring techniques, field ethics in research, relating with respondent and on public relations while in the field. They did role plays prior to pre-testing to familiarize themselves with questions in the questionnaire and how to translate and ask in a way that the respondent can understand. The training curriculum is in Appendix 4.

3.8 Data Collection Procedures

3.8.1 Individual interviews

With the help of research assistants and using a semi structured questionnaire, the following data were collected:

Demographic and Socio-economic data

Individual interviews involved collection of data on: place of residence, age, marital status, parity, household size and education levels. Socio-economic data was collected which included data on household monthly income, household monthly expenditure on food and transport and pregnant woman's expenditure on health care service.

Adherence data

Adherence data collected included the number of times the pregnant women took the iron-folate supplements in a week. Taking more than four times in a week was viewed as compliance. Participants were asked the amount of iron-folate tablets they received, where they got the supplements from, if they were faithful in taking the supplements and reasons, whether they felt it was important to take the supplements, if they were directed on where to acquire the supplements from and any challenges they faced.

Health history data

Questions on history of anemia during current pregnancy, hemoglobin levels at first ANC, history of miscarriage and other women's perception on the supplements were also asked. This was recorded in the questionnaire.

Knowledge on anemia data

Participants were asked on their knowledge of anemia and if they were aware of the causes, consequences and how they could prevent the condition in pregnancy.

Dietary practices

Using the Individual dietary diversity questionnaire data was collected on the type of food consumed by the respondent in the last 24 hour period and the source of the food. The respondents were first asked if the previous 24 hours was a feast day in which their food intake was unusual. If they affirmed that it was not, they were asked the foods they ate from when they woke up the day before the interview to the morning of the interview. When any food was mentioned in a given food group, it was given a score of one and the source indicated in the questionnaire.

A Food Frequency questionnaire was used to collect data on frequency of consumption of Iron, folate and Vitamin C rich foods by the pregnant women. Questions on food avoidance and food cravings were also asked.

Use of ANC

The participants were asked on their gestational age at first ANC visit, their frequency of attendance to ANC, mode of transport to ANC, ease of access to health facility and hindrances to ANC attendance which was recorded in the questionnaire.

3.8.2 Nutritional status data

Data was collected on the trends in weight gain from the clinic card. MUAC measurements were taken using a MUAC tape by locating the midpoint of the upper arm of the hand not frequently used and taking the measurement at that point (MoH, 2009) then the results were recorded in the questionnaire for each pregnant mother.

3.8.3 Key informant interviews (KIIs)

Complementary data and information on iron/folate supplementation of pregnant women was gathered through key informant interviews with selected health care workers at the district hospital. The information included the supply flow of the supplements, adherence and acceptability of the supplements, challenges faced and actions to improve supplementation of pregnant women with iron and folate. The Key informants included a nurse, nutritionist, pharmacist and a community health worker.

3.8.4 Focused group discussion

One Focused group discussion was conducted at the community level consisting of eight mothers with infants less than 6 months old. Information was collected on access and utilization of ANC services, taking of the supplements and challenges faced and knowledge on anemia.

3.9 Data Quality Control Assurance

There was close supervision of the research assistants by the principal investigator. The research assistants were trained on filling out the questionnaires correctly to enhance accuracy and validity. At the

end of each day the principal investigator checked the questionnaires for omissions and possible erroneous entries to ensure that each question was answered clearly and correctly recorded. Data was carefully entered into the computer then cleaned. Statistic checks for errors were done by examining frequency distribution on all variables for items that were not logical. Data was assessed for normality by visual examination of distribution plots, determining skewness and kurtosis for all variables.

3.10 Data Storage Management and Analysis

For ease of analysis, data were edited and converted to numerical codes before entry into the computer. Data was analyzed using statistical package for social sciences (SPSS) version 16. Descriptive statistics (frequency, percentages, mean and confidence interval) including graphs and tables were used to analyze demographic, socio-economic, frequency of food consumption and mid-upper arm circumference data. The main dependent variable was adherence rate. Adherence was defined as use of supplements for four or more days in the previous one week.

Dietary diversity score was used to estimate the nutrient adequacy of foods individual respondent consumed. Dietary diversity score was calculated by adding up the number of food groups consumed by the individual respondent over the 24 hour recall period reflecting the nutrient adequacy of the diet (FAO, 2007). Impact of variables on non-adherence was estimated using logistical regression analyses. One sample t-test was used to compare differences in weight gain and MUAC while relationships between categorical data were analyzed using the Chi-square.

3.11 Ethical Considerations

Authorization to conduct the study was sought from the District Health Medical Officer in charge of Thika District Hospital. A research permit was obtained from National Council of Science and Technology. The respondents were informed of the objectives of the study and the interviewer sought their consent to participate in the study. Feedback after data analysis was given to the respondents and they were assured of confidentiality of the information shared.

CHAPTER FOUR: RESULTS

This chapter presents the study results including demographic and socio-economic characteristics, factors hindering and those associated with adherence to iron/folate supplements, knowledge on anemia, dietary diversity, frequency of consumption of iron and folate rich foods, frequency of ANC visits and nutritional status (weight gain trend and MUAC) of the pregnant women.

4.1 Demographic Characteristics of respondents

Among the 200 pregnant women interviewed, majority were from the following estates: Makongeni (25.5%), Kiganjo (18.5%) and Weiteithie (15%). Table 1 shows the distribution of the respondents as per place of residence. Over half (56%) of the respondents resided in Thika Municipality location which included the following estates: Makongeni 25.5%, Kiganjo 18.5%, Landless 3% and Athena/Kiandutu 1.5%. However 44% of the respondents resided outside Thika Municipality in areas such as Weitethie (15%), Juja (9.5%), Kandara/Kabati 8% and Ruiru/Githurai 11.5%.

Table: 1 Place of residence of respondents

Place of residence	Frequency (N=200)	Percent (%)
Women residing in Thika Municipality	112	56
Women residing out of Thika Municipality	88	44

The mean age of the pregnant women interviewed was 25.44 years (sd 4.7). Majority of the respondents (47.5%) were aged 21-25 years (Figure 3).

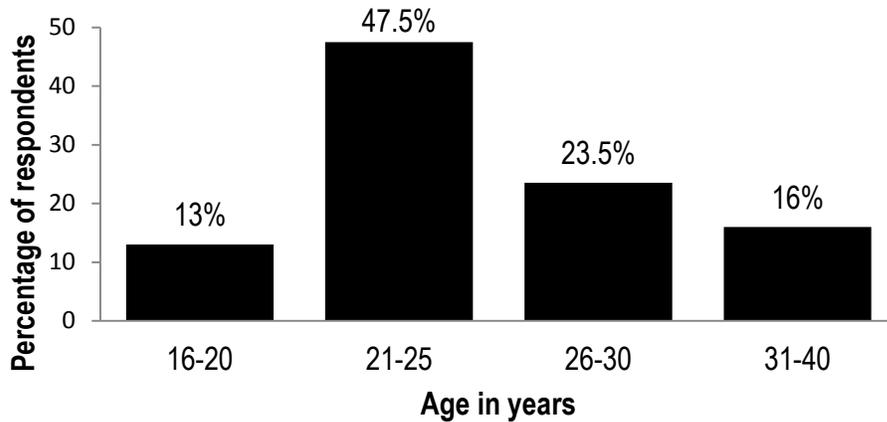


Figure 3: Age distribution of the pregnant women

The average age of the 8 lactating women who were involved in the FGD was 23.5 years with the minimum age being 19 years and maximum age being 35 years.

More than one-third (35%) of the respondents had not schooled beyond primary level of education, 34.5% had completed secondary school and only 18.5% had higher than secondary level of education (Figure 4).

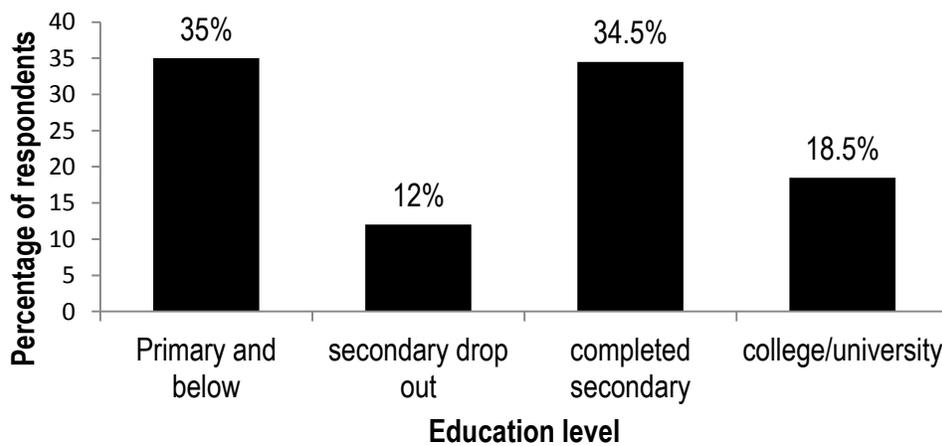


Figure 4: Education level of the pregnant women

Majority of the pregnant women interviewed were married (89%) with only 11% saying they were single or separated from their partners (Figure 5).

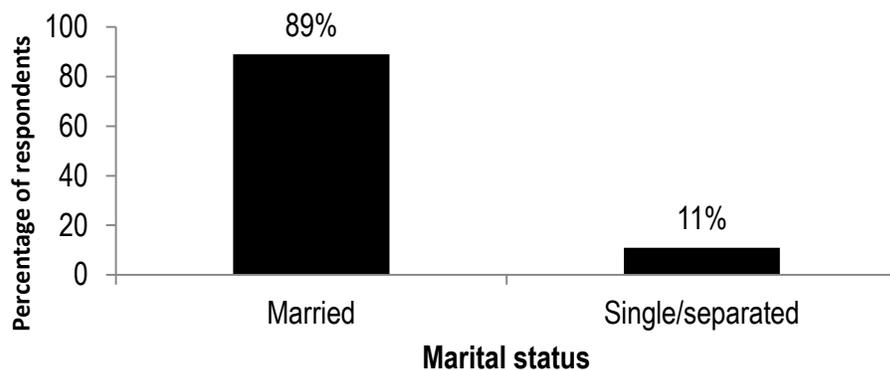


Figure 5: Marital status of the respondents

The average household size of the respondents was 2.62 (sd 1) with minimum household size of 1 and maximum of 6 (Table 2).

Table 2: House hold composition

Household size	Frequency (N=200)	Percent (%)
1-2	104	52
3-4	85	42.5
5-6	11	5.5

4.2 Socio-economic Status of Respondents

The average household monthly income was Kshs. 13, 482.25. Majority of the households (49%) earned a monthly income of less than Kshs. 10,000 (Table 3).

Table 3: Household monthly income

Household monthly income (Kshs)	Frequency (N=200)	Percent (%)
0-10,000	98	49
10,001-20,000	68	34
20,001-30,000	26	13
30,001-40,000	8	4

Majority (34.5%) of households spent 21-40% of their monthly income on food while 21.5% spent 41-60%, 13.5% spent 61-80% and 30.5% less than 20% of their income on food (Table 4).

Table 4: Proportion of house hold income spent on food

Proportion of income spent on food	Frequency (N=200)	Percent (%)
0-25%	61	30.5
26-50%	69	34.5
51-75%	43	21.5
>75%	27	13.5

4.3 Pregnancy Status of Study Women

A high percentage of the pregnant women interviewed were in their third trimester (52%) while 41% were in their second trimester and only 7% in their first trimester. The mean gestational age was 6.44 months (sd 1.66). Of the 200 pregnant women interviewed, 52% were multigravidae while 48% were primigravidae. When the respondents were asked if they had any history of birth complications such as miscarriages and still births, 13% confirmed they had a history while 87% did not have.

One of the mandatory things the pregnant women have to do when they first attend clinic is to go for lab tests. One of the tests done is on Hb levels. Up to 22% of the respondents had been told they had low Hemoglobin (Hb) levels in their current pregnancy while 78% had never been told. The mother and child booklet verified this in which 21.5% had Hb <11g/dl and 78.5% had Hb >11g/dl. Records from the ANC registers of the Health Facility traced back from January 2012 to June 2012 showed the average number of women who recorded Hb less than 11g/dl was 21% (sd 1.83).

4.4 Knowledge on Anemia Causes and Consequences of Respondents

Majority of the pregnant women interviewed were not aware of anemia, its causes and consequences during pregnancy (65.5%). Among the 34.5% who were aware, 62.3% knew the causes of anemia and half (55%) of those aware knew the consequences of it in pregnancy (Table 5).

Table 5: Awareness on anemia, causes and consequences

Variable	Yes (%)	No (%)
Aware of anemia	34.5	65.5
Know causes of anemia	62.3	37.7
Know consequences of anemia in pregnancy	55	45

Among those who were aware of anemia, causes of anemia cited were: unbalanced diets, lack of iron, excessive bleeding and malaria in that order (Figure 6). Consequences of anemia cited were: loss of consciousness, mother and child death, poor health of mother and child, delivery complications, miscarriage and low birth weight of infant in that order (Figure 7). The FGD revealed that most of the lactating women had no knowledge on anemia.

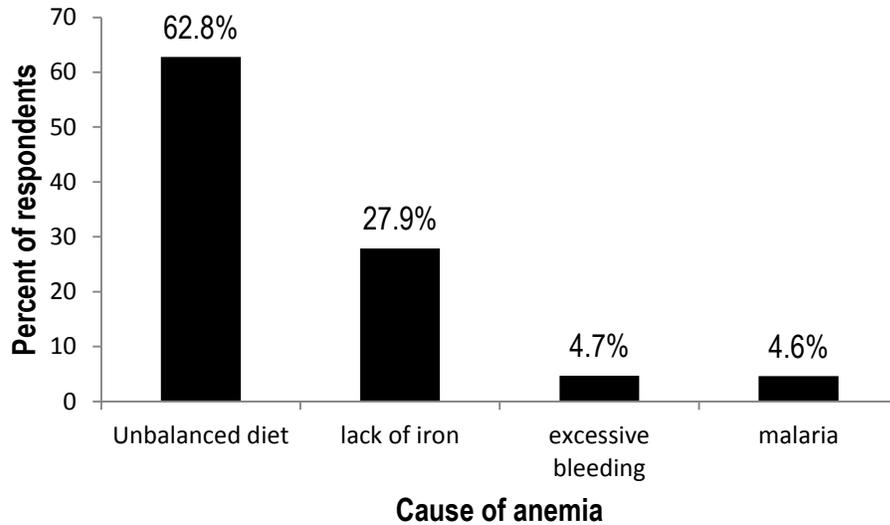


Figure 6: Causes of anemia cited by respondents

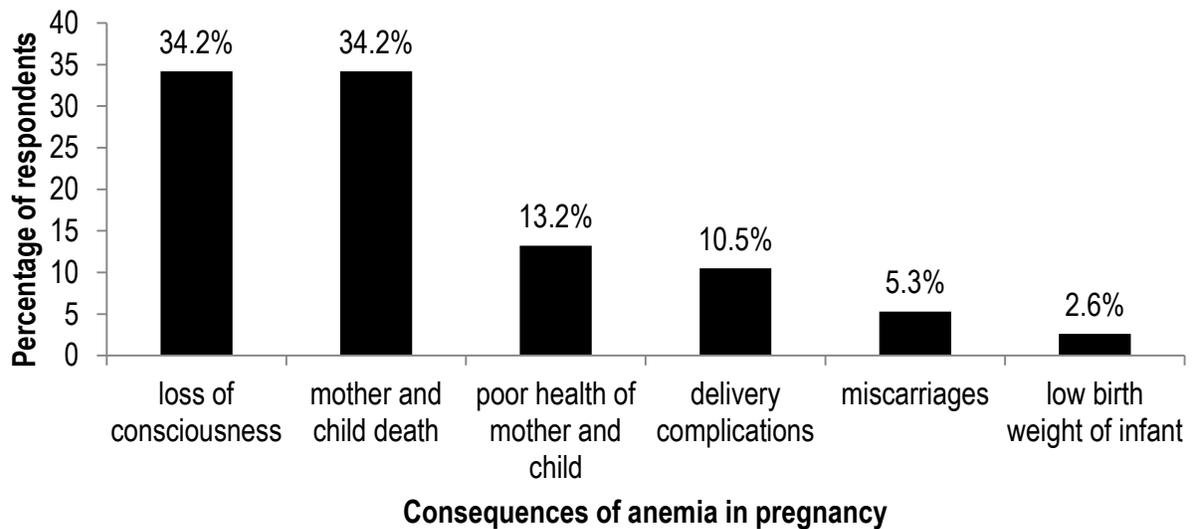


Figure 7: Consequences of anemia in pregnancy cited by respondents

Among those who were aware, (69 out of 200) the main source of information was school, followed by health professional, media, friends and CHW in that order (Table 6).

Table 6: Source of knowledge on anemia

Source of information	Frequency (N=69)	Percentage (%)
School	33	47.8
Health professional	18	26.1
Media	8	11.6
Friend and relative	6	8.7
Community health worker	4	5.8

Among the respondents who were aware about anemia (34.5%), most of them (60.9%) were in their third trimester. There was no significant association between awareness on anemia and pregnancy trimester (Pearson's chi-square 3.32, df 1, p-0.19), (Table 7).

Table 7: Association of awareness on anemia and pregnancy trimester

Variable	Awareness on anemia		Statistical test
	Yes (%)	No (%)	
Pregnancy trimester			
First trimester	5.8	7.6	$X^2 = 3.32$: 2df
Second trimester	33.3	45.0	P= 0.19
Third trimester	60.9	47.3	

Majority of those aware about anemia were aged between 21 years to 26 years (46.4%). However no significant association was found between age and awareness on anemia (Pearson's chi-square 3.18, df 3, p-0.36), (Table 8).

Table 8: Association of awareness of anemia and age of respondents

Variable	Awareness on anemia		Statistical test
	Yes (%)	No (%)	
Age			
15-20 years	11.6	13.7	$X^2 = 3.18$; 3df
21-26 years	46.4	56.5	p=0.36
27-32 years	31.9	21.4	
33-40 years	10.1	8.4	

4.5 Dietary Diversity and Frequency of Consumption of Iron and Folate by Respondents

Individual dietary diversity score (IDDS) was assessed based on FAO (2007) 12 food group guidelines. The average dietary diversity score of the respondents was 8.18 (sd 1.46). Maximum dietary diversity score was 12 and minimum 2. Majority (90.5%) of the respondents had a score above 6. When asked their main source of food, majority of the respondents said they purchased (85%) while few (15%) sourced from their own farms (Table 9).

Table 9: Individual dietary diversity score and food source of the respondents

Characteristics	Frequency (N=200)	Percentage (%)
Individual dietary diversity score		
≤ 6	19	9.5
>6	181	90.5
Main source of food		
-Purchase	170	85
-Own farm	30	15

Dietary diversity score was not significantly associated with household monthly income (Spearman's rho, $r=0.08$, $p>0.05$), proportion of income spent on food (Spearman's rho, $r=-0.03$, $p>0.05$), Hb level at first ANC visit (Spearman's rho, $r=0.04$, $p>0.05$) and weight gain of the women (Spearman's rho, $r=0.1$, $p>0.05$).

Food frequency of consumption indicated that majority (94.5%) of the respondents consumed green leafy vegetables for more than once per week. Meats which were rarely consumed included: liver (66%), chicken (74.5%) and fish (78.5%). Beef and goat meat were highly consumed (69.5%). Beans and lentils were a favorite with majority (88%) consuming more than once per week. Consumed at a high frequency, more than once per week, were Vitamin C rich foods such as citrus fruits (95.5%) and tomatoes (100%). Fortified cereals were consumed more than once per week by most (70.5%) of the respondents (Figure 8).

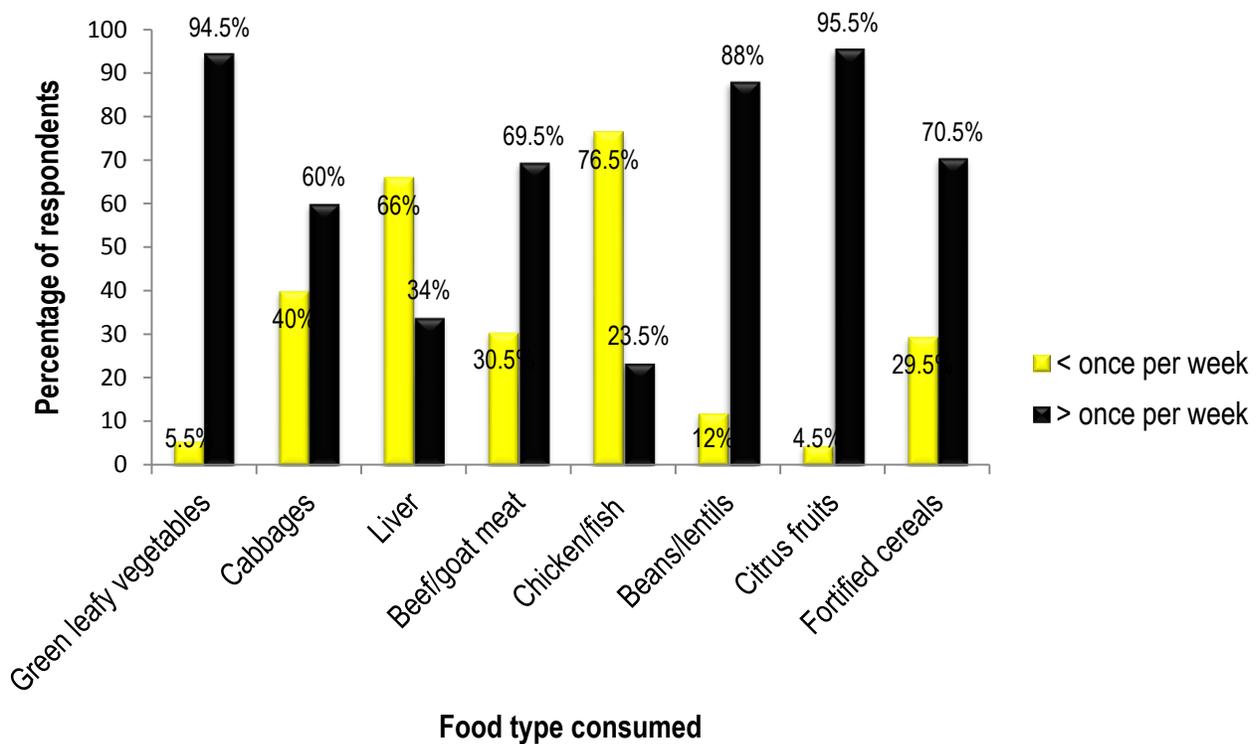


Figure 8: Frequency of consumption of iron, folate and vitamin C rich foods

The FGD conducted revealed that vegetables (kales, spinach, amaranths and pumpkin leaves), beans and fruits were easily available while meats were not easily available.

The respondents who took beverages such as tea, coffee or cocoa were 92.5% and 57.3% of these took the beverage less than 20 minutes before or after a meal. 23.2% took it more than 20 minutes before or after a meal, while 19.5% took during a meal. Meal frequency for majority (66.5%) of the respondents was 3-4 meals in a day. 23% of the respondents took 1-2 meals in a day, while 10.5% took 5-6 meals in a day (Figure 9).

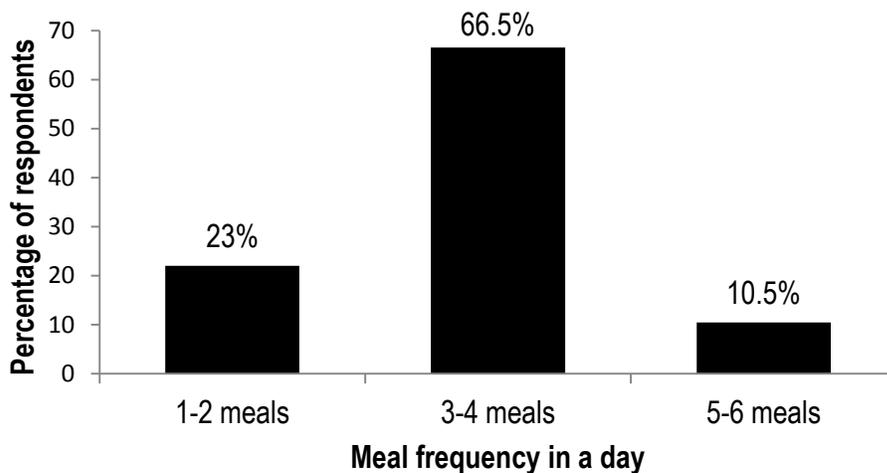


Figure 9: Meal frequency in a day of the respondents

Food avoidance was practiced by 37.5% of the respondents with majority (63.2%) being in their third trimester. The foods avoided included: fish 36%, beans and lentils 20%, green leafy vegetables 13.3%, beef/goat meat 9.3%, and liver and eggs 5.3%. The reasons given for avoiding the foods included: dislike (57.3%), stomach upset and ulcers (16%), heartburn and nausea (10%). The pregnant women who reported craving for non-food items were 27.5% with 95% of these craving stones and 5% soil. There was significant association between food avoidance and pregnancy trimester (Table 10).

Table 10: Association of food avoidance and pregnancy trimester

Variable	Practice food avoidance		Statistical test
	Yes (%)	No (%)	
Pregnancy trimester			
First trimester	7.9	6.5	$X^2 = 7.42$; 2df
Second trimester	28.9	48.4	$p = 0.03$
Third trimester	63.2	45.2	

Majority (67.3%) of those who practiced pica were in the third trimester. There was significant association between pica and pregnancy trimester (Table 11).

Table 11: Association of pica and pregnancy trimester

Variable	Practice pica		Statistical test
	Yes (%)	No (%)	
Pregnancy trimester			
First trimester	5.5	7.6	$X^2 = 7.15$; 2df
Second trimester	27.3	46.2	$p = 0.03$
Third trimester	67.3	46.2	

4.6 Utilization of Antenatal Care

The average gestational age for the respondents when attending first ANC was 4.54 months (sd 1.63). This information matches with that of the FGD in which the lactating women said that most pregnant women went to the clinic for the first time when they were at about 4 months of pregnancy. The average number of ANC visits by the respondents was 2.59 (sd 1.36). Few (7.3%) of the women in the first and second trimester had gone for ≥ 4 ANC visits, this is expected since it is still the early stages of pregnancy. Less

than half (41.3%) of the pregnant women in the third trimester had gone for ≥ 4 ANC visits. This could be a pointer that majority of the pregnant women may not reach the recommended minimum of 4 ANC visits at full term pregnancy Table 12.

Table 12: Frequency of ANC attendance by pregnancy trimester

Pregnancy trimester	Number of ANC visits	
	<4 visits (%)	≥ 4 visits (%)
1 st and 2 nd trimester (96)	92.7	7.3
3 rd trimester (104)	58.7	41.3

Women who were pregnant for the first time paid more ANC visits (52%) than women who had been pregnant before. There was no significant association between ANC visits and number of previous pregnancies (Table 13). Number of ANC visits attended and distance to health facility were not significantly correlated (Spearman's rho -0.04, $p > 0.05$).

Table 13: Association of ANC visits and previous pregnancies had

Variable	ANC visits		Statistical test
	<4 (%)	≥ 4 (%)	
Previous pregnancies had			
Primigravidae	46.7	52.0	$X^2=0.43$: 1df
Multigravidae	53.3	48.0	$P=0.51$

Few (5%) of the respondents experienced any hindrance to ANC attendance. The type of hindrance experienced included: transport cost, health condition (dizziness, vomiting), job commitments and long

waiting time for service. The FGD revealed that most pregnant women faced the challenge of cost pertaining to transport and mandatory lab charges that amounted to Kshs. 300 for first visit.

The average distance to the health facility for the respondents was 28 minutes (sd 15.65) with a maximum distance of 60 minutes. Most (81.5%) of the respondents took less than 30 minutes to get to the health facility while 18.5% took more than 30 minutes to get there. Majority of the respondents used matatu ride as a means of transport (94%) and 6% walked to the health facility. The amount of money the respondents paid as fare to get to the health facility was an average of Kshs. 21.40 (Table 14).

Table 14: Distribution of respondents by hindrance faced to attend ANC and distance to health facility

Variable	Category	
	Yes (%)	No (%)
Women experiencing hindrance to ANC attendance	5	95
Distance to health facility	>30 minutes	<30 minutes
	18.5	81.5
Means of transport	Matatu ride (%)	Walking (%)
	94	6

4.7 Nutritional status of the respondents

The pregnant women who knew how much they weighed before their current pregnancy were 41%. The average pre-pregnancy weight for those respondents was 59.73kg (sd 11.86). There was no significant

correlation between pre-pregnancy weight and Hb level at first ANC visit ($r=0.05$, $p>0.05$). The weight gain trend of the respondents was an average of 1.48kg per month (sd 1.27). The mean weight gain trend per month for the pregnant women as per trimester was as follows: First trimester 0.01, second trimester 1.12 and third trimester 1.23. There was no significant correlation between weight gain trend and Hb level at first ANC visit ($r=0.01$, $p>0.05$) Table 15.

Average MUAC of the respondents was 26.61cm (sd 3.08). Majority (99.5%) of the respondents had a MUAC of more than 21cm while 0.5% had a MUAC of less than 21cm (Table 15). There was a significant correlation between age and MUAC ($r=0.38$, $p=0.00$) but there was no significant correlation between MUAC and Hb level at first ANC visit ($r=0.08$, $p>0.05$).

Table 15: Distribution of respondents according to nutritional status

Variable	Category	
	Yes (%)	No (%)
Aware of pre-pregnant weight	41	59
	< 21cm (%)	>21cm (%)
MUAC	0.5	99.5

4.8 Adherence and Associated Factors

4.8.1 Adherence

Adherence which was considered as taking of iron/folate supplements for four or more times in a week was observed by 24.5% of the respondents, while 75.5% had not adhered to the supplements.

Reasons provided for adherence/ non adherence

Slightly more than half, (53%) of respondents reported to have never received any iron/folate supplements during their current pregnancy compared to 47% who had received at some point. The major reason given by the lactating women involved in the FGD on why majority of pregnant women had never received iron/folate supplements during their current pregnancy was ignorance on the need to take the supplements.

When the respondents were asked on whether they had received any iron/folate supplements in the previous one week, 25% had while 75% had not received. The reasons given for not receiving the supplements are indicated in Table 16. The reason cited for not receiving the supplements in the previous past week as given by the lactating women in the FGD was that they expected to receive the supplements from the hospital and yet they were not given.

Table 16: Reasons for not receiving iron/folate supplements

Reasons for not receiving iron/folate	Frequency (n=150)	Percent (%)
Lack of information that it is a requirement to take	87	58
Lack of information to buy more once dose ends	36	24
Diet provides adequate nutrients	11	7.3
Side effects (vomiting, heartburn)	6	4
Forgot to buy	4	2.7
Bad taste	3	2
Lack of money to buy	2	1.3
Unwillingness to take	1	0.7

The pregnant women who had accessed the iron/folate supplements in the previous one week sourced it from the District hospital pharmacy (9.8%). Others sourced their supply from a private hospital pharmacy

(7.8%) and majority from a business owned pharmacy (82.4%). According to the focused group discussion held, the lactating women said that mostly women bought the supplements from business owned pharmacies which was different from the past when they would get the supplements from the hospital.

The key informants interviewed also gave similar information. They reported that previously supplements were provided by Kenya National Medical Supplies Agency (KEMSA) but this stopped from the year 2010 since the Board that published the Kenya Essential Medical List (KEML) which dictated the drugs to be supplied by KEMSA removed ferrous sulphate and folic acid from the list of essential drugs. The health facility did not consider the supplements as essential and as a result they were not stocked in the hospital pharmacy and pregnant women were referred to buy at the business owned pharmacies.

Majority (76.5%) of those who took the supplements in the previous past week knew which type they were given. Of these, 87.2% reported that they received ferrous sulphate and/or folic acid and 12.8% had received ranferon syrup. Among the 50 who received iron/folate supplements in the previous past week, they received a dose to last them a mean of 27.68 days (sd 6) with the minimum dose issued expected to last 7 days and maximum dose expected to last 30 days.

A high percentage of the pregnant women, who had taken the iron/folate supplements in the previous past week, claimed that they faithfully took the supplements (82%). All of those who said they were not faithful in taking cited forgetfulness as the reason. This was also highlighted by the lactating women who said that since many women hardly took lunch, they were likely to forget to take the supplements at lunch hour. Those who faithfully took the supplements cited the major reason (56.1%) as helping to boost their blood

levels, 39% were simply following doctor's advice while 4.9% thought it would help increase their appetite (Figure 10).

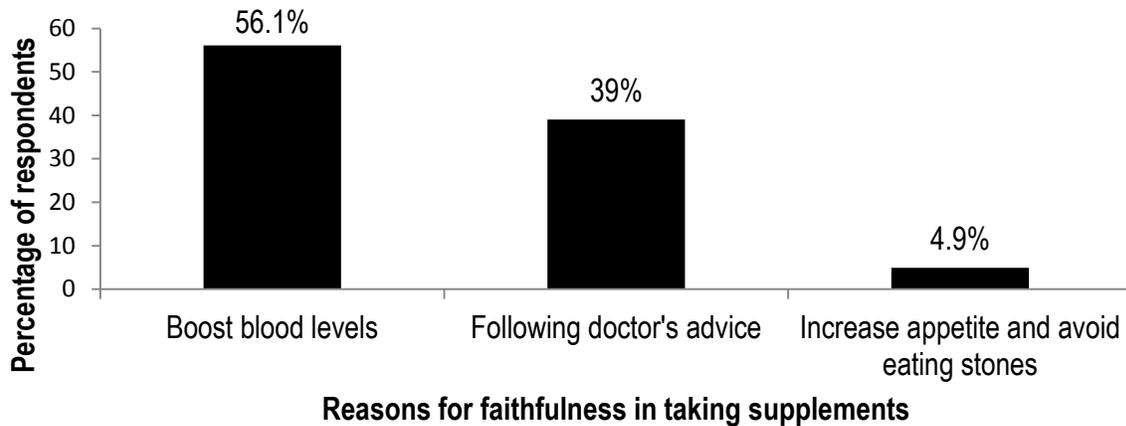


Figure 10: Reasons for taking iron/folate supplements faithfully

Table 17 shows the proportion of study women indicating that iron/folate supplements were important, directed on where to get supplies and who would face challenges in getting supplies of which majority (78.5%) of the women thought that it was important for a pregnant woman to take iron/folate supplements throughout pregnancy. The lactating women involved in the FGD, also agreed that it was important to take the iron/folate supplements to avoid excessive blood loss during delivery. Most of the pregnant women (65%) got directive from the health workers on where to get the supplements from and 35% said they did not get any directive. Only 7.5% of the 200 pregnant women interviewed said they would face challenges in acquiring the supplements. Expected challenges included cost of buying (87.5%) and distance to the supplies (12.5%).

Table 17: Proportion of study women indicating that supplements were important, directed on where to get supplies and who would face challenges in getting supplies

Characteristics	Yes (N=200) %
Women indicating that iron/folate supplements are important	78.5
Women directed on where to get the supplement at ANC	65
Women who would face challenges in getting the supplements	7.5

According to the lactating women in the FGD, it was difficult to get the money to buy the supplements which would cost them Kshs. 180 for one month's dose from the business owned pharmacies. One of the key informants said that whenever they had some stock at the hospital, they sold to the women at Kshs. 100 for both iron and folate supplements for a dose to last them one month. In the past when KEMSA would supply, the supplements were issued for free to the pregnant women.

The respondents who had heard of other women's perception on the supplements were 8.5%. Such perceptions included: leading to delivery of a healthy child (35.3%), causing vomiting (47%), and increasing appetite, causing nose bleeding and not being good for the baby (5.9%) table 18. The FGD revealed that most women did not like the taste and smell of the supplements. According to the Ministry of Public Health and Sanitation, efforts were being made to provide a combined tab of iron and folate supplements which were sugar coated to improve on taste.

Table 18: Distribution of respondents according to perceived effects of iron/folate supplements

Women's perception on iron/folate supplements	Frequency (n=17)	Percent (%)
Cause vomiting	8	47
Leads to birth of healthy child	6	35.3
Increase appetite	1	5.9
Cause nose bleeding	1	5.9
Not good for baby	1	5.9

4.8.2 Factors associated with adherence to iron/folate supplements

Demographic and socio-economic characteristics were associated with adherence to iron/folate supplements (Table 19). There was significant association between adherence and household monthly expenditure on food (Pearson's chi-square 8.34, 3df, p-value 0.04). There was also significant association between residential area and adherence (Pearson's chi-square 6.77, 1df, p-value 0.01). There was no significant association of adherence and age, education level, marital status, household size and proportion of income spent on food (p-value >0.05).

Table 19: Association of adherence and demographic and socio-economic characteristics

Variable	Adherence to iron/folate supplements	Adhere (%)	Statistical test
Residence			
Within Thika Municipality location (n=112)	71.1	28.9	X ² = 6.77 : 1df
Outside Thika Municipality location (n=88)	89.6	10.4	p= 0.009
Age			
< 26 years (n=132)	76.5	23.5	X ² = 0.22:1df
≥ 26 years (n=68)	73.5	26.5	P=0.64
Education level			
Secondary and below (n=163)	76.7	23.3	X ² = 0.67:1df
Above secondary (n=37)	70.3	29.7	P= 0.41
Marital status			
Married (n=178)	73.6	26.4	X ² = 3.17:1df
Unmarried (n=22)	90.9	9.1	P= 0.08
Household size			
≤ 3 (n=164)	73.8	26.2	X ² = 1.46: 1df
>3 (n=36)	83.3	16.7	P= 0.23
Proportion of income spent on food			
0-25% (n=61)	77	23	
26-50% (n=69)	72.5	27.5	X ² = 0.54: 3df
51-75% (n=43)	76.7	23.3	P= 0.91
>75% (n=27)	77.8	22.2	

Pregnancy status and history of low hemoglobin level in current pregnancy was associated with adherence to iron/folate supplements (Table 20). There was significant association of adherence and pregnancy trimester, history of low hemoglobin level in current pregnancy and Hb level at first ANC visit (p value <0.05). There was however no significant association between adherence and having had previous

pregnancies (p value >0.05). There was a significant relationship between knowledge on anemia and adherence to iron/folate supplements (p value <0.05).

Table 20: Association of adherence and pregnancy status of the respondents

Variable	Adherence to iron/folate supplements		Statistical test
Pregnancy trimester	Not adhere (%)	Adhere (%)	
First and second trimester (n=96)	84.4	15.6	X ² =7.86:1df
Third trimester (n=104)	67.3	32.7	P=0.01
Previous pregnancies had			
Primigravidae (n=96)	74.0	26.0	X ² = 0.24:1df
Multigravidae (n=104)	76.9	23.1	P= 0.63
History of low Hb			
Yes (n=44)	52.3	47.7	X ² = 16.45:1df
No (n=156)	82.1	17.9	P= 0.00
Hb level at first ANC			
< 11g/dl (n=43)	53.5	46.5	X ² =14.3:1df
≥11g/dl (n=157)	81.5	18.5	P=0.00
Awareness on anemia			
Aware (n=69)	62.3	37.7	X ² =9.89:1df
Not aware (n=131)	82.4	17.6	P=0.00

There was no significant association between dietary diversity and meal frequency and adherence to iron/folate supplements (p value > 0.05), (Table 21).

Table 21: Association of adherence and dietary diversity score and meal frequency

Variable	Adherence to iron/folate supplements		Statistical test
Dietary diversity score	Not adhere (%)	Adhere (%)	
≤ 6 (n=19)	73.7	26.3	X ² =0.34:1df
> 6 (n=181)	75.7	24.3	P=0.85
Meal frequency			
1-2 times a day (n=46)	87.0	13.0	X ² = 0.4.62:2df
3-4 times a day (n=133)	72.9	27.1	P= 0.10
5-6 times a day (n=21)	66.7	33.3	

There was significant association between frequency of ANC attendance and adherence to iron/folate supplements (p value >0.05). There was no significant association between adherence and mid-upper arm circumference (p value >0.05) Table 22.

Table 22: Association of adherence and frequency of ANC attendance

Variable	Adherence to iron/folate supplements		Statistical test
Frequency of ANC attendance	Not adhere (%)	Adhere (%)	
Once (n=47)	95.7	4.3	X ² =17.56:4df
Twice (n=66)	75.8	24.2	P=0.00
Thrice (n=37)	59.5	40.5	
Four times (n=28)	64.3	35.7	
More than four times (n=22)	72.7	27.3	
MUAC			
<23cm (n=21)	85.7	14.3	X ² =1.32:1df
≥23cm (n=179)	74.3	25.7	P=0.25

A logistic regression analysis was conducted to predict factors affecting adherence to iron/folate supplements. All the variables that showed significant associations based on chi-square tests such as place of residence, pregnancy trimester, knowledge on anemia, history of low Hb in current pregnancy, Hb level at first ANC, and number of ANC visits were entered into the model.

The Wald criterion demonstrated that knowledge on anemia and place of residence made a significant contribution to prediction (p value < 0.05), (Table 23). History of low Hb, Hb at first ANC, pregnancy trimester and frequency of ANC visits were not significant predictors (p value > 0.05). Exp (B) value indicates that when knowledge on anemia is raised by one unit (one person) the odds ratio is twice as large and therefore with pregnant women being more aware about anemia, adherence to iron/folate supplements is twice more likely.

Table 23: Regression analysis on the predictors of adherence to iron/folate supplements

Characteristics	B	S.E.	Wald	df	Sig.	Exp(B)
Hb level at first ANC	-21.063	4.019E4	0.000	1	1.000	0.000
Awareness on anemia	0.856	0.367	5.450	1	0.020	2.354
History of low Hb	22.234	4.019E4	0.000	1	1.000	4.532E9
Pregnancy trimester			2.261	2	0.323	
Frequency of ANC visits	-0.016	0.433	0.001	1	0.971	0.984
Place of residence	-1.191	0.536	4.935	1	0.026	0.304

CHAPTER FIVE: DISCUSSION

This chapter is a self-critique of the findings and analyses how the results obtained compare to other researches done in the area of study. Therefore a discussion on the dependent and independent variables is presented. The main dependent variable was adherence rate. This was determined based on the intake of iron/folate supplements for four or more days in a week as given by the Ministry of Health (Stoltzfus and Dreyfuss, 1998).

5.1 Demographic and Socio-economic Characteristics of Respondents

Thika District hospital is located within Thika town. Findings showed that nearly all the users of the ANC services at the district hospital reside in estates around Thika town. Majoritiy are aged between 21 years and 30 years corresponding to the age (20-24 years and 25-29 years age cohorts) reported to have high fertility rate in Kenya (KNBS and ICF Macro, 2010).

Studies in Kenya have shown that few women (7.3%) in the reproductive age (15 to 49 years) have gone to school past secondary level (KNBS and ICF Macro, 2010). This study indicates similar results in that only one-fifth of the respondents have schooling past secondary level (KNBS and ICF Macro, 2010).

The findings that majority (89%) of the study women are married are in agreement with those of the KDHS, 2008 concerning women in the reproductive age group (15 to 49 years) (KNBS and ICF Macro, 2010). However, the proportion of married women in the study is much higher than that found in the KDHS probably because this study focused only on pregnant women while the KDHS included even those who are not pregnant and are therefore less likely to be married compared to the pregnant ones.

Data has shown that the mean size of a Kenyan household is 4 persons (KNBS and ICF Macro, 2010), which is higher than the mean household size of 3 found in this study. The differences could probably be attributed to the fact that the study sample was mainly urban-based with the urban size according to the KDHS, 2008 being much smaller than the rural size. In addition, the study focused on women of reproductive age while the KDHS sample included all households (urban, rural and households with even older women who have more children or have finished giving birth).

5.2 Adherence and Associated Factors

The adherence rate to iron/folate supplements was higher (24.5%) than the National figures for Central Province of 0.7% (KNBS and ICF Macro, 2010). The fact that this study was urban based and the women were probably more educated than those in rural areas could have contributed to the higher level than the Central province level.

According to a health survey conducted in Kenya, there were a higher percentage of pregnant women residing in urban areas taking iron/folate supplements (KNBS and ICF Macro, 2010). The present study also shows a significant association between adherence and the residential area of study respondents. Majority of those who adhered to the supplements were from areas located near the district hospital. Neither length of education nor age is associated with adherence to iron supplements. These findings are similar to those reported in a Finnish study (Erkkola *et al.*, 1998). Another study differs with this in that education beyond high school was positively associated with adherence however age and income variables did not have an effect on adherence on iron/folate supplementation (Jasti *et al.*, 2007). The variations could be due to the differences in characteristics of the study population.

A study in Nepal showed that pregnant women started to take supplements at 11 weeks of gestation on average (Christian *et al.*, 2003). The current study notes that majority of those who adhere to the supplements are in their third trimester and a significant positive association has been found between gestational age and adherence to iron/folate supplements. A common finding is that women who have been pregnant before and have other children have a more casual attitude to supplementation especially if they have had uncomplicated pregnancies in the past than first time pregnant women (Carmichael *et al.*, 2006; Seck and Jackson, 2008). This study however does not find a significant association between having previous pregnancies and adherence to iron/folate supplements.

The findings of a significant association between history of low Hb in current pregnancy and adherence to iron/folate supplements compare with the findings of Erkkola *et al.* (1998) who found an association between low Hb values and intake of iron supplements during pregnancy, suggesting that low Hb values might be a strong incitement for the use of iron supplements.

The average dose duration of the supplements is 27.68 days and most of the pregnant women interviewed are not buying more supplements once their month's supply ends citing a lack of directive from the health personnel to purchase more. In addition, almost one-third of the pregnant women are not directed on where to get iron/folate supplements. Based on observation, the pregnant women are simply being given pieces of paper written ferrous sulphate and folic acid without explanation on what these are and where to get them from. Health professionals should communicate to the pregnant women in a way that is clear to them.

A study in Vietnam showed inadequate supplies as barriers to adherence (Galloway *et al.*, 2002; Ritsuko *et al.*, 2006). During discussions with nutritionists from Ministry of Public Health and Sanitation, it was

understood that there was a procurement problem at the national level. The national drug supply agent had decided to stop procurement of single iron sulfate and folate tablets and had opted for a combined formulation. However, no supplier responded to the tender for the combined formulation, this resulted in an acute shortage of hematinics in the national supply. Thus government health facilities within the Country had not received the supplements from Kenya national medical supplies agency as was the routine, for a period of 2 years. It was explained that plans for the National supply to resume were underway hence the supplements would be available at the facilities. Nevertheless, making the pregnant women aware on their need to have a continuous supply throughout pregnancy is important.

Contrary to belief that most women stop taking iron tablets mainly due to negative side effects (Aziz *et al.*, 2002)), in our study experiencing side effects does not seem to influence duration of iron intake. Those not adhering to the iron supplements indicated forgetting as the major reason for not taking all their tablets and side-effects are of minor importance. This may indicate that pregnant women are not aware of the benefits and the importance of iron for the health of their babies and themselves. However, focus group discussion results show that the negative perceptions of women regarding the iron/folate supplements are that the supplements cause vomiting and they have bad taste and smell. Comparable results were found in a study done in Malawi in which 20.7% of the respondents reported problems with their supplements with 43.6% of them reporting experiencing nausea (Kalimbira *et al.*, 2009). Similar results were also reported in another study in Vietnam where the respondents reported that they wrapped the iron tablets in pumpkin leaves or ate them with other foods to disguise their bad smell and taste (Aikawa *et al.*, 2006).

The findings show significant positive associations between knowledge on anemia and adherence to iron/folate supplements. Studies show that when consumers are informed, the compliance rate for taking

iron tablets increases. Unfortunately, consumer ignorance is caused in part by health providers' limitations, including lack of knowledge about anemia and iron tablets and insufficient communication and counseling skills (Emamghorashi and Heidari, 2004).

5.3 Knowledge on Anemia Causes and Consequences by Respondents

A study in Turkey found that there was lack of appropriate knowledge on anemia among pregnant women (Kisioglu *et al.*, 2004), another study conducted in Dar-es Salaam among pregnant mothers interviewed from maternal and child health clinics also found a lack of awareness on anemia (Massawe *et al.*, 1995). Despite the fact that prevalence of anaemia among women during pregnancy in Kenya has been found to be at levels that warrant public health concern, Kenya micronutrient survey of 1999 found 55% of pregnant women to be anemic (Mwaniki *et al.*, 1999), the majority of pregnant women interviewed were not aware of anemia, its causes and consequences in pregnancy. The few pregnant women who know the causes of anemia cite only unbalanced diet and lack of iron as the major causes. Those who are aware of the consequences of anemia in pregnancy cite loss of consciousness and maternal and infant mortality as the major consequences. They seem not to be aware of the impaired development consequences of their children.

It is estimated that anemia may be responsible for as much as 20% of all maternal deaths in sub-Saharan Africa (UNICEF, 1998). Several studies have shown an association between anemia and maternal mortality from both hospital data and community based studies (Macleod and Rhode, 1998). In Senegal the prevalence of low birth weight is at least 15%; maternal and infant mortality rates are high at 560/100,000 and 58/1,000, respectively. The proportions of these rates attributable to anemia are unknown; however, studies suggest that they are significant (Brabin, 2001).

Although iron deficiency is the most common cause of anemia, there are other nutritional and non-nutritional causes of anemia such as inadequate intake of folate and vitamin B12, infections and genetic abnormalities such as thalassemia may also contribute to anemia (Allen and Casterline-Sabel, 2001).

5.4 Dietary Diversity and Frequency of Consumption of Foods Rich in Iron and Folate

Moving from a monotonous diet to one containing a more diverse range of foods has been shown to increase intake of energy as well as micronutrients in developing countries (Kennedy *et al.*, 2007). The individual's dietary diversity has been shown to be related to increased nutrient adequacy of the diet, increased mean micronutrient density adequacy of complementary foods (FANTA, 2006) and micronutrient adequacy of the diet in non-breastfeeding children (Hatloy *et al.*, 1998; Ruel *et al.*, 2004; Steyn *et al.*, 2006; Kennedy *et al.*, 2007), adolescents (Mirmiran *et al.*, 2004) and adults (Foote *et al.*, 2004). The observed high individual dietary diversity score (8.18) among pregnant women in this study might therefore imply that the women generally have an adequate diet.

While it is observed that the pregnant women consume various sources of iron, folate and vitamin C rich foods, frequency of consumption of meats is however low. Increasing iron-rich flesh food consumption is thought to serve as an ideal dietary solution to improving iron intake; however, flesh foods are expensive (Gibson, 2001). Beans and lentils are indicated as frequently consumed in this study however many plant-based foods such as legumes and cereals are said to contain high levels of phytates which can inhibit dietary iron absorption (Gibson, 2001). Certain food processing techniques such as fermentation and germination is reported to reduce the phytate concentration in foods, and thereby improving the bioavailability of dietary iron (Gibson, 2001). A positive observation in this study is that vitamin C rich foods

such as citrus fruits and tomatoes are consumed at a high frequency which is good considering that vitamin C enhances the bioavailability of dietary iron (Gibson, 2001).

Majority (76.8%) of the pregnant women interviewed take beverages such as tea, coffee and cocoa which are known to contain polyphenolic compounds with their meals or directly after taking a meal. Polyphenolic compounds decrease bioavailability of iron (Zijp *et al.*, 2000). In tea, these compounds are tannic and gallic acid, which bind iron in the gut lumen and form chelates; thus, inhibiting iron absorption. In coffee, the main inhibitory compound is chlorogenic acid, which binds iron. A cup of tea with a meal reduces iron absorption by about 75% depending on the amount of phenolic compounds per cup. A cup of coffee with a meal has been shown to reduce iron absorption by about 60% (Zijp *et al.*, 2000). It is thus recommended to consume tea between meals instead of during the meal and to drink tea simultaneously with vitamin C and or meat, fish and poultry (Zijp *et al.*, 2000). Therefore despite the high dietary diversity score among the study group, it is possible that the bioavailability of iron in the diet is compromised by the utilization of tea and coffee with meals, which are predominantly plant-based.

It is recommended that pregnant women consume three meals and two or more snacks per day (IOM, 1992). In this study majority of the pregnant women consume three meals and snacks in a day which is less than the recommended more than five meals and snacks. This could be a pointer to the pregnant women not meeting their required micronutrient needs. 37.5% of the pregnant women practiced food avoidance. Significant positive correlation has been found between food avoidance and lower intake of nutrients especially micronutrients (Kroskey, 1990).

A study in Ghana showed that 48% of the women studied had pica habit (Tayie and Lartey, 1999) which is higher than the findings in the current study with 27.5% of the pregnant women practicing pica. A study in Kenya reported low iron status and anemia among 56% of pregnant women who practiced pica (Frie and Lowe, 1998). The non-food items craved by the respondents in this study are mainly stones and soil which could mean these women were at higher risk of anemia.

5.5 Utilization of Antenatal Care

WHO guidelines recommend that the first ANC visit occur as early as possible in pregnancy, and preferably in the first trimester to provide preventive measures (e.g. tetanus toxoid immunization), screen for underlying conditions and diseases (e.g. malaria, STDs, HIV), and provide health education and promotion for the woman and her family (WHO, 2006). However, most women in Kenya do not receive antenatal care early in pregnancy. Only 15% of women obtain antenatal care in the first trimester of pregnancy, and only about half (52%) receive care before the sixth month of pregnancy. Overall, the median number of months of pregnancy at first ANC visit in Kenya is 5.7 (KNBS and ICF Macro, 2010). This explains why majority of the pregnant women participating in this study were in their third trimester.

Strong evidence also shows that iron deficiency in the first trimester of pregnancy results in significant decrements in fetal growth, although most iron intervention programs rely on initiating treatment at the first visit of the newly pregnant woman to her health care provider, which often occurs in the second trimester (Beard, 2000). The evidence agrees with the findings of this study in which the average gestational age for first ANC visit is 4.54 (KNBS and ICF Macro, 2010). Hence if mothers are iron deficient in the first trimester, this is not detected until the second trimester, predisposing their fetuses to the risk of compromised fetal growth and development.

This study found that the frequency of ANC visits for majority (75%) is less than the recommended minimum number of four (WHO, 2006). Across sub-Saharan Africa there is wide variation in ANC attendance: although 71% of pregnant women attend formal ANC at least once, only 44% attend ANC four or more times (Kinney et al., 2010). A health survey done in Kenya showed that less than half of the pregnant women make four or more antenatal visits. This is because most women do not receive antenatal care early in the pregnancy (KNBS and ICF Macro, 2010). Pregnant women who live far from the ANC have the lowest rate of ANC visits. Long distances causes a reduction in accessibility to ANC services (Tlebere *et al.*, 2007 and Magadi *et al.*, 2000).The average distance to the health facility for the respondents in the current study is 28 minutes with majority of the respondents boarding a vehicle to get to the health facility. This distance does not seem to be too far. For international comparisons and national disparity assessment the common yardstick used is the 1-hour to health services criteria of spatial access (World Bank, 2001). Hence among women in this study, other reasons might account for why they do not start their ANC early in pregnancy.

5.6 Nutritional Status of Respondents

WHO bases its recommendations for folic acid and iron supplementation mainly on data from women with anemia defined as hemoglobin less than 11 g/dl which is the main indication for folic acid and iron supplementation (WHO, 2001). The hemoglobin levels among the pregnant women recorded at the health facility in terms of the percent of those with less than 11 g/dl averaged 21% between January and June 2012. This is lower than the prevalence of anemia among pregnant women in Africa estimated at 57% (WHO, 2002), in Kenya estimated at 55% (Mwaniki *et al.*, 1999) and in Tanzania estimated at 58% (TDHS, 2005). This result could be biased since only those pregnant women who could afford to pay the laboratory

charges had their hemoglobin levels checked at their first ANC visit. This indicates that a substantial proportion of women could be anemic when they make their first visit to ANC.

Table 24 shows the new guidelines for maternal weight gain during pregnancy released by the Institute of Medicine (IOM, 2009).

Table 24: The 2009 Institute of medicine gestational weight gain recommendations

Pre pregnancy BMI Category	Total Weight Gain	Rate of Weight Gain in the 2nd and 3rd Trimesters (mean)
Underweight (<18.5 kg/m ²)	12.5–18 kg	0.51 (0.44–0.58) kg/wk
Normal weight (18.5–24.9 kg/m ²)	11.5–16 kg	0.42 (0.35–0.50) kg/wk
Overweight (25.0–29.9 kg/m ²)	7–11.5 kg	0.28 (0.23–0.33) kg/wk
Obese (≥30.0 kg/m ²)	5–9 kg	0.22 (0.17–0.27) kg/wk

This study found that the average weight gain for the pregnant women in the 2nd and 3rd trimester is 0.28kg/wk and 0.31kg/wk respectively which is lower than the recommended weight gain for normal women (IOM, 2009). Inappropriate weight gain has been associated with difficulties during delivery process for the mother and low birth weight, prematurity and intrauterine growth retardation for the baby (Ehrenberg et al., 2003).

The value of MUAC has been evaluated in many studies as an alternative or complementary measurement of pre pregnancy weight during prenatal care (Ogbonna *et al.* 2007; Thame *et al.*2007). This study classified the pregnant women as normal based on their average MUAC of 26.61cm which is above the

minimum standard cut offs of 21cm for pregnant and lactating women (WHO,2006). Few (0.5%) of the respondents had MUAC less than 21cm in this study. Women with lower than normal maternal body weight have been shown to be at increased risk of adverse prenatal outcomes such as prematurity and intrauterine growth restriction (Ehrenberg et al., 2003). MUAC measurement was a single assessment that reflected the current nutritional status while weight gain trend is a reflection of the nutritional status over a given period. Throughout gestation, body components are constantly changing with increased fluid retention and sub-cutaneous fat (McCarthy *et al.*, 2004), which may have attributed to greater MUAC in the study group.

CHAPTER SIX: CONCLUSIONS AND RECOMMENDATIONS

6.1 Conclusions

In line with the objectives of this study, the following conclusions can be drawn:

- The adherence rate to iron/folate supplements is low among pregnant women attending ANC in Thika district hospital.
- Factors significantly associated to adherence include:
 - Place of residence: Pregnant women residing in a more urban area are more likely to adhere probably due to the fact that they are able to access a pharmacy, the major source for the supplements.
 - Gestational age: Women in the third trimester are more likely to adhere. The reason could be because pregnant women start attending ANC in their second trimester and may take time before commencing on any prescriptions made at the facility.
 - History of low Hemoglobin level: When the pregnant women perceive their health and that of the baby to be at risk, they are likely to follow on any recommendations made by the health professionals.
 - Knowledge on anemia: Majority of the pregnant women do not have any knowledge on anemia and its effects in pregnancy, which influences the importance to which they attach to the supplements.
 - Frequency of ANC visits: majority of the pregnant women in the third trimester are unlikely to achieve the minimum recommended ANC visit of 4 which could mean less contact between health professional and pregnant woman for dissemination of key messages.

- Dietary diversity of the pregnant women is high meaning there is access to variety of foods. Frequency of consumption of foods such as meat is however low with high frequency of consumption of legumes, green leafy vegetables and citrus fruits.
- Weight gain trend is lower than the recommended 0.42kg per week in the second and third trimester which means there are great health risks to the mother and fetus. Thus although dietary diversity is high, dietary adequacy might be poor.

6.2 Recommendations

Based on findings, the following recommendations are made:

1. Health professionals at the health facility should sensitize pregnant women on the need to continuously take the supplements throughout pregnancy. To ensure that the pregnant women actually take the supplements, education on anemia in relation to pregnancy should be done. Firstly on job training can be done to the health professionals and community health workers in regard to anemia, nutrition during pregnancy and counseling skills to be applied when they come in contact with the mothers.
2. Increase ANC attendance by pregnant women through offering of outreach services to enhance access to the supplements or engaging of community health workers in the distribution of the supplements.
3. Sensitization of women at the community level to start antenatal clinics early and on the importance of early supplementation with iron/folate by health professionals.
4. Manufacturers of the supplements should evaluate their product to ensure it is acceptable to the clients. Good strides have been made to come up with a combined tablet that is thought to be sweet and more acceptable.

5. The Ministry of Health should ensure that there is continuous and timely supply of the supplements to the health facilities. With the plans underway to revive supply through KEMSA of the combined iron/folate tablets, there should be efforts to ensure there is adequate stock throughout. This will enable all pregnant women to access the supplements from the health facility during their ANC visits.
6. Subsequent studies should be undertaken by the Ministry of Health and other research bodies on the iron/folate supplementation program for the improvement of maternal health and on dietary adequacy.

REFERENCES

ACC/SCN. (1991) Controlling iron deficiency. A report based on an ACC/SCN workshop, State-of-the-art series. Nutrition policy discussion paper, 9: 4-9.

Adam, I., Babiker, S., Mohammed, A., Salih, M., Prins, M. and Zaki, Z. (2007) Low body mass index, anaemia and poor perinatal outcome in a rural hospital in eastern Sudan. *Journal of Tropical Pediatrics*, 54 (3):202-204.

Allen, L.H. (2000) Anemia and iron deficiency: effects on pregnancy outcome. *American Journal of Clinical Nutrition*, 71(5):1280S-1284S.

Allen, L. and Casterline-Sabel, J. (2001) Prevalence and causes of nutritional anemias. In: *Nutritional anemias*. Editor U. Ramakrishnan Boca Raton, FL. CRC Press: 7–21.

Aikawa, R., Jimba M., Nguen, K., Zhao, Y., Binns, C., Lee, M. (2006) Why do Adult Women in Vietnam Take Iron Tablets? *BioMed Central Public Health*, 6:144.

Antelman, G., Msamanga, G., Spiegelman, D., Urassa, E.J., Narh, R., Hunter, D. and Fawzi, W. (2000) Nutritional factors and infectious disease contribute to anemia among pregnant women with Human Immunodeficiency Virus in Tanzania. *Journal of Nutrition*, 130:1950-1957.

AOP 5, (2005) Thika District Development Plan 2005-2010. Ministry of Planning and National Development. Nairobi : 3-8.

Aziz zadeh Frozi, M., Mohammadalizadeh, S., Ghazanfari, Z., Afsharadeh, P. (2002) Prevalence of iron deficiency on pregnancy women in Kerman health centers, Iran. *Journal of Research in Health Sciences*, 2(1):11-15.

Barret, J.F., Whittaker, P.G., William, J.G. and Lind, T. (1994) Absorption of non-haem iron from food during normal pregnancy. *British Medical Journal*, 309:79-82.

Beard, J. (2000) Effectiveness and strategies of iron supplementation during pregnancy. *American Journal of Clinical Nutrition*, 71 (5):1288S-94S.

Beratis, S. (1989) Non compliance with iron chelation therapy in patients with beta thalassaemia. *Journal of Psychosomatic Research*, 33: 739-745.

Berry, R.J., Li, Z., Erickson, J.D., Li, S., Moore, C.A., Wang, H., Mulinare, J., Zhao, P., Wong, L.Y., Gindler, J., Hong, S.X. and Correa, A. (1999) Prevention of neural tube defect with folic acid in China. *The New England Journal of Medicine*, 341:1485-1490.

Blot, I., Pdpiernik, E., Kaltwasser, J., Werner, E. and Tchernia, G. (1981) Influence of routine administration of folic acid and iron during pregnancy. *Gynaecologic and obstetric Investigation*, 12 (6): 294-304.

Botto, L.D and Yang, Q. (2000) 5,10 Methylenetetrahydrofolatereductase gene variants and congenital anomalies: A Huge Review. *American Journal of Epidemiology*, 151: 862-877.

Brabin, B.J., Hakimi, M., Pelletier, D. (2001) An analysis of anemia and pregnancy-related maternal mortality. *Journal of Nutrition*, 131: 604S-615S.

Carmichael, S., Shaw, G., Yang, W., Laurent, C., Herring, A., Royle, M., Canfield, M. (2006) Correlates of intake of folic acid-containing supplements among pregnant women. *American Journal of Obstetric Gynecology*, 194: 203–210.

Charoenlarp, P., Dhanamitta, S., Kaewwichit, R., Silprasert, A., Suwanaradd, C., NaNakorn, S., Prawatmuang, P., Vatanavicharn, S., Nutcharas, U., Pootrakul, P., Tanphaichitr, V., Thanangkul, O., Vaniyapong, T., Thane, T., Valyasevi, A., Baker, S., Cook, J., DeMaeyer, E., Garby, L. and Hallberg, L. A. (1988) WHO collaborative study on iron supplementation in Burma and Thailand. *American Journal of clinical Nutrition*, 47: 280-297.

Chaulet, P. (1987) Compliance with anti-tuberculosis chemotherapy in developing countries. *International Journal of Tuberculosis Diseases*, 68 (2):19-24.

Christensen, R.D. and Ohls, R.K (2004) Anaemias unique to pregnancy and the perinatal period. In: *Wintrobe's clinical hematology*, Vol. 2. 11th edition. Edited by: Greer, J.P., Foerster, J., Lukens, N.J., Rodgers, G.M., Paraskevas, F. and Glader, B. Lippincott Williams and Wilkins, USA: 1467-1486.

Christian, P., Khattry, S., Katz, J., Pradhan, E., LeClerq, S., Shrestha, S., Adhikari, R., Sommer, A., West, K. (2003) Effects of alternative maternal micronutrient supplements on low birth weight in rural Nepal: double blind randomised community trial. *British Medical Journal*, 26:571–83.

Conrad, M.E. and Umbreit, J.N. (2000) Disorders of iron metabolism. *New England Journal of Medicine*, 42 (17): 1293–4.

Cromer, B., Steinberg, K., Gardner, L., Thornton, D. and Shannon, B. (1989) psychosocial determinants of compliance in adolescents with iron deficiency. *American Journal of Diseases of Children*, 143:55-58.

de Benoist, B., McLean, E., Egli, I. and Cogswell, M. (2008) Worldwide prevalence of anaemia 1993-2005: WHO Global Database on Anaemia. Geneva: World Health Organization. : 6-7.

Ehrenberg, H., Dierker, L., Milluzi, C. and Mercer B. (2003) Low maternal weight, failure to thrive in pregnancy and adverse pregnancy outcomes. *American Journal Obstetric Gynecology*, 189:1726-1730.

Ellis, R.D. (1998) "A Method for Quantifying Distributive Justice." In: *Just results: ethical foundations for policy analysis*. Georgetown University press, Washington, DC. : 143-172.

Emamghorashi, F., Heidari, T. (2004) Iron status of babies born to iron-deficient anaemic mothers in an Iranian hospital. *East Mediterranean Health Journal*, 10(6):808-14.

Erkkola, M., Karppinen, M., Jarvinen, A., Knip, M., Virtanen, S. (1998) Folate, vitamin D, and iron intakes are low among pregnant Finnish women. *European Journal of Clinical Nutrition*, 52:742-748.

Fahreus, R. (1921) The suspension stability of the blood. *Actamedicascandinavica*, 55:1-28

FAO, (2007) *Guidelines for Measuring Household and Individual Dietary Diversity*.

<http://www.foodsec.org/News/tr/nut/guidelines.pdf>

Favin, M. and Griffiths, M. (1991) Social marketing of micronutrients in developing countries. Paper prepared for the Population and Human Resources Department, the World-Bank. : 25-26.

Fisher A., Laing, J., Stoeckel, J., Townsend, J. (1991) Handbook for family planning operations Research Design. Operations Research, Population Council, U.S.A. :40-43.

Frii, H., Lowe B. (1998) Geophagy, Iron status and anaemia among pregnant women on the coast of Kenya. Transactions of the Royal Society of Tropical Medicine and Hygiene, 92(5): 549-553.

Galloway, R. and McGuire, J. (2002) Determinants of compliance with iron supplementation: supplies, side effects, or psychology? Social Science Medicine, 39 (3):381-390.

Galloway, R., Dusch, E., Endang, A., Achadi, E., Grajeda, R., Hurtado, E., Favin, M., Karani, S., Marsaban, J., Meda, N., More, K.M., Morison, L., Raina, N., Rajaratnam, J., Rodriguez, J. and Stephen, C. (2002) Women's perceptions of iron deficiency and anemia prevention and control in eight developing countries. Social Science Medicine, 55 (4):529-544.

Garn, S.M., Ridella, S.A., Petzold, A.S. and Falkner, F. (1981) Maternal Hematologic Levels and Pregnancy Outcomes. Seminars in Perinatology, 5:115-162.

Gibson, R., Hotz, C. (2001) Dietary diversification/modification strategies to enhance micronutrient content and bioavailability of diets in developing countries. British Journal of Nutrition, 85(2):159–166.

Grantham-McGregor, S., Ani, C. (2001) Iron-Deficiency Anemia: Reexamining the Nature and Magnitude of the Public Health Problem. Journal of Nutrition, 131 (2): 649S–668S.

Griffiths, M. (1980) Concept Testing Nutrition Communication and Behavior Change Components. Manoff International, Indonesia Nutrition Development Program, 1: 38.

Haggaz, A.D., Radi, E.A. and Adam, I. (2010) Anaemia and low birth weight in Western Sudan. Transactions of the Royal Society of Tropical Medicine and Hygiene, 104 (3): 234-236.

Hallberg, L. (1988). Iron balance in pregnancy. In: Berger H, edition. Vitamins and minerals in pregnancy and lactation. Raven press, New York. : 115-127.

Harmening, D.M. (2001) Clinical Hematology and Fundamentals of Hemostasis. In: Harrison's principles of Internal Medicine, 15th Edition. Edited by: Braunwald, E., Fauci, A.S., Kasper, D.L., Hauser, S.L., Longo, D.L. and Jameson, J.L. McGraw-Hill, New York. : 674-680.

Institute of Medicine (IOM). (1992) Nutrition during pregnancy and lactation In: An Implementation Guide. National Academy press, Washington, DC. : 109-112.

Institute of Medicine (IOM). (1998) "Folate" chapter In: Dietary reference intakes for thiamin, riboflavin, niacin, vitamin B6, pantothenic acid, biotin, and choline. National Academy Press: Washington. : 260.

Institute of Medicine (IOM). (2009) Weight gain during pregnancy: Reexamining the guidelines. The National Academies Press. Washington, DC. : 8-10

Jasti, S., Siega, A.M., Cogswell, M., Hartzema, G. and Bentley, M. (2007) Pill count adherence to prenatal multivitamin/mineral supplement use among low-income women. Journal of American Society of Nutrition Science, 2:1093-1101.

Kalimbira, A., Mtimuni, B., Chilima, D. (2009) Maternal knowledge and practices related to anaemia and iron supplementation in rural Malawi: A cross-sectional study. *African Journal of Food, Agriculture, Nutrition and Development*, 9: 550.

Kennedy, G.L., Maria, R., Chiara, S., Guy, N. and Inge, B. (2007) Dietary Diversity Score Is a Useful Indicator of Micronutrient Intake in Non-Breast-Feeding Filipino Children. *The Journal of Nutrition*, 137:472-477.

Kenya National Bureau of Statistics (KNBS), (2010) Population and Housing Census 2009. Government printer, Nairobi, Kenya.

Kenya National Bureau of Statistics (KNBS) and ICF Macro. 2010 *Kenya Demographic and Health Survey 2008-09*. Calverton, Maryland: KNBS and ICF Macro. : 158-160.

Kidanto, H.L., Morgen, I., Lindmark, G., Massawe, S. and Nystrom, L. (2009) Risk for preterm delivery and low birth weight are independently increased by severity of maternal anaemia. *South African Medical Journal*, 99 (2): 98-102.

Kinney, M.V., Kerber, K.J., Black, R.E., Cohen, B. and Nkrumah, F. (2010) Sub-Saharan Africa's Mothers, Newborns, and Children: Where and Why Do They Die? *PLoS Medicine Series*, 7(6): e1000294.

Kisioglu, N.A., Ozturk, M., Cakmak, A.Z. and Ozguner, F. (2004) Anemia prevalence and its affecting factors in pregnant women of Isparta province. *Biomed Res (India)*, 16 (1):11-14.

Kolton, K. and Piccolo, P. (1988) Patient compliance: a challenge in practice. *Nurse Practitioner*, 13 (37): 40-50.

Kroskey, D. (1990) Factors Affecting Nutritional Status of Pregnant Women. *American Dietetic Association*. : 217363.

Lacerete, P., Pradipasen, M., Temchareen, P., Imamee, N. and Vorapongsathorn, T. (2011) Determinants of adherence to Iron/folate supplementation during pregnancy in two provinces in Cambodia. *Asia Pacific Journal of Public Health*, 23 (3):315

Lanska, D.J. (2009) Historical aspects of the major neurological vitamin deficiency disorders: the water soluble B vitamins. *Hand book of clinical Neurology*, 95:445-76

Li, R., Chen, X. and Yan, H., Deurenberg, P., Garby, L. and Hautvast, J.G. (1994) Functional consequences of iron supplementation in iron-deficient female cotton mill workers in Beijing, China. *American Journal of Clinical Nutrition*, 59 (4): 908-913.

Lone, F.W., Qureshi, R.N. and Emanuel, F. (2004) Maternal anaemia and its impact on perinatal outcome. *Tropical Medicine and International Health*, 9 (4): 486-490.

Lumley, J., Watson, M. and Bower, C. (2000) Periconceptual supplementation with folate and/or multivitamins for preventing neural tube defects. *Cochrane Database for systematic reviews*, 82: 349-352.

Macleod, J. and Rhode, R. (1998) Retrospective follow-up of maternal Deaths and their associated risk factors in a rural district of Tanzania. *Tropical Medicine International Health*, 3: 130-137.

Magadi, M., Madise, N., Rodrigues, R. (2000) Frequency and timing of antenatal care in Kenya: explaining the variations between women of different communities. *Social Sciences and Medicine*, 51: 551–561.

Massawe, S., Urassa, E., Lindmark, G. and Nystram L. (1995) Anemia in pregnancy perception of patients in Dar-es-Salaam. *East African Medical Journal*, 72(8): 498-503.

McCarthy, E. A., Strauss, B. J., Walker, S. P. and Permezel, M. (2004) Determination of maternal body composition in pregnancy and its relevance to perinatal outcomes. *Obstetrical and gynecological survey*, 59(10): 731-742.

Meda, N., Mandelbrot, L., Cartoux, M., Dao, B., Ouangre, A. and Dabis, F (1999) Anemia during pregnancy in Burkina Faso, West Africa, 1995-96: prevalence and associated factors. *Bulletin of the World Health Organization*, 77 (11): 916-922.

MOH (2009) Thika District Annual Operation Plan 5 (AOP 5) Report, Ministry of Health, Nairobi, Kenya.

MoH (2009). National Guidelines for Integrated Management of Acute Malnutrition. Government of Kenya. : 18

MoH (2008). The Kenya National Technical Guidelines for Micronutrient Deficiency Control. Government of Kenya. : 49-71

Morrow, O. (1990) Iron Supplementation During Pregnancy: Why aren't Women Complying.7 A Review of Available Literature. World Health Organization. : 16.

Msolla, M.J. and Kinabo, J.L. (1997) Prevalence of anaemia in pregnant women during the last trimester. *International Journal of Food Science and Nutrition*, 48 (4): 265-270.

Mwaniki, D.L., Omwega, A.M., Muniu, E.M., Mutunga, J.N., Akelola, R., Shako B., Gotink, M.H. and Peret, A.M. (1999) Anemia and Micronutrient status of Iron, Vitamin A and zinc in Kenya; National Micronutrient survey report. : 60-64.

Murphy, J.F., O'Riordan, J., Newcombe, R.G., Coles, E.C., Pearson, J.F. (1986) Relation of haemoglobin levels in first and second trimesters to outcome. *Lancet*, 3(1): 992-5.

NCAPD, (2005) Thika District Strategic Plan 2005-2010:11-17.

Nelen, W.L., Blom, H.J., Thomas, C.M., Steegers, E.A., Boers, G.H. and Eskens, T.K. (1998) Methylene tetrahydrofolate reductase polymorphism affects the change in homocysteine and folate concentrations resulting from low dose folic acid supplementation in women with unexplained recurrent miscarriages. *The Journal of nutrition*, 128 (8): 1336-1341.

Ogbonna, C., Woelk, G., Ning, Y., Mudzamiri, S., Mahomed, K., Williams M. (2007) Maternal mid-arm circumference and other anthropometric measures of adiposity in relation to infant birth size among Zimbabwean women. *Acta Obstetrica et Gynecologica Scandinavica*, 86: 26-32.

Ramankrishnan, U. (2001) Functional consequences of Nutritional anemia during pregnancy and early childhood, Ed: Ramankrishnan, U., *Nutritional Anemia*, CRS press LLC, USA. : 43-68.

Reichman, L. (1987) Compliance in developed nations. *International Journal of Tuberculosis Diseases*, 68: 25-29.

Ritsuko, A., Jimba, M., Nguen, K.C., Zhao, Y., Binn, C. and Lee, M.K. (2006) Why do adult women in Vietnam take iron tablets? *BMC Public Health*, 6:144-152.

Robinson, V. (1939) *Blaud's Pills for anemia. The modern Home Physician, a new encyclopedia of medical knowledge.* WM. H. wise and company, New York.: 435

Scholl, T.O, Hediger, M.L., Fischer, R.L. and Shearer, J.W. (1992) Anemia vs iron deficiency: Increased risk of preterm delivery in a prospective study. *American Journal of Clinical Nutrition*, 55: 985-988.

Scholl, T.O. and Hediger, M.L. (1994) Anaemia and iron-deficiency anaemia: compilation of data on pregnancy outcome. *American Journal of Clinical Nutrition*, 59 (2): 492S–500S.

Scholl, T.O. and Johnson, W.G. (2000) Folic acid: influence on outcome of pregnancy. *American Journal of Clinical Nutrition*, 71 (5): 1295S-1303S.

Schultink, W., Van der Ree, M., Matulesi, P., Gross, R. (1993) Low compliance with an iron-supplementation program: a study among pregnant women in Jakarta, Indonesia. *American Journal of Clinical Nutrition*, 57(2):135-9.

Scrimshaw, S., Zambrana, R., Estuoinan, S., Luna, R. and Rivera, H. (1990). Mass Communications/education, Strategies for Improvement of Prenatal Health Behaviors in Mexico. Maternal Nutrition and Health Care Program Research Report Series, International Center for Research on Women, 4: 22.

Scrimshaw, N. (1997) Special issue on Institution building for research and advanced training. Food Nutrition Bulletin, 18: 103-178.

Seck, B., Jackson, R. (2008) Determinants of compliance with iron supplementation among pregnant women in Senegal. Public Health Nutrition, 11:596–605.

Stoltzfus, R. J., and Dreyfuss, M. L. (1998) Guidelines for the use of iron supplements to prevent and treat iron deficiency anemia. ILSI Press, Washington: 18-21.

Tayie, F. and Lartey, A. (1999) Pica practice among pregnant Ghanaians: Relationship with infant birth weight and maternal hemoglobin level. Ghana Medical Journal, 33(2).

TDHS (2005) Tanzania Demographic and Health Survey 2004-2005. Dar es Salaam, Tanzania: National Bureau of Statistics and ORC Macro. :190-196.

Thame, M., Trotman, H., Osmond, C., Fletcher, H., Antoine M. (2007) Body composition in pregnancies of adolescents and mature women and the relationship to birth anthropometry. European Journal of Clinical Nutrition, 61: 47–53.

Tlebere, P., Jackson, D., Loveday, M., Matizirofa, L., Mbombo, N., Doherty, T., Wigton, A., Treger, L., Chopra, M. (2007) Community-based situation analysis of maternal and neonatal care in South Africa to explore factors that impact utilization of maternal health services. *Journal of Midwifery and Women's Health*, 52: 342–350.

Uneke, C.J., Duhlinska, D.D. and Igbiniedion, E.B. (2007) Prevalence and public health significance of HIV infection and anemia among pregnant women attending antenatal clinics in South Eastern Nigeria. *Journal of Health Population and Nutrition*, 25 (3): 328-35.

UNICEF (1998) *State of the World's Population 1994*, UNFPA: New York.

UNICEF. (2005) *Report on Assessment of Health Based Strategies for National Iron/Folate Supplementation programme*. :5.

Valyasevi, A. (1988) *Delivery system for iron supplement in pregnant women-Thailand experience*. November INACG meeting in Geneva, Switzerland. : 2.

Weatherall, D.J and Clegg, J.B. (2001) *Inherited haemoglobin disorders: an increasing global health problem*. *Bulletin of World Health Organization*, 79 (8): 704–12.

Werler, M.M., Shapiro, S. and Mitchell A.A. (1993) *Periconceptional folic acid exposure and risk of occurrent neural tube defects*. *JAMA*, 269 (10):1257-1261.

WHO. (1962) *Causes of Death. Anaemias*. *World Health Statistics*, 15: 594-604.

WHO. (2001) Iron deficiency anemia assessment prevention and control: a guide for program managers. Geneva: World Health Organization. WHO/NHD/01.3.

WHO. (2002) The World Health Report: Reducing risks, promoting healthy life. Geneva: World Health Organization. : 1-248.

WHO. (2006) Making Pregnancy Safer. Standards for Maternal and Newborn Care. Geneva, Switzerland: World Health Organization. :20-23.

World Bank. (2001) African Development Indicators. Washington DC. :366.
<http://publications.worldbank.org/>

Wouters, M.G., Boers, G.H.J. and Blom, H.J. (1993) Hyperhomocysteinemia: a risk factor in women with unexplained recurrent early pregnancy loss. Fertility and Sterility, 60 (5): 820-825.

Ziauddin, H., Persson, A., Chowdhury, A. and Ekstrom, E. (2002) Do side effects reduce the compliance to iron supplementation? A study of daily and weekly dose regimens in pregnancy. Journal of Health and Population Nutrition, 20:175-179.

Zijp, I., Korver, O. and Tijburg, L. (2000) Effect of tea and other dietary factors on iron absorption. Critical Review of Food Science and Nutrition, 40:371-398.

APPENDICES

Appendix 1: Questionnaire

Informed consent and cover page

Hello. My name is _____ I am conducting a survey on the factors associated with adherence to Iron/folate supplementation among pregnant women as part of the requirement to graduate with masters degree in Applied Human Nutrition from the University.

You have been selected by chance among other participants. I would like to ask you some questions related to this study.

Participation in this survey is voluntary and you can choose not to take part.

There will be no injections, drawing of blood or any body fluid involved. All information you will give will be confidential and will be used to make a general report. No names will be included in the report and there will be no way to identify you as one of the people who gave information.

If you have any questions about the survey, feel free to ask me.

Do you mind if we proceed?

Respondent agreed to be interviewed: Circle one

1. Yes 2. No

Name of interviewer _____

Signature of interviewer _____

FACTORS ASSOCIATED WITH ADHERENCE TO IRON/FOLATE SUPPLEMENTATION DURING PREGNANCY IN THIKA MUNICIPALITY, KIAMBU COUNTY-KENYA

Name of interviewer _____ Date of interview _____
Name of respondent _____ Place of residence of respondent _____

SECTION A: SOCIO ECONOMIC AND DEMOGRAPHIC INFORMATION

1. Demographic Information

- a) What is your age? _____
- b) What is your level of education? 1. Primary drop out 2. Primary complete 3. Secondary drop out 4. Secondary complete 5. College/university
- c) What is your marital status? 1. Married 2. Single 3. Divorced 4. Separated
- d) What is your household size? _____

2. Socio-economic Information

- a) How much is your average household monthly income? _____
- b) How much is your average household monthly expenditure on food? _____
- c) How much is your average household monthly expenditure on transport? _____
- d) How much is your individual monthly expenditure on health care services? _____

SECTION B: KNOWLEDGE ON ANEMIA CAUSES AND CONSEQUENCES

- 1. Do you know of an illness where the affected person is said to have little or no blood? 1. Yes 2. No
- 2. a. Do you know what causes the disease? 1. Yes 2. No
b. If Yes, what? _____
- 3. a. Do you know what the consequence of this disease in pregnancy is? 1. Yes 2. No
b. If Yes, what? _____
- 4. Where or from whom did you learn about this disease? 1. Community health worker 2. Health professional
3. Friend 4. Relative 5. Media 6. Other (specify) _____

SECTION C: ADHERENCE RATE AND FACTORS HINDERING AND THOSE ASSOCIATED WITH COMPLIANCE TO IRON-FOLATE SUPPLEMENTS

1. How many months pregnant are you? (record number of completed months) _____
2. a. Do you know your expected delivery date? 1. Yes 2. No
b. If yes, what is your expected delivery date? _____
3. How many pregnancies have you had before this one? _____
4. a. Have you ever had a pregnancy that miscarried; was aborted or ended in still birth? 1. Yes 2. No
b. Have you ever been told you have little or no blood since you became pregnant? 1. Yes 2. No
5. a. Have you ever accessed any iron/folate tablets or syrup since you became pregnant? 1. Yes 2. No
b. If No, what are the reasons? _____
c. If yes, in the past 1 week have you taken any iron/folate tabs or syrup? 1. Yes 2. No
d. If no to (c), why not? _____
e. If yes to (d), was it given as supplement to diet or prescribed as medicine? 1. Medicine 2. Supplement to diet 3.N/A
- f. What was your source for the tablets or syrup? 1. Public hospital pharmacy 2. Private hospital pharmacy 3. Business owned pharmacy 4. N/A
- g. Do you know what type of iron/folate tablets or syrup you were given? 1. Yes 2. No 3.N/A
- h. If yes, which one? 1. Ferrous sulphate 2. Folic acid 3. Combined iron-folate tab 4. Ranferon 5. N/A
- i. For how long were the tablets or syrup you were given to last? _____
- j. Do you faithfully take the given tablets or syrup? 1. Yes 2. No
- k. If yes/no what are the reasons? _____
- l. How many tablets have you taken in the past 1 week? _____
6. a. Do you think it is important to take iron/folate tablets to supplement your diet throughout pregnancy?
1. Yes 2. No
b. If Yes/No, why? _____
c. Do you know where to get the tablets from? 1. Yes 2. No
d. Do you face any challenges in acquiring the tablets? 1. Yes 2. No
e. If yes, which ones? _____
7. a. Have you ever heard of other women's opinion regarding the iron/folate tablets? 1. Yes 2. No
b. If yes, which ones? _____

SECTION D: I DIETARY DIVERSITY

1. Was yesterday a feast day or a celebration day where you ate something unusual?

What food did you consume in the past 24 hours (from this time yesterday to now? Include snacks)	Did you consume food from any of these food groups in the last 24 hours? 1. Yes 2. No	Indicate source of food 1. Own production 2. Purchases 3. Gifts 4. Food aid 5. Bartered
Food group		
Cereals and cereal products (e.g. maize, spaghetti, rice, bread, biscuits, wheat, porridge, noodles, foods from millet or sorghum)		
Milk and milk products (e.g. goat/cow fermented milk, milk powder, cheese, yoghurt or other milk products)		
Sweets (e.g. sugar, honey, sweetened soda or sugary foods such as chocolates, cake, sweets or candies)		
Oils/fats (e.g. cooking fat, margarine, butter, ghee)		
Meat, poultry, organ meat and offal (e.g. goat, beef, chicken or their products, liver, kidney, heart)		
Pulses/legumes, nuts and seeds (e.g. beans, lentils, green grams, peanuts)		
Root and tubers (e.g. potatoes, arrow roots, cassava, pumpkin, carrots, sweet potatoes)		
Vegetables (tomatoes, carrots, onions, green leafy vegetables, cabbages)		
Fruits (e.g. water melons, mangoes, lemon, bananas, oranges, avocados)		
Eggs		
Fish and sea foods		
Miscellaneous (e.g. spices, salt, sauce, coffee, tea, alcoholic beverages)		

SECTION D: II FREQUENCY OF CONSUMPTION OF IRON AND FOLATE RICH FOODS

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

FOOD ITEM	Never	Rare	Once/2 weeks	1	2	3	4	5	6	7
Dark green leafy vegetables(sukuma, spinach, terere)										
Cabbage										
Liver										
Beef/goat meat										
Chicken										
Fish										
Beans and legumes (pigeons peas, cow peas, chick peas, lentils)										
Citrus fruits(Orange, tangerines, lime, lemon, guava, grape fruits, grapes, passion fruit, strawberries)										
Vegetables such as tomatoes, pepper and parsley										
Whole grain cereals (finger millet) and fortified cereal products										

1. Do you take tea, cocoa, or coffee? 1. Yes 2. No
2. At what times do you take these beverages? 1. <20 min before/after meals 2. During meals 3. >20 min before/after meals
3. How many meals and snacks do you take in a day? _____
4. a. Are there foods you avoid? 1. Yes 2. No
b. If yes which ones and why? _____
5. a. Do you crave for or eat any non-food items? 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 items? _____

SECTION E: FREQUENCY OF VISITS TO ANC

1. How many months pregnant were you when you first attended ANC for this pregnancy? _____
2. How many times have you attended ANC during this pregnancy? _____
3. a. Is there any reason that has hindered your attendance to ANC? 1. Yes 2. No
b. If yes, what? _____
4. How far is your place of residence from this facility in minutes? _____
5. What means of transport do you use to get to the facility? 1. Walking 2. Matatu ride 3. Motor cycle 4. Bicycle ride
6. How much if any does it cost you to get to the facility? _____

SECTION F: NUTRITIONAL STATUS (TRENDS IN WEIGHT GAIN AND MUAC)

1. (Refer to the mothers clinic card and record the weight)

Weight (Kg) by visit						
Pre-pregnancy (Date: _____)	1 st visit (Date: _____)	2 nd visit (Date: _____)	3 rd visit (Date: _____)	4 th visit (Date: _____)	5 th visit (Date: _____)	6 th visit (Date: _____)

2. MUAC (cm) _____

Appendix 2: Key Informant Interview Guide

Name of respondent _____

Date _____

Job title _____

Gender _____

1. Does the health facility have a policy of supplementing pregnant women with Iron/folate tablets?
2. Do you think it is important to supplement pregnant women with iron/folate tablets regardless of Hb levels?
3. Are the tablets prescribed as medication or as supplements to diet for all women regardless of Hb levels?
4. Are pregnant women advised on the importance of the iron/folate tablets during pregnancy?
5. What is the source of supply for the iron/folate tablets and have there been any changes?
6. Is the supply flow perfect? If not what are the challenges?
7. Which type of iron/folate tablets are issued to pregnant women?
8. How is adherence and acceptability of the tablets like? What do you think are the issues affecting adherence and acceptability? (probe on color, size, taste, side effects)
9. What has been the trend in terms of supplementation and adherence of pregnant women to the tablets?
10. In your opinion, what can be done to enhance supplementation of pregnant women with iron/folate tablets?

Appendix 3: Focused Group Discussion

Name of moderator_____

Date_____

Name of recorder_____

Place_____

No	Name of participant	Age of child in weeks	Age	Occupation	Marital status	Parity
1						
2						
3						
4						
5						
6						
7						
8						
9						
10						

Question guideline:

1. How many have ever accessed iron/folate tablets during their pregnancy?
2. How many have taken the tablets throughout any of their pregnancies?
3. Are the tablets usually given as medication or as supplement to diet?
4. What are the reasons for pregnant women not taking the tablets at all?
5. What are the reasons for stopping for those who take the tablets and stop?
6. In your opinion is it important for a pregnant woman to take the iron/folate tablets throughout pregnancy?
7. What do you think if addressed would make more women take the tablets as required?
8. What do you think is anemia and how can you identify someone who has the condition?
9. In what ways can anemia affect a pregnant woman?

Appendix 4: Training Curriculum

This curriculum was designed to guide the training of research assistants who were to undertake the collection of data during research that was to take place at Thika District Hospital on factors associated with adherence to iron/folate supplements among pregnant women.

The purpose of the curriculum was to develop competencies to perform the specified job during research period starting July to August 2012. The minimum qualification for the assistant was K.C.S.E certificate.

The training took two days.

Objectives:

By the end of the training the learner will be able to:

1. Demonstrate an understanding of the research objective of the study.
2. Explain the ethics and rights of the respondents.
3. Obtain consent from respondent before interviewing them.
4. Carry out data collection procedures and take MUAC.
5. Interview client within 30-45 minutes.

Topic	Activity	Time	Materials
DAY ONE			
Overview of study	lecture	60 minutes	Flip charts, marker pens, notebooks, pens, pencils, MUAC tapes, sample questionnaire
Data collection procedures	Lecture and demonstrations	30 minutes	
Taking MUAC	Lecture and demonstration	20 minutes	
Interview technique and persuasive skills	Lecture and demonstrations	30 minutes	
Ethical procedures and maintaining confidentiality	Lecture and brainstorming	30 minutes	
DAY TWO			
Review of questionnaire	Role play	3 hours	
Pre- testing	practical	5 hours	