COMPLIANCE TO PRENATAL IRON/FOLIC ACID SUPPLEMENTATION AND ASSOCIATED BARRIERS AMONG PREGNANT WOMEN ATTENDING ANTENATAL CLINIC IN MACHAKOS COUNTY, KENYA

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DECLARATION

This thesis is my original work and has not been presented for a degree in any other University.

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ABBREVIATIONS AND ACRONYMS

ANC	Antenatal care clinic
IDA	Iron Deficiency Anaemia
IFAS	Iron and Folic Acid Supplementation
KDHS	Kenya Demographic Health Survey
MoH	Ministry of Health
PDHS	Pakistan Demographic and Health Survey
SPSS	Statistical Package for Social Sciences
US	United States
UNICEF	United Nations Children Fund
WHO	World Health Organization

OPERATION DEFINITION

Anemia	This is a state where the level of hemoglobin in the blood falls below 11g/dl an indication of low oxygen carrying capacity.
Antenatal care clinic (ANC)	These are health institutions where expectant mothers gets maternal services like nutritional supplements, regular check ups consistent check-ups, (iron/folate) and trainings on proper diet required when one is expectant.
Antenatal visit	The expectant mother should begin receiving IFAS at 12 weeks then for the next 8 follow ups according to WHO guidelines (2018) throughout the ante partum period.
Compliance	The extent to which pregnant mother's medication taking behavior coincides with health care providers' medical advice. In this study mothers who will have taken the iron/folic acid daily was considered to be compliant to the supplementation.
Iron deficiency (IDA)	situation in which iron level found in the body of pregnant women recorded less than 3g
Iron/folic acid supplement	Additional combined nutrient to be taken by pregnant women in order to make up for iron/folic acid deficiency

ABSTRACT

Iron nutrients plays a very critical role in body. Iron and folate nutrients are availed during expectance period so as cater for the high demand when one becomes pregnant to ensure sufficient supply of such elements to both baby and expectant mother. Therefore, the general objective of this research is to determine the barriers that controls compliance to iron/folate nutrients amidst expectant mothers in Machakos county. The specific goals were to determine maternal social demographic factors influencing adherence to IFAS supplementation, obstetric related factors and health facility related factors influencing adherence level to usage of IFAS. An illustrative sampling research design was used in three sub-county hospitals found in Machakos county to sample 200 expectant mothers whose years of age was between 18-49 years. The facilities that were used were selected randomly from seven sub-counties hospitals within Machakos County while the mothers were systematically and randomly sampled. Morisky medication compliance scale questionnaire was employed to estimate compliance of iron/folate. Data gathering was achieved by help structured questionnaire. Statistical package software (SPSS version 24) was employed to analyze the data. The kind of relationship that existed between study variables was determined by use of logistic regression. The strength of association between these variables was established using odds ratio, with 95% confidence interval. Bar charts and tables played the role of visual presentation of the data. Three focus group discussions with health unit managers and administrators were held out. The data from these discussions was sorted and themes that appeared were reported. Results: Most of the participants fall under age bracket of 21-40 years. A few respondents were above 40 years. 84 % were in marriage whereas 76 % of them had made it to secondary school. Above 50% of the sampled expectant mothers were involved in casual work while 69% received family support during expectant period. Among the socio-demographic factors of the participants, family support and level of literacy of the expectant women were significantly connected with adherence to iron and folate supplements at p value <0.05. Maternal knowledge on consequences of low haemoglobin levels, source of information about the consequences and perceived benefits of taking the supplements were significant predictors of iron and folate supplement compliance. This was improved when the supplements were given in combined form. Provision of health education in pregnancy especially counseling on nutritional value of supplementing iron stores in the body and how to manage side effects of iron and folate supplements were significantly associated with compliance to iron and folate supplements. Also, availability of the supplements during antenatal visits was associated with compliance to the supplements. Past experience of the mothers' especially previous history of anemia, current haemoglobin level and bad obstetric history of the mother were found to increase compliance to the supplements. The time of initiating the antenatal clinics, number of antenatal clinics attended and current gestation were also found to be significant predictors of compliance to iron and folate supplements.

Recommendation: The government of Kenya, through the County government of Machakos, to develop policies on procurement and distribution of combined iron and folate supplement. This will promote availability of the drugs and improve compliance to the supplements

CHAPTER ONE: INTRODUCTION

1.0 Background the study

Iron deficiency anemia remains a common serious public health problem in the world. Iron is needed in the formation of red blood cells and contributes to maternal haemoglobin (Hb) levels. Lack or inadequate iron stores leads to anemia in pregnancy. Folic acid on the other hand is essential in formation of the neural tube during embryological development, lack of this essential acid, leads to neural tube defects. The World Health Organization (WHO) recommends that all pregnant women receive a standard dose of 30-40 mg iron and 400µg folic acid beginning as soon as possible during gestation (WHO, 2012). In Kenya, the national policy recommends that pregnant women should be supplemented with 60/mg per day for iron and 400µg of folic acid daily for 180 days. The risk for iron deficiency anemia increases during pregnancy because the demand for iron is increased in pregnancy to cater for both the mother and the developing fetus. Due to this reason in countries where micronutrient deficiencies are common such as the developing nations iron supplementation is therefore recommended. (WHO, 2012).

Globally almost half of all pregnant women are anemic and the highest proportion of the affected population is in developing nations. Developed countries have a lower prevalence of anemic women in comparison with the developing nations (UNICEF, 2015). Iron is one of the essential nutrients that is responsible for synthesis of hemoglobin and whose demand increases during pregnancy and its supply can be inadequately supplied through regular diet. Therefore, interventions which include iron supplementation which is administering iron along with folic acid in form of tablets to pregnant mothers is usually done with the

aim of increasing hemoglobin concentrations to the best possible extent so that women do not reach term pregnancy with anemia (Titilayo & Agunbiade, 2014).

Kenya, like most sub-Saharan Africa countries, has a national policy aiming at combating anemia in pregnancy. This includes the provision of ferrous sulfate and folic acid to all pregnant women. The recommended dose in Kenya is 60mg/day of ferrous sulfate and 400μg of folic acid once a day taken by mouth for 180 days of prenatal period, preferably with a meal. This dosage is usually supplied in a single combined iron and folic acid tablet (MOH, 2008).

The effectiveness of and success of the policy interventions on anemia prevention in pregnancy largely depends on the compliance to iron and folic acid tablets usage. Compliance is the extent to which a client correctly follows medical advice given to him/her. Many experts have come to believe that the major reason that the national supplementation programs have failed is non-compliance to iron and folate by pregnant women. Health system and patient factors determine adherence, and research has not been extensively done on these factors. Apparently, there is no clear cut-off for compliance but missing 2 or more doses consecutively is usually referred to as non-compliance.

1.1 Problem statement

Even though interventions are often designed in both national and international level to combat anemia in pregnancy by the introduction of iron supplements, complying to the regimen of taking the drugs on daily basis and with the recommended dosage remains to be a challenge.

Estimates by the World Health Organization (WHO) reveal that approximately 500 million women of childbearing age worldwide are anemic, and the greatest of these numbers are recorded in Africa (WHO, 2014). The WHO country estimates for pregnant women aged 15-49 years found anemia to be a moderate public health concern in Kenya with 36% of these women having hemoglobin levels of less than 11g/dl.

According to the Kenya Demographic Health Survey of 2014, compliance to iron/folate supplements by pregnant women in Kenya was low. Nationally only 14% of the pregnant women took Iron supplements more than 90 days of the recommended 180 days. The statistics revealed that 5% of the respondents took supplements for 60-89 days, 53% took the supplements for fewer than 60 days and 30% reported that they did not take iron supplements at all during their last pregnancy. Machakos county lies within eastern Kenya and the KDHS 2014 statistics revealed that in eastern province only 13.6% of the respondents reported taking iron supplements for more than 90 days during their last pregnancy. Records from the district health information systems in Machakos County revealed that in the year 2016/2017, among the pregnant women visiting the antenatal clinics 6% had severe anemia and 19% had moderate to mild anemia in pregnancy respectively. The mothers were anemic and yet their compliance level to IFAS was low. These numbers were noted to be significantly higher in comparison with numbers in the previous years.

1.2 Justification of the study

Pregnant women need iron and folate because of the demand that they have as a result of the changes in their body's and also to accommodate the demands of developing fetus. Any situation that leads to deficiency of these nutrients therefore means that the pregnant mother will not be able to supply them in sufficient quantities to the developing fetus and this increases pregnancy risk. Evidence suggests that maternal hemoglobin levels less than 11g/dl during pregnancy has several impacts to both the mother and the fetus. Some of the effects include poor cognitive development, decreased work capacity; maternal mortality rates, infant mortality rates, low birth weight and premature births among women with anemia (Burke 2014).

Iron and folate supplementation during pregnancy is required for good outcome of both mother and fetus. Pregnancy is characterized by rapid tissue growth and as such the need for folic acid increases. This is usually to cater for the growth of the uterus and the placenta (Fraser, 2010). The intake of iron and folic through diet intake could be inadequate to meet the demand during pregnancy and therefore the need to supplement is justified.

According to the world health organization, majority of women are not able to take the elemental iron supplements for the recommended 180 days during pregnancy because they lack knowledge on the importance of iron or they visit antenatal care clinics late and therefore this study aims to identify the gaps in compliance to iron supplementation. Anaemia among expectant mothers is a major contributor of maternal mortality and morbidity. Therefore, it's important to prevent this anaemia for safe motherhood.

1.3 Research question

i. What are the socio-demographic related factors associated with compliance to iron and folic supplementation among pregnant mothers in Machakos County?
ii. What are the obstetric related factors associated with compliance to iron and folic supplementation among pregnant mothers in Machakos County?
iii. What are the health service factors associated with compliance to iron and folic supplementation among pregnant mothers in Machakos County?

1.4 Broad objective

To assess the factors associated with compliance to iron/folate supplementation among pregnant women in Machakos County

1.5 Specific objectives

i. To determine the socio-demographic related factors associated with compliance to iron and folic supplementation among pregnant mothers in Machakos County.
ii. To establish the obstetric related factors associated with compliance to iron and folic supplementation among pregnant mothers in Machakos County
iii. To identify the health service factors associated with compliance to iron and folic supplementation among pregnant mothers in Machakos County

1.6 Study limitation

The research was limited to the responses of the participants. However, the study did not adjust for malabsorption and use of antiacids.

Conceptual framework

Independent variable

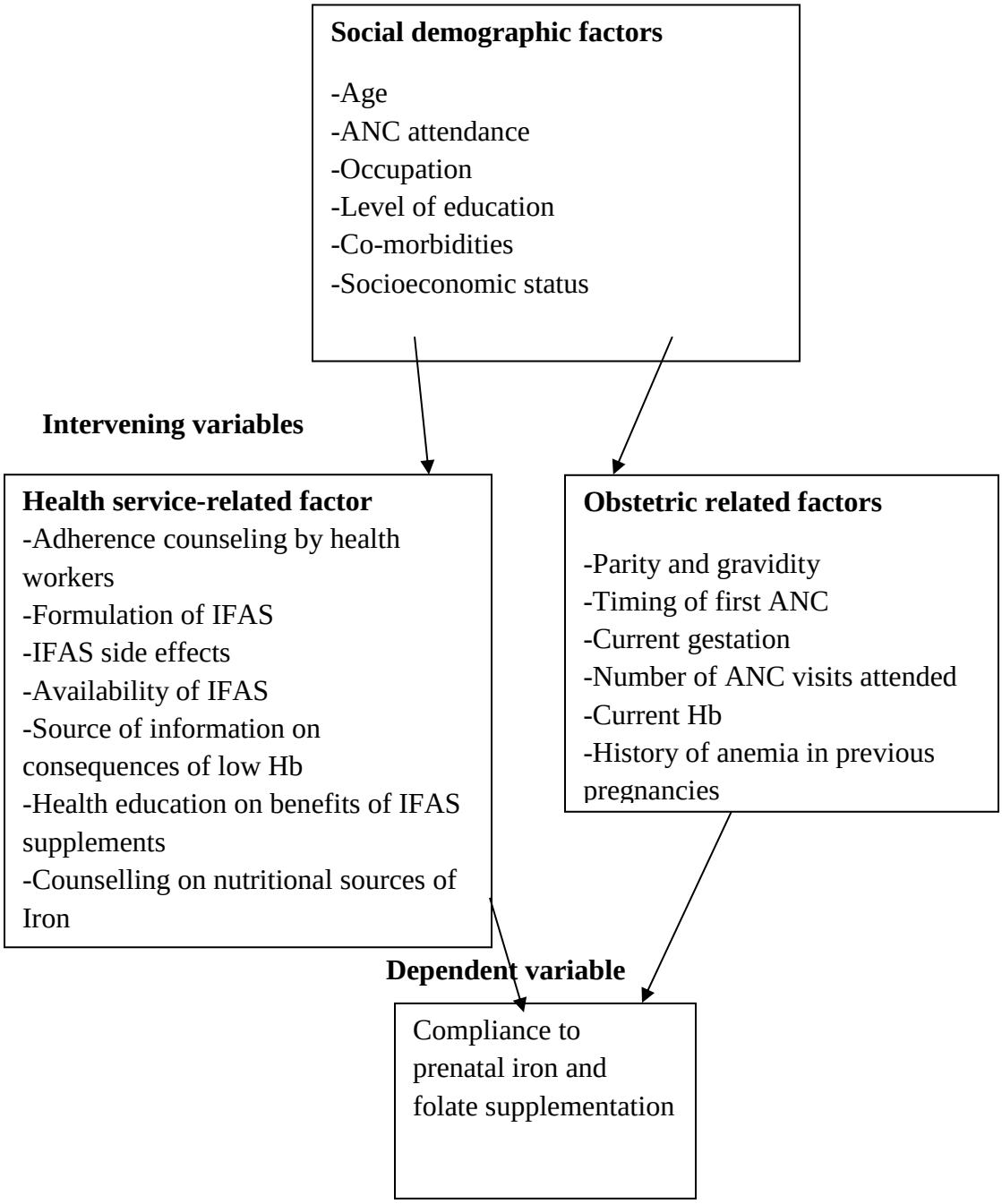


Figure 1: Conceptual framework

CHAPTER TWO: LITERATURE REVIEW

2.1 Introduction

The health of the mother and that of the fetus is dependent on the nutrition received during pregnancy. Iron and folate are some of the important micronutrients during pregnancy (Abu-saad & Fraser 2010). During pregnancy, most mothers show hematological changes that suggest iron and folate deficiency. The intake through diet alone of the two elements is not sufficient to meet the increased demand and therefore, other sources of the same are required. This is usually provided though iron supplements that are administered through out pregnancy Maternal iron stores are used to meet the fetal requirements during pregnancy (Abu-Saad & Fraser, 2010). According to the recommendations by the World Health Organization currently all pregnant women are supposed to start taking a dosage of 30 to 60 mg of elemental iron and 400 µg (0.4 mg) of folic acid once a day every day early before they conceive and throughout the period they are pregnant (WHO, 2012).

It is approximated that half of all the cases of anemia are as a result of lack of iron considered to be due to iron deficiency, but this could vary among different populations in different geographic areas (Branca *et al.,* 2013). Anemia as a result of lack of iron affects adversely both cognitive and motor development of children and, causes fatigue and low productivity (Balarajan *et al.*, 2011) and, its consequences in pregnancy, could lead to low birth weight and increased risk of maternal and perinatal mortality (Kozuki., 2012). In the developing nations, maternal and neonatal mortality accounted for three million deaths in 2013 and were the single important contributors to overall global mortality (UNICEF, 2014). Estimates further reveal that 90 000 deaths in all the sexes and all age groups were

directly attributed to lack of iron alone (WHO, 2014). The deficiency of iron, which is the main component of hemoglobin, is the leading cause of anemia in pregnancy. Folic acid reduces the risk of birth defects in fetus although the mechanism is not known, complications such as folic acid anemia, spinabifida, anencephaly and encephalocele occur when it is deficient during pregnancy (Afkhami *et al*., 2009).

Among other reasons, there is evidence that the main reason why iron supplementation programs have been less effective in reducing maternal mortality than anticipated is low compliance of women with taking daily iron drugs as prescribed by their healthcare providers (Lacerte *et al.,* 2011). In order to be effective, iron supplements bust be taken regularly for a long period and therefore there is a need to measure the compliance to iron supplementation. Discontinuing taking of iron pills before could lead to poor impacts as the drugs must be made available to the body for a sustained period of time in order to reach the required threshold (Habib *et al.,* 2009).

2.2 Factors associated with iron/folate compliance

2.2.1 Socio-demographic factors

A study done in Ethiopia to investigate factors associated with compliance to iron and folate found significant association between age and compliance. The study found women who were ≥25 years old were 2.9 times more likely to be compliant to iron-folate supplementation than women with younger ages (<25 years) (Sadore *et al.,* 2015). A study in India observed a direct relationship between age and compliance levels with a greater

number of women aged 25 years and above being more compliant in comparison with the young ones (Mithra *et al.*, 2013)

Level of education is a variable that has been studied to see if it influences compliance to iron and folate supplementation as it's expected educated women are more likely to understand the benefits of supplementation. In Nigeria, Ugwu *et al*., (2014) found out higher compliance to iron supplements in pregnancy among women who had secondary education when compared to those who were less educated. They found that the less educated had poor knowledge on the reason for taking the iron supplements. The results of a demographic health survey in Pakistani indicated that women who had no education were less likely to consume iron supplements during their pregnancy (PDHS, 2013).

The socio-economic status of a woman can also influence compliance to iron and folate supplementation. Ogundipe *et al.*, (2011) carried out a study in Tanzania to investigate the status of compliance to iron supplementation and found out better iron supplement utilization among socio-economically empowered women. Godara *et al.,* (2013) studied the predictors for compliance to iron supplements and found out that compliance was better observed in women with higher socioeconomic status compared to those with from low socio-economic status. In Pakistan Nisar et *al.,* (2014) found women belonging to the lowest household wealth index group had higher odds of not using antenatal IFA supplements in their sample. Aoko, *et. al.,* (2013) found significant association between compliance and household monthly expenditure on food.

Place of residence has been investigated to show how its influence on the utilization of folic acid supplements. A study in Pakistan found rural women lacking sufficient information about the benefits of IFA supplements when compared to those from urban setting (Nisar *et al.,* 2014). In Kenya Aoko et al*.,* (2013) found a significant association between compliance and the residential area of study respondents. Majority of those who complied to the supplements were from areas located near the district hospital.

2.2.2 Obstetric related factors

Antenatal care clinics provide an avenue through which the reinforcement of compliance to iron supplementation is done. Visiting antenatal care clinic four and more times is reported to have effects on compliance with iron-folate supplement. In the findings of their study done in Egypt by Ibrahim et al., *(*2011), found mothers who had visited ANC for four and more times are 3.5 times more likely to be compliant with iron-folate supplement compared to mothers who visited ANC for less than four times.

The timing of first ANC attendance influences compliance rate to iron and folate supplementation. Gebre *et al.,* (2014) found compliance to iron and folate supplementation was better observed among pregnant women who registered early for antenatal care service as compared to those that registered late.

Parity is another factor that can predict factor for folic acid and iron supplementation. A study done in Northern Tanzania found out that first time mothers with anaemia during pregnancy were also more likely to comply in taking iron supplements when compared with women who had more than one pregnancy previously (Ogundipe *et al.,* 2012). The

explanation given to this scenario was that women who had more than one uncomplicated pregnancy previously had developed a causal attitude that pregnancies are safe even without the use of supplements

The presence of other co-morbidities can influence the compliance to iron and folate supplementation. Bekele et al., (2015), found women who had previous history of anaemia during pregnancy were almost 6 times more likely to be compliant compared to those women who did not report history of anaemia.

2.2.3 Health service-related factors

Information by health care workers if provided in an ineffective manner can lead to lack of compliance to any treatment. In Pakistan, a study revealed that about two fifths of the respondents interviewed reported having received iron and folate supplements from community health workers (Nisar *et al.,* 2014).

Most of the healthcare workers stress on the importance of taking iron supplements, but give little information on the timing of taking the drug as the absorption of iron salts may be impeded by other elements present in the diet, and therefore it is recommended that ingestion of iron sulfate occur on an empty stomach, one hour before meals (Cançado & Chiattone 2010).

Explanation about the importance of iron and folate supplementation during pregnancy helps in improving the compliance rates. In their study, Beleke *et al.*, 2015 found the reasons for compliance were clinician instruction where 65.6% of the respondents cited that they received adequate explanation about the tablets by providers. About 44.5% of the

respondents in their study cited that they comply because they had been informed that the tablets would increase their blood.

Counseling on the importance of iron supplementation plays a major role in reinforcing compliance. In Ethiopia for example, a study observed that most of respondents interviewed stopped taking the supplements as they thought that too many tablets would harm them and/or their baby (Beleke *et al.,* 2015).

When consumed in an empty stomach, iron shown that it can cause irritation and erosion of the gastrointestinal mucosa especially. High dose of supplement is commonly associated with constipation and other gastrointestinal effects such as nausea, vomiting and diarrhoea and the severity of these effects varies according to the amount of elemental iron released in the stomach. The institute of medicine has set 45mg/day dose of daily iron as the tolerable limit, but the decision to prescribe iron and folic supplementation to women during pregnancy can also be altered by the health care worker depending on the condition of the mother (Nisar, 2014).

In their Godara et al., (2013) observed that a proportion of the pregnant women who were included in their study stopped taking the medication because of side effects. In India Mithra *et al.,* (2013) did a study and found out that the subjects had perceived side-effects with iron supplementation which made them to skip taking the drugs. Some of these side effects included vomiting, constipation, and gastritis. Some of the respondents in their study quoted that they did not like the supplements as they perceived that the government supplied iron tablets were of poor quality. A qualitative study done in Ethiopia to identify the factors that contribute to non-adherence to iron/folate supplementation identified side

effects such as nausea and heart burn immediately after taking the drugs as the major reason that mothers stop taking the drugs (Nisar, 2014).

The cost of iron/folate supplementation could influence compliance. In a study done in Senegal, iron supplementation compliance increased in women who received free supplements when compared to those that were given prescriptions to go and buy the iron drugs (Seck & Jackson 2008).

In Tanzania Ongundipe et al., (2012) study found high antenatal attendance but low number of women receiving iron supplements. The reason they explained this scenario was that iron supplements were offered at a cost and the mothers had to pay some amount for monthly dosage.

In Ethiopia, nearly half of the women who attended antenatal care were not put on iron supplements. The study explained the reason for the observed scenario could be due to shortage of iron supply as a result of logistical failures within the government health system (Gebremedhin *et al.,* 2014).

Previous studies reveal that the acceptability of the supplement could influence compliance. A study by Lacerete et al., (2011) showed that most women had no problem with the size, color, packaging, and instructions of iron/folate tablets they received. The preparation in which the iron supplements are available within the market can in some instances influence compliance. Fixed dose combination compared to single doses for both iron and folate tablet has been studied to establish whether it influences compliance to iron and folate supplementation. Mithra et al., (2013) findings in Mangalore state, south India

found fixed dose combination drugs seemed to have higher compliance levels compared to single doses of ferrous and folic drugs.

2.3 Summary of literature review

From the reviewed writings, it is evident that most studies had varied findings on the objectives of the current study. Therefore, there is need to explore these objectives in Machakos county to compare with the findings in other study areas.

CHAPTER THREE: MATERIALS AND METHODS

3.1.Research Design

Health facility descriptive cross-sectional study was used to collect both quantitative and qualitative data at one particular point in time. This design allows the researcher to assess the cause and effect at the same point (Kumar R., 2019)

3.2.Study variables

3.2.1. Dependent variable

The dependent variables were iron and folic acid supplementation compliance

3.2.2. Independent variables

Independent variables were client socio-demographic, obstetric related factors and health service-related factors.

3.3.Location of the study

Machakos County is located within the Eastern region of Kenya. the land mass of Machakos county is estimated to be 6,208 Square Kilometers. The population size is estimated to be around 1,098,584 people according to 2009 census. The neighboring counties are; Nairobi and Kiambu counties to the West, Embu to the North, Kitui to the East, Makueni to the South, Kajiado to the South West and Murang'a and Kirinyaga to the North West. The county has 110 registered health facilities spread across the county. Among these facilities, one is a level V hospital; four are level IV hospitals, 86 level II facilities, 22 level III facilities, 2 maternity homes, 34 medical clinics and 2 nursing homes.

The study was conducted in Yatta, Kangundo and Mwala sub-county hospitals within Machakos County. Kangundo Level 4 hospital is in Kangundo sub-County. It is situated in Kangundo town along the Nairobi-Kangundo road. The catchment population of Kangundo level four hospital is estimated to be 94,891.

Mwala Sub- County hospital is located along the MatuuYatta road, Mwala location in Mwala Sub-County, Machakos County. The catchment population of the hospital is estimated to be 18622. Yatta sub-county hospital is located within Matuu town along the Nairobi Garissa highway. It is within the Yatta sub-county, Matuu location, Machakos county. The catchment population of the hospital is estimated to be 25,634

3.4.Study population

A large portion of women attending ANC clinic at Machakos County have moderate to mild anemia in pregnancy (DHIS, 2017). The study targeted all pregnant women aged between 18-49 years who were visiting ANC clinic at the selected facilities and IFAS distributed to them within the study period.

3.5.Sample size determination and sampling technique

The sample was determined using the formula as designed by Fisher (1998),

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

Z is the Z value for the corresponding confidence level was set at 1.96 for 95% confidence);

d is the margin of error was set at 0.05 = ± 5%) and

P= 0.14 % (compliance to iron/folate supplementation according to KDHS,2014)

$$n = \frac{1.96^2 x\ 0.14(1 - 0.14)}{0.05^2}$$

$$n = 185$$

Add 10% attrition rate (20 pregnant mothers), therefore the study will sample 203 respondents.

The total number of pregnant women seen in a month in the three sub county hospitals is as follows,

Table 1: Proportionate sampling

Sub County Hospital	Total population	Sampled proportion	Percentage
Kangundo	428	97	48%
Mwala	257	58	28%
Yatta	210	48	24%
Total	895	203	100%

3.5.1. Sampling Technique

The study adopted purposive sampling technique to identify three level four hospitals among the four sub-county hospitals within Machakos County. These were the high-volume level four hospitals among the others. Systematic random sampling was adopted to select the study participants.

$$k = \frac{Total\ population}{Needed\ sample}$$

$$k = \frac{895}{226}$$

$$k = 3$$

The first client was picked randomly from 0 to 9 and thereafter, every 3rd pregnant woman attending antenatal clinic who fit inclusion criteria was then picked until the desired sample size was obtained. The researcher carried out the recruitment of the mothers in the maternal child health clinic for one month until the desired sample size was achieved.

3.5.2. Inclusion criteria

First antenatal clinic should start before 12 weeks gestation, therefore, all pregnant women aged between 18-49 years who had attended ANC clinic at least once and have been issued with IFAS supplements were included.

3.5.3. Exclusion criteria

Those mothers who were critically sick and or mentally incompetent

3.6 Data collection tools/instruments

Data was collected using structured a questionnaire. The questionnaire featured both closed and open-ended questions. A combination of qualitative and quantitative data collection was used in order to assess iron/folate compliance and the associated factors among pregnant women. Key Informant Interviews were conducted among the nurse managers of the selected institutions because they had knowledge and understanding of the study and

they gave insight on the nature of the problem and helped in giving recommendations on the same. A Key Informant guide was used.

3.6.1 Assessment of compliance

The study adopted self-reported measurement of medication compliance and Morisky medication compliance scale was used to measure compliance to iron and folic acid as illustrated in appendix 3. If a mother reported missing taking iron supplements once or more times, they were considered non-compliant. According to National Collaborating Centre for Primary Care, in clinical practice compliance to medication needs to be measured in a cheap and relatively unobtrusive way, which can be used routinely (NICE, 2009). Self-reported compliance is the only measure that is able to distinguish between intentional and non-intentional non-compliance to medication, which all have different underlying causes and require different interventions. The study did not employ measurement of hemoglobin levels to assess the compliance of iron/folate supplementation because control of co-founders is not possible. The factors that affect hemoglobin levels other than iron/folate supplements are known to be many and may include; diet, diseases, drugs, the device used in measurement, site of blood draw, position of body, time of hemoglobin measurement among others.

3.7 Pre-testing data collection tool

The questionnaire was pre-tested in Kathiani Level 4 hospital in Machakos County which has similar characteristics to the study area. It was administered to 20 pregnant women aged between 18-49 years attending antenatal care (10 percent of the sample size). This was to allow for modifications on the questionnaires by correcting mistakes and inclusion

of questions that may have been missed out or elimination of questions that may not be applicable. To ensure the questionnaire measured the objectives of the study. The results were coded in SPSS V24, to establish the reliability of the tool.

3.7.1. Validity

To ensure validity, the questionnaire was tested and validated by technical persons so as to ensure that the questions elicit the required answer.

3.7.2. Reliability

The questionnaire was pre-tested to check on the length, content, question wording and language. Ambiguous questions were corrected to ensure clarity and to elicit the required information therefore enhancing reliability. The Cronbach's alpha reliability coefficient was obtained at 0.82 and this was accepted for the study.

3.8 Data collection technique

Both qualitative and quantitative data was collected. Quantitative data was collected using structured questionnaire that was administered by the researcher and researcher assistant. Focus group discussion guide was used to conduct FGDs. Key informant interview guide was used to conduct key informant interviews.

3.9 Data analysis

Data collected was coded, entered into the computer, cleaned and analyzed using the Statistical Package for the Social Sciences (SPSS) software, version 24. Descriptive statistics were used to summarize and organize the data. Analysis of contingency tables was done to establish relationship between variables and Chi square statistic was used to

test for association between variables and level of significance was set at $p<0.05$. In addition data from open ended questions, focus group discussion and key informant interviews was analyzed qualitatively according to emerging themes reported.

3.10 Logistical and ethical considerations

Permission was sought from both the graduate school and Kenyatta University Ethics Review Committee for approval to carry out the research. Permission was obtained from Machakos County government to carry out the study in the selected health institutions. A research authorization letter and a research permit were obtained from the National Council of Science, Technology and Information (NACOSTI). The purpose of the study was explained to the research subjects and confidentiality assured. Informed consent was sought first before study questionnaire is administered to the respondents. To ensure confidentiality, names and other means of identity were not used during the data collection. The researcher ensured that all information obtained was kept in strict confidence and is only used for the purpose of the study.

CHAPTER FOUR: PRESENTATION, INTERPRETATION AND DISCUSSION OF RESULTS

4.1 Introduction

This chapter presents a detailed report on the results of the study on adherence on iron and folate supplements among pregnant mothers in Machakos County. First a brief socio-demographic profile of the study sample will be presented followed by level of adherence of iron and folate supplements in Machakos County. Presentation of data on specific variables in the study will be done starting with socio-demographic factors of the mothers and adherence to iron and folate supplement. This will be followed by obstetric factors associated with adherence of iron and folic acid use and finally the health facility related factors affecting adherence of iron and folate. The chapter concludes with discussion of the results.

The study target was able to attain 200 completely filled questionnaires out of the 226 which was the target sample size. This represented 88% response rate which was excellent. Mugenda 2003, cited any response rate above 70% as excellent.

4.2 Socio-demographic profile of the pregnant mothers.

The ages of the respondents ranged from 18 to 45 complete years with a mean age of 29 years. More than half of the participants (86.6%) were aged between 21 and 40 years of age, while the remaining (22%) were below 20 years and 8.5% aged above 40 years; however, the compliance to iron and folate varied across the ages.

Majority of the respondents were mothers who were married (84%), while the remaining were single and others separated or cohabiting, (13%) and (3%) respectively. Most of the

respondents were Christians by denomination (95%) while the remaining participants (5%) belonged to Muslim denomination. The Christians included 65% who belonged to Catholic Church followers, 13% Seventy-day Adventists (SDA), Christians and, 17% Protestants. The level of education was reported to vary from informal to tertiary level. 2.5% had informal education, 14.5% had primary education, with a majority of respondents 76% having secondary level of education. A few respondents (7%) reported to have attained tertiary level of education. On occupation of the mothers, 8.5% were farmers, 61% casually employed, 26.5% had their own businesses and 4% had formal employment.

Table 2: Demographic characteristics of the mothers

Variable		**Frequency**	**Percentage**
Age	<20	44	22
	21-30	90	45
	31-40	49	24.5
	>41	17	8.5
Total		**200**	**100**
Marital status	Married	168	84
	Single	26	13
	Divorced/widowed/cohabiting	6	3
Total		**200**	**100**
Denomination	Christian	190	95
	Muslim	10	5
Total		**200**	**100**
Level of education	Informal	5	2.5
	Primary	29	14.5
	Secondary	152	76
	Tertiary	14	7
Total		**200**	**100**
Occupation	Farmer	17	8.5
	Casual employment	122	61
	Formal employment	8	4
	Business	53	26.5
Total		**200**	**100**
Receives family support	Yes	138	69
	No	62	31
Total		**200**	**100**

The researcher probed more on occupation of the husband or the supporting partner. Majority of the husbands or supporting partners were also found to be casually employed (55%), 8% were farmers, 21% formally employed, and 16% in business. Majority of the mothers (69%) reported to be having supportive families and partners while a few (31%) were depending on their own means.

Each specific objective in the study was then analyzed separately, beginning with the first objective;

4.3 Social demographic factors of the mothers that influence adherence to iron and folate supplements.

4.3.1. Maternal age and level of adherence to iron and folate supplements

On analysis, out of 44 (22%) participants who were below 20 years of age, only 26 (13%) were found to be compliant. 90 (45%) participants were between 21-30 years old and 33 of them were found to comply to iron and folate supplements.

Table 3: Association between age of the mother and level of adherence

Variable	Category	Level of adherence		df	P value
		Adherence	Non-adherence		
Age	<20	26	18	3	P=0.060
	21-30	33	57		χ^2=7.403
	31-40	21	28		
	>41	5	12		

Forty-nine (25%) of the respondents were aged between 31-40 years and only 21 (11%) of them were complying to the instructions given and took the supplements daily. Those who were above 40 years of age were 17 (9%) and 5 of them were complying. On Chi square, age was not a significant predictor of iron and folate adherence χ^2 (3, N = 200) =7.403, p≤0.060.

4.3.2. Religion of the mother and adherence to iron and folate supplements

The religion of the respondents was assessed and the affiliation of the respondents was not significantly associated with adherence to iron and folate supplements. Out of 190 (95%) respondents who were Christians, relatively have of them (80) were adhering to iron and folate supplements. 10 of the respondents were Muslims and half of them were adhering while the other half was non-adhering χ^2 (1, N = 200) = 0.242, p≤0.746.

Table 4: Association between religion and level of adherence

Variable	Category	Level of adherence		df	P value
		Adherence	Non-adherence		
Religion	Christian	80	110	1	P=0.746
	Muslim	5	5		χ^2=0.242

4.3.3. Marital status of the mother and adherence to iron and folate supplements

On marital status, 168 (84%) participants were married and 100 of them were not adhering to iron and folate supplements. Out of 26 (13%) respondents who were single, 12 were non-adhering to iron and folate supplement. Half of those who were not married or single were adhering while the other half was not adhering to iron and folate supplement χ^2 (2, N = 200) = 1.789, p≤0.409.

Table 5: Association between marital status and level of adherence

Variable	Category	Level of adherence		Df	P value
		Adherence	Non-adherence		
Marital status	Married	68	100	2	P=0.409 χ^2=1.789
	Single	14	12		
	Divorced/ widowed	3	3		

4.3.4. Level of education of the mother and adherence to iron and folate supplements

The level of education was varied among the participants. Five respondents who were having informal education were found to be non-adhering to iron and folate supplement. 29 (15%) of the participants had a primary level of education and 26 of them were not adhering to iron and folate supplement. These findings reveal that lower level of education is associated with non-adherence iron and folate supplement. Majority of the respondents (76%) were having secondary level of education. Out of the 152 (76%) respondents with secondary level of education 78 of them were adhering to iron and folate supplement. For those who had tertiary level of education8 out of 14 were adhering to iron and folate supplements. Increase in level of education shows positive association to adhering to iron and folate supplement χ^2 (3, N = 200) = 19.573, p≤0.000.

Table 6: Association between level of education and level of adherence

Variable	Category	Level of adherence		df	P value
		Adherence	Non-adherence		
Level of education	Informal	0	5	3	P=0.000 χ^2=19.573
	Primary	3	26		
	Secondary	78	74		
	Tertiary	8	6		

4.3.5. Occupation of the respondent and adherence to iron and folate supplements

Majority of the respondents (61%, n=122) reported to be casually employed, out of all these 69 were non-adhering to iron and folate supplements. Out of 17 farmers, 9 were non-adhering to the supplements. 8 (4%) of the respondents were having formal employment and five of them were non-adhering to iron and folate supplements. Out of 53 (27%) who were operating business, 32 were non-adhering to the supplements. The findings reveal that, the occupation of the respondents was not significantly associated with adherence to iron and folate supplements χ^2 (3, N = 200) = 0.450, p≤0.930.

Table 7: Association between occupation of the mother and level of adherence

Variable	Category	Level of adherence		df	P value
		Adherence	Non-adherence		
Occupation of respondent	Farmer	8	9	3	P=0.930 χ^2=0.450
	Casual	53	69		
	Formal employment	3	5		
	Business	21	32		

4.3.6. Receipt of family support and level of adherence to iron and folate supplements

Receipt of family support was considered rendered when one of the family members was reported to remind the pregnant mother to take the supplements or supported them financially to procure the supplements in case they were not provided by the hospital. In this study it was evident that some participants received family support during pregnancy while others did not. 62 (31%) of the respondents reported not to be supported while 138 of them revealed to be supported. Out of the 138 (69%) who were supported, half of them were adhering to iron and folate supplement. Of the 62 (31%) who were not supported, few of them (16) were found adhering to the supplement. This implies that lack of family

support increases chances of non-adhering to iron and folate supplements. On Chi-square, there was a significant association between receiving family support and adherence to iron and folate supplements χ^2 (1, N = 200) = 10.247, p≤0.001. The respondent reported:

> *My husband is very keen in reminding me to take IFAS so as to take care of our unborn child. He gives me money to come to the clinic and buys for me the advised fruits and vegetables.*
>
> (Respondent 2, 28-year-old mother)

Table 8: Association between receiving family support and level of adherence

Variable	Category	Level of adherence		df	P value
		Adherence	Non-adherence		
Family support	Yes	69	69	1	P=0.001
	No	16	46		χ^2=10.247

4.3.7. Maternal perceived benefits of iron and folate supplements and adherence to iron and folate supplements

The respondents who were aware of the benefits of taking the supplements were found to adhere to the intake of the supplements than those who were ignorant. On benefits of taking iron/ folate supplements, majority (86%) knew them. 69.5% of the mothers reported to take the supplements to increase their blood, 8% reported to take the supplements to increase blood and prevent abnormalities, 10% took the supplements to prevent abnormalities and the remaining reported that they didn't know the benefits of taking the supplements. Among 41 respondents who were ignorant of the benefits, only 5 were found to be adhering to the intake of the supplements. Relatively half the number of the participants, (80) of those who knew the benefits were found to be adhering to the intake of the supplements χ^2 (1, N = 200) = 19.381, p≤0.000.

Table 9: Association between having knowledge on benefits of using IFAS supplements and level of adherence

Variable	Category	Level of adherence		df	P value
		Adherence	Non-adherence		
Knew the benefit of the supplements	Yes	80	79	1	P=0.000 χ^2=19.381
	No	5	36		

4.3.8. Maternal knowledge on consequences of low blood and adherence to iron and folate supplements

The mothers were asked if they have ever been health educated on the consequences of low Hb. Those who reported yes, were asked to indicate the consequences. This was used to measure those who were knowledgeable and those who were not. Majority of the respondents were knowledgeable on the consequences of low blood in pregnancy. In this study, 152 (76%) respondents were knowledgeable and more than half of them (80) were adhering to iron and folate supplements. Out of 48 (24%) respondents who were ignorant of the consequences, only five were adhering to iron and folate supplements. This indicates that there is a strong association between knowledge and practice. In this study, knowledge on consequences of low blood in pregnancy was significantly associated with adherence to iron and folate supplements χ^2 (1, N = 200) = 26.603, p≤0.000.

Table 10: Association between knowing the consequences of non-adherence and adherence level

Variable	Category	Level of adherence		df	P value
		Adherence	Non-adherence		
Knowledgeable on consequences of low blood in pregnancy	Yes	80	72	1	P=0.000 χ^2=26.603
	No	5	43		

4.3.9. Maternal knowledge on signs and symptoms of anemia

The mothers were asked to respond to six statements about anemia in pregnancy. Majority of the respondents (76%) knew the consequences. Among the consequences identified, 46% reported fatigue, 10% reported leg swelling, 6% headache, 14% dizziness and 24% didn't know.

Table 11: Signs and symptoms of anemia

Variable		**Frequency**	**Percentage**
Knows signs and symptoms of anemia	Yes	152	76
	No	48	24
Signs and symptoms of anemia identified	I don't know	48	24
	Dizziness	28	14
	Leg swelling	20	10
	Fatigue	91	46
	Headache	12	6
Beverages affecting absorption of iron from intestines	I don't know	142	71
	Tea	27	13.5
	Coffee	31	15.5
Source of information about anemia in pregnancy	Health worker	96	48
	Media	62	31
	Friends/ relatives	42	21
Knows benefits of iron/ folate supplements	Yes	172	86
	No	28	14
Reasons for taking supplements	To increase blood	139	69.5
	To increase blood and prevent birth abnormality	16	8
	To prevent birth abnormality	20	10
	I don't know	25	12.5

Some beverages are associated with malabsorption of iron from the intestines. In this study, majority 71% didn't know which beverages affects absorption of iron from the duodenum. 13.5% reported tea to be associated with malabsorption and the remaining 15.5% reported coffee to be associated with malabsorption of iron. Majority of the respondents (48%)

reported to have gotten this information from health workers, 31% got the information from media and 21% got their information from family friends and relatives.

On regression, the variables were entered stepwise and probability of F-to-remove value set at >0.1. In Model one, the variable was contributing 28% of the association while in model two the variables were contributing 35%. Therefore, inclusion of both receiving family support and level of education variables in the model 2 made it fit and met the assumption for regression model fitness. The model was significant at 0.002. Level of education of the mother, knowledge on consequences of anemia, knowledge on benefits of IFAS and receiving family support were significant socio-demographic factors affecting adherence to supplements.

Model summary

Table 12: Regression table for maternal factors

Model	R	R Squares	Adjusted R Squares	Std. Error of the Estimate	Change statistics				
					R Squared change	F change	Df1	Df2	Sig. F change
1	.289[a]	.083	.079	.476	.083	18.022	1	198	.000
2	.359[b]	.129	.120	.465	.046	10.332	1	197	.002

a. Predictors: (Constant), what is your level of education
b. Predictors: (Constant), what is your level of education, do you receive family support in this pregnancy, has knowledge on benefits of IFAS, Has knowledge on consequences of anemia in pregnancy
c. Dependent variable: level of adherence

4.4 Obstetric factors of the mothers that influence adherence to iron and folate supplements during pregnancy.

4.4.1 Parity and gravidity of the mother and adherence to iron and folate supplements

Gravidity defines the number of times the mother has been pregnant regardless of the time and parity is the number of times the mother has carried the pregnancy to a viable gestation. The mothers were requested to respond to the number of times they have been pregnant.

The parity and gravidity of the respondents was determined in this study. 14% of the mothers had their first pregnancy, 38% had second pregnancy, and 39.5% on the third pregnancy and 8.5% of the respondents had been pregnant more than three times. In the current pregnancy, their gestation was also sought.

On analysis, out of the 28 (14%) mother who were carrying their first pregnancy, 7 were found to be adhering. Those who were having their second pregnancy were 76 and 47 of them showed non adherence. The proportion of those adhering to the supplements increased among those who were in their third pregnancy. Out of 79 (40%) pregnant mothers in their third pregnancy, 43 were found to adhere. This might be attributed to their experience in the first pregnancies. However, those who had their fourth or more pregnancy were less likely to take the supplements. This might also be due to the past experience. The study revealed that parity and gravidity significantly predict adherence to iron and folate supplements χ^2 (3, N = 200) = 9.058, $p \leq 0.029$.

Table 13: Association between parity and level of adherence

Variable	Number of pregnancies	Level of adherence		df	P value
		Adherence	Non-adherence		
Parity and gravidity of the mother	1	7	21	3	P=0.029 χ^2=9.058
	2	29	47		
	3	43	36		
	4 and more	6	11		

4.4.2 Adherence to iron and folate supplements and current gestation

The researcher used the antenatal cards and booklets of the mothers to determine the time they initiated their ANC. It was found that, 47.5% were in their first trimester, 13% in the second trimester and 39.5% in their third trimester. There was a positive association between the current gestation and adherence. Out of 95 (48%) mothers who were in their first trimester, more than half of them were non-adhering to the supplements. Among the 26 mothers who were in the second trimester, 5 of them were found to be adhering. There were 79 mothers in their third trimester and majority of these mothers were found adhering to the iron and folate supplements. In this study, it was found that as the gestation increases the level of adherence increases. According to the policy on iron and folate supplementation, the mothers should start taking the supplements before conception. From the results it was evident that increase in gestation was significantly affecting adherence to iron and folate supplements χ^2 (2, N = 200) = 9.680, $p \leq 0.008$. There was a moderate association between current and adherence to iron and folate supplements (Cramer's V=0.220).

Table 14: Association between current gestation and level of adherence

Variable	Trimesters	Level of adherence		df	P value
		Adherence	Non-adherence		
Current gestation of the mother	First	38	57	2	P=0.008 χ^2=9.680
	Second	5	21		
	Third	42	37		

4.4.3 Initiation time for the antenatal clinics (ANC) and adherence to iron and folate supplements

On initiation of ANC, 85.5% of the respondents reported to have started their clinics in the first trimester, 14.5% in the second trimester. There were no respondents who had started their clinic late in third trimester.

On the timing when the mothers initiated their ANC, it was found that 116 (58%) mothers started attending the clinics in the first trimester, and 34 in the second trimester. The mothers reported that they were given the iron and folate supplements in their first ANC visit. Among those who started their clinic in the first 82 out of 171 (86%) were adhering to the supplements. 29 (15%) mothers had started their clinics in the second and only three of them were found to be adhering. This indicates that those who start their ANC late are less likely to be adhering to the iron and folate supplements while early initiation of the clinic encourages adherence. There was a significant association between timing for initiation of the ANC and adherence to iron and folate supplements χ^2 (1, N = 200) = 14.351, $p \leq 0.000$. There was a moderate association between initiation of ANC and adherence to iron and folate supplements (Cramer's V=0.268).

Table 15: Association between timing for initiation of ANC and adherence level

Variable	Trimesters	Level of adherence		df	P value
		Adherence	Non-adherence		
Timing for initiating ANC	First	82	89	1	P=0.000
	Second	3	26		χ^2=14.351

4.4.4 Number of ANC visits a mother has attended and adherence to iron and folate supplements

Majority of the respondents (54%) had attended one antenatal visit, 33% had attended two visits and 13% had come for the third antenatal visit. Among those who had attended one visit, 38 of 108 were adhering to the supplements. The mothers who had attended at least two visits were found to be adhering to iron and folate supplements. Out of 66 (33%) who had attended two visits, 38 were adhering, and out of 26 (13%) who had attended three visits, 9 were adhering. These results showed significant association between number of visits attended and adherence to iron and folate supplementsχ^2 (2, N = 200) = 9.164, $p \leq 0.010$.

Table 16: Association between number of ANC attended and level of adherence

Variable	Visits	Level of adherence		df	P value
		Adherence	Non-adherence		
Number of ANC visits	One	38	70	2	P=0.010
	Two	38	28		χ^2=9.1641
	Three	9	17		

4.4.5 Current Hb of the mothers and adherence to iron and folate supplements

The most recent haemoglobin (Hb) levels were considered to be current in this study. The current haemoglobin was checked and the study revealed that 73% of the respondents had a deficit in haemoglobin. 27% of the respondents had their haemoglobin within the normal

ranges. Previous medical history revealed that 16.5% of the participants had suffered a medical condition during the pregnancy; however, the majority 83.5% reported a healthy pregnancy.

Table 17: Association between current Hb and level of adherence

Variable	Level	Level of adherence		df	P value
		Adherence	Non-adherence		
Current Hb level of the mother	Normal	10	44	1	P=0.000 χ^2=17.409
	Deficit in Hb	75	71		

It was evident from the study findings that lower Hb among the mothers was contributing to adherence to haematinics. Among 54 (27%) mothers who had their Hb within the normal ranges, only 10 were found to be adhering to iron and folate supplements. On the other hand, among 146 who had a deficit in Hb, more than half were adhering to the use of the supplements χ^2 (1, N = 200) = 17.409, p≤0.000.

4.4.6 History of anemia and adherence to iron and folate supplements

History of anemia before pregnancy was also sought and it was evident that 45% of the respondents had anemia before pregnancy and the 22.5%of the respondents were informed and aware of the signs and symptoms of anemia.

Majority of the respondents had not suffered from anemia previously. Among all the participants 110 (55%) mothers had not suffered from anemia. In this group, only 32 were found adhering to iron and folate supplements. Out of 90 (45%) who reported history of anemia, 53 were found to be adhering. This indicated that history of anemia in the past makes the mother perceive herself to be at risk and more likely to use the haematinics.

Therefore, past history of anemia was a significant predictor of adherence to iron and folate supplements in the current pregnancyχ^2 (1, N = 200) = 17.985, p≤0.000.

Table 18: Association between having history of anemia in pregnancy and level of adherence in the current pregnancy

Variable	Category	Level of adherence		df	P value
		Adherence	Non-adherence		
History of anemia in the past	No	32	78	1	P=0.000 χ^2=17.985
	Yes`	53	37		

On chi-square analysis, number of times a mother had been pregnant, number of ANC visits a mother had attended, time of initiating the ANC clinics, current Hb and past history o anemia were significantly associated with adherence to iron and folate supplements. These variables that were found to be statistically significant at chi-square level were entered in a binary regression model. The six variables were entered into backward stepwise regression model and five of them were significantly predicting adherence to iron and folate supplements. The number of times a mother had been pregnant was not significant in this. Time of initiating the ANC clinic was 13.235 times more likely to predict adherence to iron and folate supplements.

Variables in the equation

Table 19: Regression table for maternal obstetric factors

		B	S.E.	Wald	Df	Sig.	Exp(B)	95% C.I for EXP(B)	
								Lower	Upper
Step1[a]	Gravidity	-.354	.203	3.021	1	.082	.702	.471	1.046
	Current Hb	-1.282	.421	9.294	1	.002	.277	.122	.633
	Current gestation	-1.194	.409	8.512	1	.004	.303	.136	.676
	Initiation of ANC	2.583	.714	13.091	1	**.000**	**13.235**	**3.266**	**53.625**
	History of anemia	-.992	.334	8.833	1	.003	.371	.193	.713
	No. of ANC visits	1.069	.499	4.591	1	.032	2.911	1.095	7.738
	Constant	1.584	1.245	1.618	1	.203	4.876		

4.5 Health facility related factors affecting adherence to the supplements

On health-related factors, health education on anemia and use of supplements, counseling on other sources of iron and folate, availability of the supplements and accessibility of the health facility were assessed.

4.5.1. Formulation of supplement provided in the health facility and adherence to the supplement

The respondents reported that, the supplements were given in two different formulations. One group was getting the supplements in separate doses; iron supplement separates from folate supplement while the other was given combined tablets with both supplements. Those who received the supplements separately were 51 (26%), and out of these only 6 were found to adhere to the daily intake of the supplements. Among the 149 (75%) respondents who were taking combined tablets, 79 were found to be adhering. This revealed a significant association between combining the supplements and adherence χ^2 (1,

N = 200) =26.463, p≤0.000. There was a strong association between formulation of the supplements (if combined or separate) and adherence to iron and folate supplements (Cramer's V=0.364).

The findings revealed that the formulation also comes in different sizes which could also affect the compliance of IFAS

> *The size of this new drug that I have received today (Aristofol Fe) is too big, I am scared of its big size*

*(*Respondent 4, a 20-year-old respondent from Kangundo level four hospital).

However, the focused group discussion with the health workers revealed that there are inconsistencies in the tablet preparations that are supplied to the health facilities.

> *Sometimes the supplies we receive in the hospital consist of fixed dose combination of IFAS and other times single doses of both iron and folate packed separately. So, by the time a pregnant mother completes the ANC clinic, she has to switch between the single and fixed dose combinations. Most of the times when we are supplied with the single doses, we at times have stock outs of either iron or folic acid so you only dispense one and the mothers have to buy the drug that is not available. You cannot be sure if they will buy*

(Respondent 5, a nurse from Mwala level four hospital).

Table 20: Association between formulation of supplement and level of adherence

Variable	Formulation	Level of adherence		df	P value
		Adherence	Non-adherence		
If the supplement were separate or combined	Separate	6	45	1	P=0.000 χ^2=26.463
	Combined	79	70		

4.5.2. Source of information on consequences of low blood in pregnancy (anemia) and adherence to iron and folate

On analysis, there were those respondents who got the information from the health workers, from friends and from the media. 96 (48%) of the respondents got information from the health workers and among them 49 were adhering to iron and folate supplements. 62 (31%) participants got information from the media and amongst them only 25 were adhering to iron and folate supplements. There were also those who got information from friends, 11 out of 42 (21%) were found to adhere to the supplements. The results reveal that the source of information was significant in determining adherence to iron and folate supplements χ^2 (2, N = 200) = 7.558, p≤0.023.

Table 21: Association between source of information for consequences of anemia and level of adherence

Variable	Category	Level of adherence		df	P value
		Adherence	Non-adherence		
Source of information about consequences of low blood in pregnancy	Health worker	49	47	2	P=0.023 χ^2=7.558
	Media/internet	25	37		
	Friends/relatives	11	31		

4.5.3. Duration of taking supplements and compliance to the supplements

Majority of the mothers (86%) reported to have taken the supplements for a period of 1-2 months. 14% had taken the supplements for about three months. On their current gestation, 91.5% reported to have been taking tablet supplements while 8.5% had been taking syrup for iron supplement and tabs for folate supplement. In the same study, reported to have been taking iron and folate supplements separately while 76% had been using a combined tablet. On both formulations of the supplements, 89% reported to have had side effects

from the supplements. Some of the side effects reported were; nausea 21%, bad taste 23.5%, smell like blood 28%, 16.5% had heart burn and the remaining had no side effects.

When I take the medication daily, I experience hurt burn. Sometimes I vomit after taking the medication.

*(R*espondent 4, 24-year mother from Kangundo level four hospital).

Taking these drugs leaves me uncomfortable, when I take it in the morning, I feel that I cannot perform well during the day

(Respondent 7, a 27-year-old mother from Mwala sub county hospital)

The brown tablets (ferrous sulphate) have a bad taste and smell, they taste like blood"

(Respondent 1, 22-year-old mother from Matuu level four hospital).

Table 22: Provision of supplements

Variable		Frequency	Percentage
Duration on iron/ folate supplement in this pregnancy	1-2 months	172	86
	3 months	28	14
Type of supplement	Tablet	183	91.5
	Syrup	17	8.5
If supplement were separate or combined	Separate	48	24
	Combined	152	76
Ever experienced side effects from the supplements	No	22	11
	Yes	178	89
Side effects experienced	Nausea	42	21
	Bad taste	47	23.5
	Smell like blood	56	28
	Heart burn	33	16.5

The duration in which the mother had taken the iron and folate supplement was not significantly associated with adherence to the supplements. Majority (172) had taken the supplements for 1-2 months, 97 of them were not adhering to the supplements. 26 had

taken the supplements for 3 months but still a low proportion of 9 participants had adhered to taking the supplements as recommended χ^2 (2, N = 200) = 0.793, p≤0.673.

4.5.4. Health education on iron and folate supplements by health worker and adherence to iron and folate supplements

It is expected that when the mothers come for the ANC visit, they should be given health education on heamatinics and anemia prevention. In this study, 76% of the mothers reported to have been counseled on use of iron and folate supplements in pregnancy. 24% reported that they were given the supplements and just told to go and take daily. Among the 152 (76%) mothers who reported that they were health educated on use and benefits of iron and folate supplements, 79 of them were found to adhere to the instruction on taking the supplement. Out of the 48 (24%) mothers who reported to have been given the supplements without the health education, only six were found to adhere. This indicated that, health education on benefits of iron and folate supplements by a health worker was key to adherence to the supplements. On Chi-square, there was a statistical significance between provision of health education on iron and folate supplements and adherenceχ^2 (1, N = 200) = 23.260, p≤0.000. There was a strong association between health education on benefits of iron and folate supplements on adherence with a Cramer's V of 0.341. Those who received the counseling were 7.575 more likely to adhere to the supplements than those who didn't (OR=7.575, CI [3.041-18.87]). The focused group discussion with the health workers revealed that at the time of data collection, the study area was being piloted for the introduction of free health care and all services were offered for free. The health workers were therefore burdened by huge workload

Since the introduction of free healthcare, the workload has increased and therefore we have less time for health education and counselling on the IFAS

(Respondent 8, a nurse from Kangundo Level four hospital).

Focused group discussion with the health workers revealed gaps such as less instructional materials and therefore no standardized counselling in between health facilities

We do not have brochures and IFAS posters in our facility

(Respondent 5, a nurse from Matuu level four hospital).

Table 23: Association between provision of health education on anemia in pregnancy and level of adherence

Variable	Health educated	Level of adherence		df	P value
		Adherence	Non-adherence		
Health education on benefits of iron and folate supplements	No	6	42	1	P=0.000 χ^2=23.260
	Yes	79	73		

4.5.5. Counseling on nutritional sources of iron and folate and adherence to iron and folate supplements

During the clinic, the mothers are given nutritional health talks. The research wanted to establish to what level does these health talks influence use and adherence to iron and folate supplements. Majority of the mothers (91.5%) reported that they are given nutritional counseling during the clinics. Among the 183 mother who received nutritional counseling, 111 (56%) were not adhering to iron and folate supplements. 17 mothers reported that they were not counseled on nutritional sources of iron and folate and 13 of them were found to be adhering to iron and folate supplement. This implies that health education on other

sources of iron and folate from diet affects adherence to iron and folate supplementsχ^2 (1, N = 200) = 8.774, p≤0.003. The association between health education on nutrition and adherence was moderate with Cramer's V of 0.209. However, it also emerged that at times specific health education on the food rich in iron is not available and readily given to the mothers

I was just told to eat a balanced diet with foods that have iron, no explanation or examples of the food I was to eat was explained to me

*(*Respondent 8, a 28-year mother from Matuu level four hospital)

Table 24: Association between counselling on nutritional sources of iron and level of adherence

Variable	Counseled	Level of adherence		df	P value
		Adherence	Non-adherence		
Counseling on nutritional sources of iron and folate	No	13	4	1	P=0.003 χ^2=8.774
	Yes	72	111		

4.5.6. Availability of the iron and folate supplements in the health facility and adherence to the supplements

Majority of the respondents 184 (92%) reported that they are given iron and folate supplements for free in each clinic they attend. Out of the 184 (92%) mother who were given the iron and folate supplements, 84 of them were found to be adhering while among the 16 who reported that they were not always given the supplements only one was found to be adhering.

Table 25: Association between availability of the supplements in the hospital and level of adherence

Variable	Availability	Level of adherence		df	P value
		Adherence	Non-adherence		
Availability of iron and folate supplements	No	1	15	1	P=0.002 χ^2=9.352
	Yes	84	100		

This indicated that availability of the supplements is significantly associated with adherence to iron and folate adherenceχ^2 (1, N = 200) = 9.352, p≤0.002.

The mothers who were given the supplements were 12.6 times more likely to adhere to the supplements than those who did not get the supplements (OR=12.6, CI [1.630-97.38). it emerged out that sometimes mothers received prescriptions of IFAS supplements that were not enough to last up to the next clinic booking.

I did not receive IFAS supplements that were adequate to last up to the next clinic booking last time I visited the hospital

*(*Cited by a 31-year-old respondent from Mwala sub-district hospital)

4.5.7. Counseling on side effects of the supplements and adherence to iron and folate supplements

Majority of the mothers 57% were not counseled on side effects of the supplements but reported to have been given the supplements. One hundred and fourteen (57%) of the mothers were not counseled. Among these only 11 were found adhering to the supplements. When the group that was counseled was analyzed, 74 out of 86 (43%) who were counseled were found to be adhering. There was a very strong association between adherence to the

supplements and counseling of the mothers on the side effects of the supplements with a Cramer's V of 0.765. The mothers who were not counseled were 0.017 less likely to be adhering to the supplements compared to those who were counseled (OR=0.017, CI [0.007-0.041]).

> *I was just given tablets by the health worker at the clinic and told to take them once a day. Nothing was explained to me and when I took them, I experienced nausea and vomiting and stopped them because I thought they would affect my baby*
>
> (Respondent 7, a 25-year-old mother)

On Chi-square, counseling mothers on side effects of the supplements was significantly associated with adherence χ^2 (1, N = 200) = 117.078, p≤0.000.

Table 26: Counselling on side effects of supplements

Variable	Counseled	Level of adherence		Df	P value
		Adherence	Non-adherence		
Counseled on side effects of iron and folate	No	11	103	1	P=0.000 χ^2=117.078
	Yes	74	12		

On regression, four variables were entered into forward stepwise regression. These factors included counseling on side effects of iron and folate supplements, availability of the supplements, health education on nutrition and benefits of iron and folate supplements in prevention of anemia in pregnancy and birth defects. After regression, counseling the mothers on benefits of iron and folate supplements in prevention of anemia in pregnancy and birth defects, counseling on nutritional sources of iron and folate and counseling on side effects of the iron and folate supplements were significantly associated with adherence to iron and folate supplements.

4.5.8 Adherence to iron and folate

Morisky medication compliance scale was used to measure compliance to iron and folic acid. Majority of the respondents (80.5%) reported to sometimes forget to take their supplements. In the previous month, 79% had forgotten to take the supplements. A good proportion of the respondents 55%, reported to stop taking the supplements when they felt worse. When travelling to distant places, 53.5% forgot to carry the supplements with them. More than half of the respondents had forgotten to take the supplements the previous day of the study. 53% of the respondents reported to stop taking the supplements when they feel their blood level is within normal levels. About convenience of taking the supplements, 59.5% reported to be inconvenienced by taking the supplements every day. In general the level of adherence was calculated to be at 16%.

Table 27: Adherence level according to Morisky questionnaire

Variable	**Frequency**	**Percentage**
Sometimes forget taking the supplements	161	80.5
Missed to take supplements in the last one month other than forgetting	158	79
Stops taking supplements when they feel worse	110	55
Forgets to carry supplements when travelling	107	53.5
Took the supplements previous day of the study	115	57.5
Stops taking supplement when they feel they have normal Hb	106	53
Feel inconvenienced taking the supplements daily	119	59.5

CHAPTER FIVE: DISCUSSION, CONCLUSION AND RECOMMENDATIONS

5.1. Introduction

In this chapter discussion of the research findings will be presented, followed by conclusion of the research, recommendation for implementation and areas for further research. The discussion was done according to the objectives. All significant findings were presented.

5.2. Discussion of the research findings

Majority of the respondents were between 21 years and 40 years, with a few above the age of 40 years. There was a weak association between age of the respondent and adherence to iron and folate supplements (Spearmans Rho =0.192). These findings contradict those by Jikamo *et al.,* 2018 who found age to be a predictor factor to adherence to iron and folic acid supplementation. The explanation for this could be due to the fact that the latter study was done in developed nation where access to information is readily available and literacy levels are much higher. In another study by Bekere *et al*., (2016) in Uganda revealed that age was also predicted to be a significant factor influencing adherence to iron and folate supplements.

The findings revealed that 84% were married and 76% had secondary level of education. There was a strong association between level of education and adherence to iron and folate supplements (Spearmans Rho=0.313). These findings concur with other studies done in India by Agrawal *et al*., (2015). Level of education increases awareness and understanding on the importance of macronutrients for the development of the fetus. It was expected that the more a mother was educated the more responsive they became. Bekere *et al*., (2015),

reported that level of education of the mother was significantly associated with adherence to iron and folate. This was also supported by a study by Mary *et al*., (2018).

More than half of the mothers were casual workers and 69% of them received family support during pregnancy. There was a weak association between occupation of respondent and adherence to iron and folate supplements (Spearmans Rho =0.047). Kiwanuka *et al*., (2017) similarly reported that formal employment was not associated with compliance to iron and folic acid supplementation. In contrast Nisar *et al*., (2014), reported that higher proportions of women of low income were not complying with iron and folic acid supplementation. This could be explained by the fact that low socioeconomic women tend to have low level of education and therefore could understand less the importance of iron supplementation.

The occupation of the husband or the supporting partner was also not significantly predicting adherence to iron and folate supplementsχ^2 (3, N = 200) = 3.842, p≤0.279. Soraya et al., 2017 did not however report any correlation between spouse income and level of compliance to IFAS among the study respondents.

Among the socio-demographic factors of the respondents, family support and level of education of the mother were significantly associated with adherence to iron and folate supplements. There was a very weak association between religion and adherence to iron and folate supplements (Spearmans Rho =0.035). Similar findings were reported by Gebre et al., 2015 in a study done in Ethiopia. There was a weak association between marital status and adherence to iron and folate supplements (Spearmans Rho =0.095). These

findings are centrally to others done by Martin *et al*., (2016) who found married mothers more compliant to IFAS as a result of support from their husbands.

There was a moderate association between family support and adherence to iron and folate supplements (Spearmans Rho =0.226). Those who received family support were 0.348 more likely to adhere to iron and folate supplements than those who didn't (OR=0.348, CI [0.18-0.673]). Family support is key and similar findings have recorded that nuclear family mothers to be less compliant compared to their married counterparts (Manasa *et al.,* 2019; Rai *et al*., 2016).

Objective one: Social demographic factors related to maternal compliance to iron and folate supplements.

The mothers who had adequate knowledge on consequences of low haemoglobin levels had higher adherence levels for iron and folate supplements compared to those who lacked the knowledge. There was a strong association between knowledge on consequences of anemia in pregnancy and adherence to iron and folate supplements (Spearmans Rho =0.365). Iuga *et al*., (2015) recorded similar findings in their study where mothers who had more knowledge on the consequences of anemia during pregnancy were more compliant to IFAS supplements. In another study Negussie *et al*., (2018) found that education level of the mother and knowledge on benefits of IFAS was significantly associated with adherence to the supplements.

It was also revealed that the mothers who got health education about these consequences from health workers were more adhering to the supplements than those who read on their

own. There was a weak association between source of information about consequences of anemia in pregnancy and adherence to iron and folate supplements (Spearmans Rho =0.194). Findings by Saprii *et al*., (2015) reported contradicting findings where source of information was associated with higher compliance. The difference could be explained that their study settings involved the use community health volunteers to link and issue IFAS supplements to pregnant women. If well utilized community health volunteers can help improve uptake of IFAS supplements.

The study found out that the mothers were issued with two formulations of the supplements; there were those who received the supplements in separate and there were those who received the supplements in a combined form. The mothers who received a combined form of the supplements were found to adhere to use of the supplements than those who received the two supplements separately. It was also evident from the findings that the mothers who knew the benefits of adhering to the supplements were more likely to adhere to their use than the mothers who were ignorant of the benefits of the supplements. There was a strong association between perceived benefits of taking iron and folate supplement and adherence to iron and folate supplements (Spearmans Rho =0.311). Other studies have shown a correlation between perceived benefits of IFAS and compliance in intake (Klevor *et al*., 2016; Zavaleta *et al*., 2014). Messages should target on promoting the therapeutic values of IFAS so that the supplements are take even in the absence of anemia during pregnancy.

Objective two: Obstetric related factors influencing compliance to iron and folate supplements

The mothers who had their first pregnancy were found to be adhering more to all instructions including compliance to iron and folate supplements. However, the mothers who had come for subsequent pregnancies had discrepancies in compliance to iron and folate supplements. There was a moderate association between parity of the mother and adherence to iron and folate supplements (Cramer's V=0.213). The study findings conflict with those done by Kamau *et al*., (2018) who found out that primiparity was associated with more compliance. Reham *et al.,* (2015) also found a strong positive correlation between parity and compliance to IFAS supplementation.

It was evident from the research findings that the mothers who had poor past obstetric history were more compliant than those whose previous outcome was good. Expectedly, those who had history of anemia in previous pregnancy were more compliant than those whose Hb was normal throughout the pregnancy. On attending the antenatal clinics, the time of initiating the clinics was significantly associated with compliance to the supplements. The mothers who initiated the clinics early were found to be more compliant. The time that a mother starts antenatal care clinic varies and to some extent is influenced by some culture and beliefs. In some settings mothers think that ANC should start during the 3rd month (2nd trimester). Compliance is better observed when ANC starts during the first trimester compared to when its started late. The findings are similar to those by (Zavaleta *et al.,* 2014, Ramakrishnan *et al*., 2015). However, Titaley *et al*., (2015) found that in Iran timing of first ANC attendance did not influence compliance. Those who initiated the clinic early in the first trimester were more likely to adhere than those who started the clinics late in pregnancy. These results were supported by a study by Khadija *et*

al., (2017) which revealed that early initiation of the ANC clinics contributed to adherence to IFAS supplements.

The current gestation was also a determinant in complying with the supplements. The mothers with higher gestation of above 24 weeks were more compliant than those with less gestation. As the number of antenatal clinics attended increased there was a significant increase in compliance to the use of the supplements among the pregnant mothers. There was a moderate association between number of ANC visits and adherence to iron and folate supplements (Cramer's V=0.214). Findings by Abel *et al*., (2017) revealed that early registration for ANC and number of visits a mother made to the hospital was significantly associated with adherence of IFAS.

The current Hb was also significantly associated with use of the supplements. The mothers whose Hb was found to be normal were less likely to be compliant to use of the supplements. There was a moderate association between current Hb and adherence to iron and folate supplements (Cramer's V=0.295). This could be explained by the counselling done by the health workers especially on the importance of having sufficient hemoglobin reserves that are required for labor and delivery. The findings are consistent with others done by Haile *et al*., (2017). However, the findings done in Egypt by Amaal *et al*., (2018) revealed only half of the respondents with mild anemia which is lower than what this study recorded. The reason could be because of the differenced in culture and economy between the two study areas.

There was also a strong association between previous history of anemia and adherence to iron and folate supplements (Cramer's V=0.3). Kassa *et al*., (2019), found similar findings in Ethiopia where mothers who had previous history of anemia were three more times likely to comply with iron and folate compared to their counterparts. More emphasis on importance of complying among respondents with anemia by the health workers could be the reason for this observation. Another study supported the results that history of anemia contributes significantly to adherence to iron and folate supplements (Banbladesh, *et al*., 2016).

Objective three: Health service-related factors influencing compliance to iron and folate supplements among pregnant mothers

It was found that the mothers who were counseled on both nutrition and side effects of the supplements were more likely to comply to use the supplements than those who didn't get the counseling. The findings on health education in this study are consisted with others done by Kumar *et al*., (2018) who found out that the degree of compliance with IFAS was mainly influenced by the health workers instructions and the fear of illness during pregnancy. In another study by Kendra *et al*., (2017) reported that counseling the pregnant mothers generally improved adherence to the supplements.

Those mothers who had received the health education were 5.01 less likely to adhere to iron and folate supplements than those who didn't receive the health education (OR=5.01, CI [1.572-15.971]). The findings concur with those by Nivedita & Shanthini (2016), who found that pregnant women did not receive health education on the foods that are rich in

iron and folic acid and therefore did not understand the importance of adhering to iron and folate supplementation.

In some visits the mothers reported to have missed to be given the supplements due to stocking issues. However, it was evident that the mothers who received or accessed the supplements all the time of need were complying to taking of the supplements compared to those who missed sometimes. Health education in general care of pregnancy was also associated with increased compliance of taking the iron and folate supplements. In this study availability of IFAS was determining adherence. These findings conflict with another study done in south Africa by Mbhenyate *et al*., (2017) who revealed that even in good availability of IFAS, compliance was minimal. Dispensing IFAS alone without reinforcing on their importance do not translate in actual use. The spread of IFAS counselling throughout all the ANC visits therefore improves compliance. the findings concur with those by Ramakrishnan *et al*., (2015) who found that health workers have a rationale to counsel pregnant mothers on IFAS when they have IFAS supplies compared to when do not have them.

In the current study, the side effects of the IFAS were significantly associated with adherence of IFAS. Side effects of IFAS have influence of compliance and the ability to manage them therefore improves compliance. Similar findings were recorded by (Arega *et al*., 2015, Zavaleta *et al*., 2014). The results in this study were also supported by Gebremlak *et al* (2017), which revealed that health education given and level of education predicted level of adherence.

After regression, counseling the mothers on benefits of iron and folate supplements in prevention of anemia in pregnancy and birth defects, counseling on nutritional sources of iron and folate and counseling on side effects of the iron and folate supplements were significantly associated with adherence to iron and folate supplements. Shivali *et al* (2015), found similar findings where women who were reassured on the side effects complied with IFAS supplementation.

5.3.Conclusion

Based on the research findings the following conclusions were made;

1. Maternal knowledge on consequences of low haemoglobin levels, source of information about the consequences and perceived benefits of taking the supplements were significant predictors of iron and folate supplement compliance. This was improved when the supplements were given in combined form.
2. Provision of health education in pregnancy especially counseling on nutritional value of supplementing iron stores in the body and how to manage side effects of iron and folate supplements were significantly associated with compliance to iron and folate supplements. Also, availability of the supplements during antenatal visits was associated with compliance to the supplements.
3. Past experience of the mothers' especially previous history of anemia, current haemoglobin level and bad obstetric history of the mother were found to increase compliance to the supplements. The time of initiating the antenatal clinics, number of antenatal clinics attended and current gestation were also found to be significant predictors of compliance to iron and folate supplements.

5.4. Recommendation

5.4.1. Recommendation for policy making

1. The government of Kenya, through the County government of Machakos, to develop policies on procurement and distribution of combined iron and folate supplement. This will promote availability of the drugs and improve compliance to the supplements
2. The County government of Machakos to develop policies and strategies to promote provision of health education to all pregnant mothers attending antenatal clinics in health facilities within the county.
3. The IFAS supplements should be available at all times for the mothers to access them during all clinic visits.

5.4.2. Recommendation for practice

1. The nurses to launch campaigns on early initiation of antenatal clinics attendance among pregnant mothers
2. The nurses in various health facilities should ensure all mothers are counseled on nutritional value and benefits in pregnancy and on management of side effects of iron and folate supplements if any.

5.4.3. Recommendation for further study

The study suggests a study to be done on factors associated with provision of family support during pregnancy among pregnant mothers. This will shed more light on family support relations and help in establishing good family support to all pregnant mothers. In this study the mothers who were receiving family support were compliant to iron and folate

supplements and adhered to the scheduled antenatal visits. If this happens to all pregnant mothers, we shall be assured of safe motherhood as a country.

REFERENCES

Abel Gebre1, Ayal Debie, Afeworki Berhane, Surender Redddy (2015). Determinants of compliance to iron-folic acid supplementation among pregnant women in pastoral communities of afar region: the cases of Mille and Assaita districts, afar, Etiopia-2015. *Medico research chronicles*

Abu-Saad K, Fraser D (2010).Maternal nutrition and birth outcomes. Epidemiol. Rev. 32(1):5-25. Bailey LB (2010). New standard for dietary folate intake in pregnant women. *American Journal of Clinical Nutrition*. 71:1304S-1307S.

Afkhami-Ardekani M, Rashidi M. (2009). Iron status in women with and without gestational diabetes mellitus. *Journal of Diabetes and its Complications*. 2009;23(3):194-8.

Balarajan Y, Ramakrishnan U, Ozaltin E, Shankar, A, H, Subramanian., S, V. (2011). Anaemia in low-income and middle-income countries. *Lancet publication.* 2011; 378:2123–35. doi:10.1016/S0140-6736(10)62304-5.

Bekele Taye,&, Gedefaw Abeje, Alemetsehaye Mekonen (2015). Factors associated with compliance of prenatal iron folate supplementation among women in Mecha district, Western Amhara: a cross-sectional study. *PanAfrican Medical Journal*. 20:43 doi:10.11604/pamj.2015.20.43.4894

BrancaF ., Stevens GA, Finucane MM, De-Regil LM, Paciorek CJ, Flaxman SR, (2013). Global, regional, and national trends in haemoglobin concentration and prevalence of total and severe anaemia in children and pregnant and non-pregnant women for

1995–2011: a systematic analysis of population-representative data. *Lancet Global Health.* 2013;1:E16–E25. doi:10.1016/S2214- 109X(13)70001-9.

Burke R, Leon J, Suchdev P. (2014). Identification, prevention and treatment of iron deficiency during the first 1000 days.2014;**6**(10):4093-114.

Cançado RD, Chiattone CS. (2010). Iron deficiency anaemia in the adult - causes, diagnosis and treatment. Rev Bras HematolHemoter. 2010; 32 (3): 240-6

Gebre A, Afework Mulugeta, BelachewEtana. (2015). Assessment of Factors Associated with Adherence to Iron-Folic Acid Supplementation Among Urban and Rural Pregnant Women in North Western Zone of Tigray, Ethiopia: Comparative Study. *International Journal of Nutrition and Food Sciences.* Vol. 4, No. 2, 2015, pp. 161-168. doi: 10.11648/j.ijnfs.20150402.16

Gebremedhin S, Aregash S, Girma M, Tibebu M, Tsehai Assefa. (2014). Coverage, compliance and factors associated with utilization of iron supplementation during pregnancy in eight rural districts of Ethiopia: *BMC Public Health* 2014, 14:607

Gebreamlak B, Dadi AF, Atnafu A (2017). High Adherence to Iron/Folic Acid Supplementation during Pregnancy Time among Antenatal and Postnatal Care Attendant Mothers in Governmental Health Centers in Akaki Kality Sub City, Addis Ababa, Ethiopia: Hierarchical Negative Binomial Poisson Regression. PLoS ONE 12(1): e0169415. doi:10.1371/journal.pone.0169415

Habib F, Alabdin EH, Alenazy M, Nooh R. (2009). Compliance to iron supplementation during pregnancy. *Journal of Obstetrics Gynaecology*2009;29:437-92.

Ibrahim ZM, El-hamid SA, Mikhail H, Khattab MS: (2011) Assessment of adherence to iron and folic acid Ssupplementation and prevalence of anemia in pregnant women. Medical Journal Cairo University 2011, 79(2):115–121.

Kassandra L. Harding, Susana L. Matias, Malay K. Mridha, Moniruzzaman, Stephen A. Vosti, Sohrab Hussain, Kathryn G. Dewey and Christine P. Stewart* (2016). Adherence to recommendations on lipid-based nutrient supplement and iron and folic acid tablet consumption among pregnant and lactating women participating in a community health programme in northwest Bangladesh. *Maternal and child nutrition*

Kendra Siekmans, Marion Roche, Jacqueline K. Kung'u Rachelle E. Desrochers, Luz Maria De-Regil (2017). Barriers and enablers for iron folic acid (IFA) supplementation in pregnant women. *Maternal and child nutrition*.

Khadija Begum Césaire T. Ouédraogo K. Ryan Wessells Rebecca R. Young M. Thierno Faye Sara E. Wuehler Sonja Y. & Hess (2017). Prevalence of and factors associated with antenatal care seeking and adherence to recommended iron-folic acid supplementation among pregnant women in Zinder, Niger. *Maternal and child nutrition*

Kozuki N, Lee AC, Katz J. (2012). Child Health Epidemiology Reference Group. Moderate to severe, but not mild, maternal anemia is associated with increased risk of small-

for-gestational-age outcomes. *Journal of Nutriton* .2012;142:358–62. doi:10.3945/jn.111.149237.

Lacerte P, Pradipasen M, Temcharoen P, Imamee N, Vorapongsathorn T. (2011). Determinants of adherence to iron/folate supplementation during pregnancy in two provinces in Cambodia. Asia Pacific Journal of Public Health 2011;23:315-23.

Mithra P, Unnikrishnan B, Rekha T, Nithin K, Mohan K, Kulkarni V, Kulkarni V, Agarwal D. (2013). Compliance with iron-folic acid (IFA) therapy among pregnant women in an urban area of south India. African Health Sciences 2013; 13(4): 880 – 885.

Mahomed K (2000). Iron and folate supplementation in pregnancy. Cochrane Database Syst. Rev. (2):CD001135.

Mary Kamau , Samuel Kimani , Waithira Mirie (2018). Counselling on iron and folic acid supplementation (IFAS) is associated with improved knowledge among pregnant women in a rural county of Kenya: a cross-sectional study. AAS Open research.

Mary Wanjira Kamau, Waithira Mirie, Samuel Thuo Kimani (2019). Maternal knowledge on iron and folic acid supplementation and associated factors among pregnant women in a rural County in Kenya. International Journal of Africa Nursing Sciences. 10

Meselech Ambaw Dessie, Ejigu Gebeye Zeleke, Shimelash Bitew Workie and Ayanaw Worku Berihun (2017). Folic acid usage and associated factors in the prevention of neural tube defects among pregnant women in Ethiopia: crosssectional study. BMC pregnancy and childbirth: 17(313)

National collaborating centre for primary care. Medicines adherence: involving patients in decisions about prescribed medications and supporting adherence. London: NICE; 2009 (PUB MED)

PDHS (2013). National Institute of Population Studies (NIPS) [Pakistan], Macro International Inc: Pakistan Demographic and Health Survey 2012-13. Islamabad, Pakistan: NIPS, Macro International Inc; 2013.

Negussie Boti , Tezera Bekele, Wanzahun Godana , Eskeziyaw Getahun , Feleke Gebremeskel , Behailu Tsegaye, and Bilcha Oumer (2018). Adherence to Iron-Folate Supplementation and Associated Factors among Pastoralist's Pregnant Women in Burji Districts, Segen Area People's Zone, Southern Ethiopia: Community-Based Cross-Sectional Study. Hindawi

Nisar Y, Dibley M, Mir A. (2014) Factors associated with non-use of antenatal iron and folic acid supplements among Pakistani women: a cross sectional household survey. *BMC Pregnancy and Childbirth* 2014;**14**:305.

Ogundipe O, Hoyo1 C, Ostbye T, Oneko O, Manongi R, Lie RT, Daltveit AK: (2012) Iron supplementation among 21,889 pregnant women in Northern Tanzania: a cross-sectional hospital-based study. *BMC Public Health* 2012, 12:481.

Titilayo A, Agunbiade OM. (2014). Iron deficiency anemia in pregnancy: implication for reproductive health in Nigeria. *Journal of Demography and Social Statistics* (Ife-Ife, Nigeria: Obafemi Awolowo University Press): 2014;1(1):98-109

Ugwu E, A. O. Olibe, S. N. Obi, and A. O. Ugwu,. (2014) "Determinants of compliance to iron supplementation among pregnant women in Enugu, Southeastern Nigeria," *Nigerian Journal of Clinical Practice*, vol. 17, no. 5, pp. 608–612, 2014.

United Nations Children's Fund, World Health Organization, The World Bank, United Nations Population Division. Levels and trends in child mortality: report 2014. Estimates developed by the UN Inter-agency Group for Child Mortality Estimation. New York: United Nations Children's Fund; 2014 (http://www.data.unicef.org/fckimages/uploads/1410869227_Child_Mortality_ Report_2014.pdf, accessed 7 May 2015).

World Health Organization Global health estimates 2014 summary tables: deaths by cause, age and sex, by WHO region, 2000–2012. Geneva:; 2014 (http://www.who.int/healthinfo/global_ burden disease/estimates/en/index1.html, accessed 25 March 2015).

World Health Organization WHO: Global health risks: mortality and burden of disease attributable to selected major risks. Geneva: World Health Organization; 2009. http://www.who.int/healthinfo/global_burden_disease/global_health_risks/en/ index.html

World Health Organization, WHO, (2012). Guideline: Daily iron and folic acid supplementation in pregnant women. Geneva, World Health Organization

World Health Organization (WHO). WHO Recommendations on Antenatal Care for a Positive Pregnancy Experience: Summary. Geneva, Switzerland: WHO; 2018. Licence: CC BY-NC-SA 3.0 IGO.

APPENDICES

Appendix 1 Informed consent

My name is Stephen Musyoki, a postgraduate student at Kenyatta University. I am conducting a research on prenatal iron/folic acid additives compliance by expectant mothers aged 18-49 years taking part in receiving antenatal care services sin Machakos County, Kenya as part of requirement to graduate with a master's degree in public health, from the above said university.

Procedures

I am going to describe more about this study and request you to optionally take part in this study by filling the questionnaire. You at liberty to ask any query or explanation about the study during or after data gathering by help of the contact address availed at the end of the document.

Benefits

There are no financial, material, or any form of direct benefits guaranteed to the respondents in this research but your participation will aid in discovering compliance to iron/folate supplements and associated barriers. This information is of great held in coming up with informed strategies to improve the health of expectant mothers.

Risks

There are no any kind of dangers or risks that one will incur by taking part in this research.

Voluntary Participation

Your taking part in this study is optional. You are free to decide whether to get involved or not. Your decision will be appreciated and failure to get involved will not affect you in any way. You may decide not to continue at any point in this research.

Duration

Gathering of the data will last for 45 minutes. Within the stipulated 45 minutes, you are required to respond to queries as asked the researcher from the availed questionnaire.

Confidentiality

Confidentiality of those participating in this research will not be revealed to the third party. You ID no., name or any form of identification will note be used in questionnaire forms, just to enhance confidentiality. All the information gathered will be only used for academic purpose and meeting the goals of this research.

Contact Information

If you have any queries, you may call Dr. Thigiti-0711920700 or Dr. Munyoki - 0733773509

Consent Giver statement

The information mentioned above concerning my involvement in this research is comprehensible to me. Taking part was optional and I can quit from participating in this research at ana time. I ama aware of the risks and benefits incurred in this research.

Name of Consent giver_____

Signature _____ Date_____

Name of witness _____

Signature _____ Date_____

Appendix 2 Questionnaire

Questionnaire number

Date of interview

Socio demographic

1. Age of respondent
2. What is your religion

   Christian

   Muslim

   Others specify
3. Marital status

   Married

   Divorced

   Separated

   Single

   Widowed

   Others specify
4. What is your level of education

   Primary

   Secondary

   College

   Vocational education

Adult education

None

5. What is your job

   Employee with end moth salary

   Self employment/business

   Student

   Farmer

   Casual laborer

   Housewife

   Others specify

Maternal factors

1. How many children do you have

   First pregnancy

   One

   Two

   Above three

2. How many weeks is the pregnancy during this visit (gestation). Confirm from the ANC booklet …….
3. How many months pregnant were you when you first attended ANC during this pregnancy…… (confirm from the ANC booklet
4. How frequently do you attend ANC when expectant? Second visit

   Third visit

Fourth visit

Above four visits

5. Do you know of an illness where the infected person is said to have little or no blood

   Yes

   No

6. Do you know of any consequence of little or no blood during pregnancy

   Yes

   No

   If yes name the consequence of low blood

   ……

7. Where/from whom did you learn about the disease of low or little blood during pregnancy

   Community health worker

   Health professional

   Friend

   Relative

   Media

   Others (specify)

8. Why is the significance of taking iron and folic supplements when expectant?

   For proper barain growth of the foetus

To avert defects or abnormalities of brain skull and spine of the unborn child during delivery.

Others specify

Don't know

9. Do you know of some beverages that decrease the absorption of iron when taken with meals

   Yes if yes answer question 10

   No

10. If yes which ones ……..
11. Mention any tow kinds of suppliments or additives that expectant mothers benefit when expectant.

    Iron supplements

    Folic acid supplements

    Others

    Don't know

Health service factors

1. How long in minutes do you take to move from you are of residence to this facility
2. By which means of transport do you use to access facility.

   Walking

   Matatu ride

   Motor cycle

   Bicycle

3. What is the cost of transportation do you incur to asses this area?
4. Has your hemoglobin level been checked during this visit or previous visit

   Yes (proceed to question 5)

   No
5. What is the hemoglobin level recorded in the ANC booklet

   ……..
6. What was the gestation when the hemoglobin testing recorded in the ANC card done

   …….
7. Have you received iron supplement during this pregnancy (confirm from the ANC card)

   Yes (go to question 6)

   No (go to question 7)
8. Which source supplied iron/folate supplement

   From government health facility

   From private health facility

   Bought from chemist/pharmacy

   Others specify
9. If no kindly give the reason for not receiving iron/folate supplement

   I was not offered the iron supplement at the facility

   I was informed that iron supplements were out of stock.

   Was not informed about the program.

   I decided not to receive the iron supplement offered to me (proceed to question 8)

Other reason specify

10. Please give the reason for declining to receive iron supplements…….
11. Have you received any nutrition education sessions

    Yes

    No
12. Have you been given any information on iron and folic acid supplement during the education session

    Yes

    No
13. Have you been on any other prescribed medication for the last one month

    Yes

    No
14. What are the reasons for taking the prescribed medications

    ……
15. Do you suffer from any chronic illness

    Yes

    No

Supplement related factors

1. Have you been taking iron supplements?

   Yes [ ]

   No (proceed to question 5) [ ]

2. If taking, what form of supplement are you taking?

   Syrup [ ]

   Tablet [ ]

3. If taking tablet, kindly what tablet form are you using?

   Combined form [ ]

   Single [ ]

   Don't know [ ]

4. Why did you choose to take iron supplements?

   .....

   .....

5. Which reason made you not to take iron supplements.

   Frustration from taking many drugs [ ]

   Forgetfulness [ ]

   Not knowing the advantages of IFA [ ]

   Insufficient tablets [ ]

6. In the last seven days how many pills of iron supplements have you taken

   …….

7. After taking iron/folate supplements didi you ever experience any side effect?

   Yes [ ]

   No [ ]

   if yes answer question 8

8. If yes, describe the side effects experienced……

Appendix 3: Morisky medication compliance scale

Question	**Patient answer (YES/ NO)**	**Score YES=1 NO = 2**
Do you fail to remember taking iron/folate supplements occasionally		
Some expectant Mothers occasionally fails taking their iron/folate supplements for other reasons apart from just forgetting. Fro the past two weeks are there any day you missed taking your medicine.		
At any point in the past, did you find yourself not partaking iron supplements without informing your doctor because of the impacts they had on you after taking them?		
When are on a journey or far away from your place of residence,do you sometimes fail to carry your iron supplements medicine.		
Did you take all your iron/folate supplements yesterday		
When you feel like you do not have any symptoms of anemia do you sometimes stop taking iron/folate supplements		

Taking iron supplements on a daily basis is a difficulty to some individuals. Do you feel any inconvenience or irritation about sticking to your iron/folate supplementation.		
How frequently do you have problems in recalling to take iron supplements? A Scarcely A=0 B Once in a while B-E=1 C ocassionally D regularly E Always		
TOTAL SCORE		

Score >=low adherence

1 or 2 =medium adherence

0= high adherence

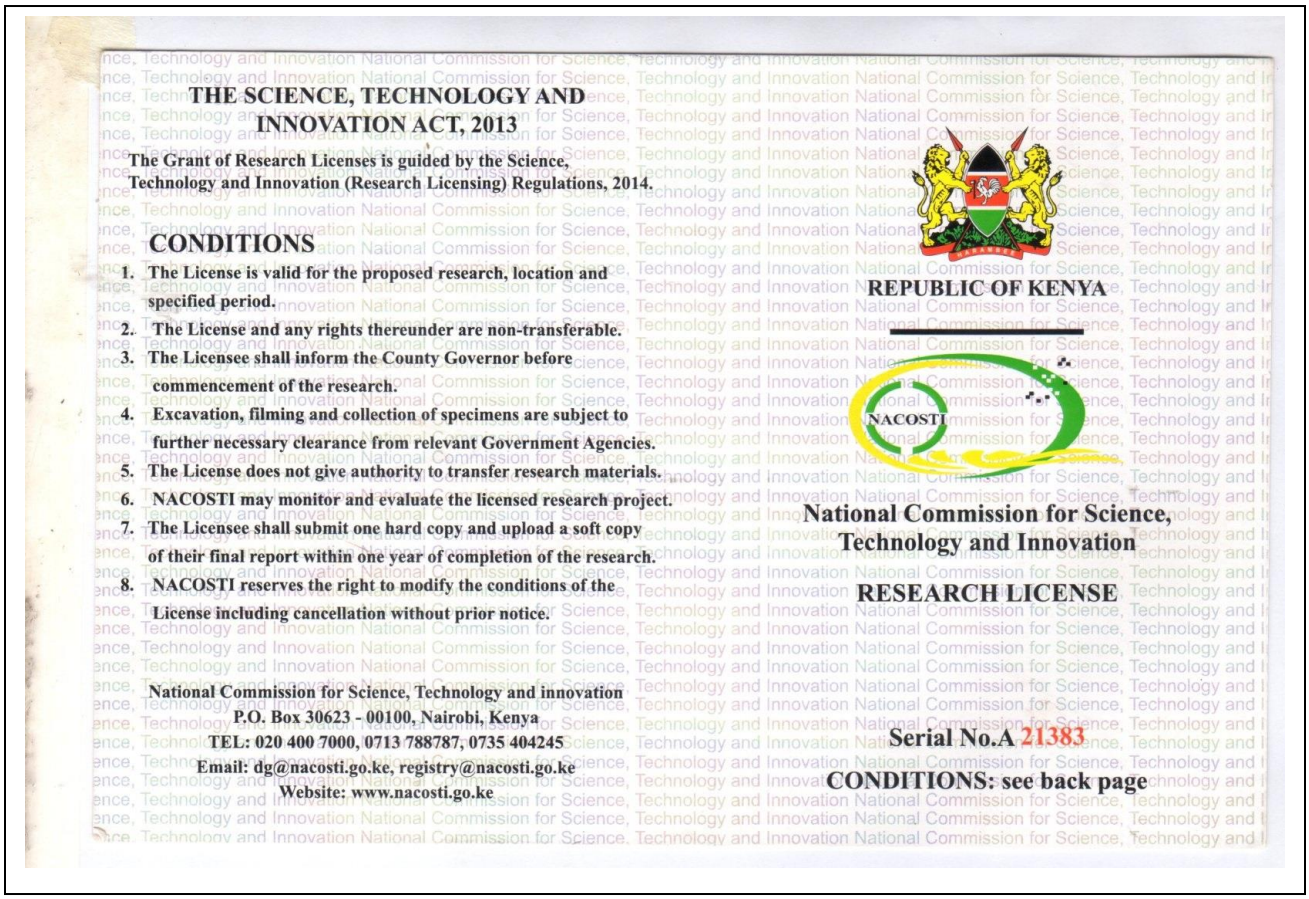
Morisky DE, Green LW, Levine DM. concurrent and predictive validity of a self reported measure of medication compliance *Medcare* 1986,24:67-74.

Key informant interview guide

1. Is your facility equi[ed with strategies on supplementing expectant mothers with iron/folate tablets.
2. Which type of iron/folate supplement is availed to expectant mothers in your health facility
3. In your own opinion what would you say is the compliance like in your health facility
4. Give some of the reason that you think makes expectant mothers not to take iron supplements.
5. What challenges do you face as managers that would contribute to non-compliance to iron supplementation amidst expectant mothers?
6. What advice would you give to help in making more women to take iron supplements as required?

Map of study area

Appendix 4 Research permit



THE SCIENCE, TECHNOLOGY AND INNOVATION ACT, 2013

The Grant of Research Licenses is guided by the Science, Technology and Innovation (Research Licensing) Regulations, 2014.

CONDITIONS

1. The License is valid for the proposed research, location and specified period.
2. The License and any rights thereunder are non-transferable.
3. The Licensee shall inform the County Governor before commencement of the research.
4. Excavation, filming and collection of specimens are subject to further necessary clearance from relevant Government Agencies.
5. The License does not give authority to transfer research materials.
6. NACOSTI may monitor and evaluate the licensed research project.
7. The Licensee shall submit one hard copy and upload a soft copy of their final report within one year of completion of the research.
8. NACOSTI reserves the right to modify the conditions of the License including cancellation without prior notice.

National Commission for Science, Technology and innovation
P.O. Box 30623 - 00100, Nairobi, Kenya
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Website: www.nacosti.go.ke

REPUBLIC OF KENYA

NACOSTI

National Commission for Science, Technology and Innovation

RESEARCH LICENSE

Serial No.A 21383

CONDITIONS: see back page

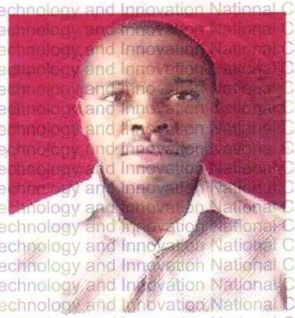
THIS IS TO CERTIFY THAT:
MR. MUSYOKI STEPHEN MATATA
of KENYATTA UNIVERSITY, 1002-90115
KANGUNDO,has been permitted to
conduct research in *Machakos County*

on the topic: *COMPLIANCE TO IRON AND FOLIC ACID SUPPLEMENTATION AND ASSOCIATED BARRIERS AMONG PREGNANT WOMEN ATTENDING ANTENATAL CARE CLINIC IN MACHAKOS COUNTY KENYA*

for the period ending:
22nd October,2019

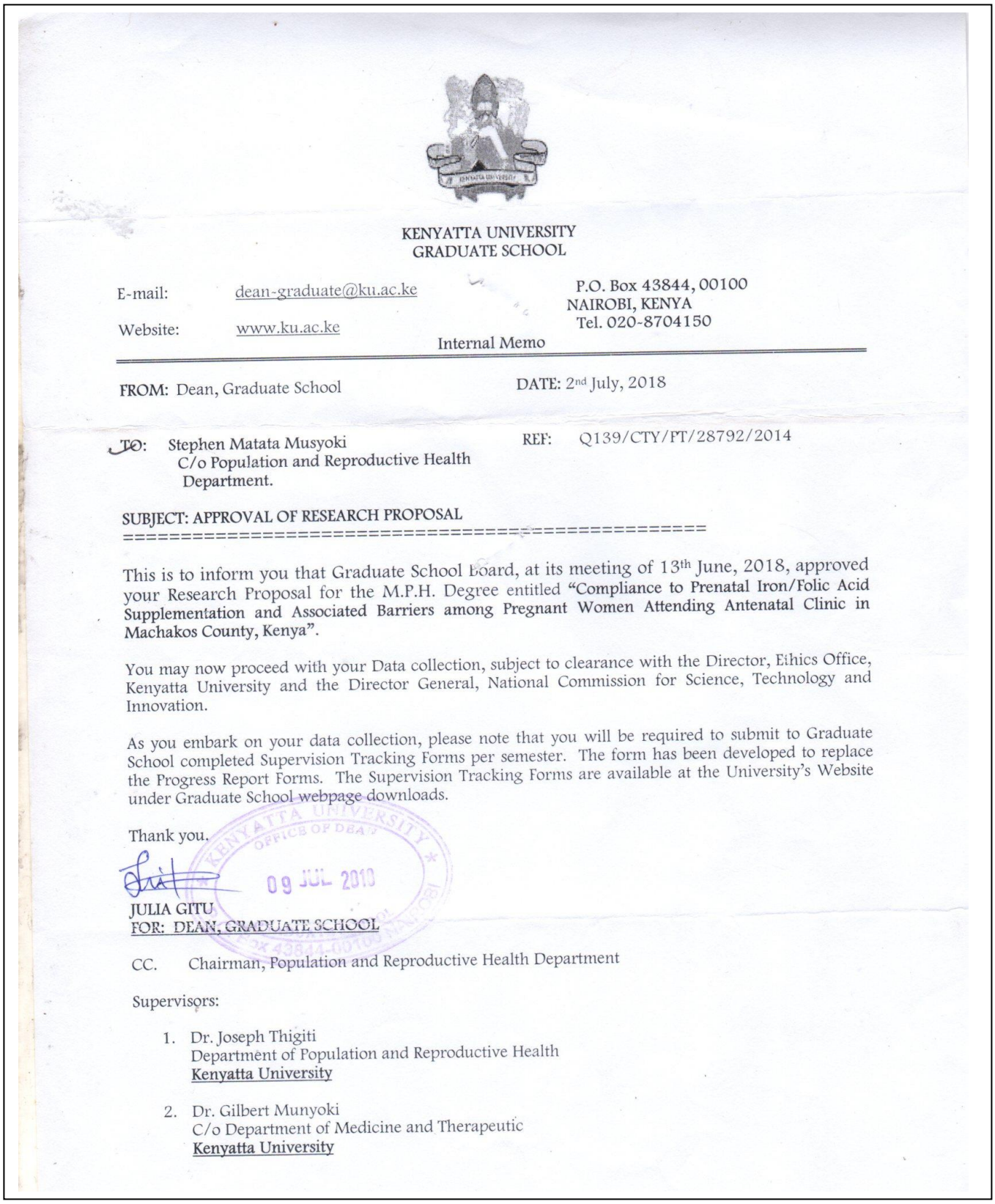
.....
Applicant's Signature

Permit No : NACOSTI/P/18/23976/25904
Date Of Issue : 23rd October,2018
Fee Recieved :Ksh 1000



.....
Director General
National Commission for Science, Technology & Innovation

Appendix 5 Research Approval



KENYATTA UNIVERSITY
GRADUATE SCHOOL

E-mail: dean-graduate@ku.ac.ke
Website: www.ku.ac.ke
P.O. Box 43844, 00100
NAIROBI, KENYA
Tel. 020-8704150

Internal Memo

FROM: Dean, Graduate School DATE: 2nd July, 2018

TO: Stephen Matata Musyoki
C/o Population and Reproductive Health
Department.

REF: Q139/CTY/PT/28792/2014

SUBJECT: APPROVAL OF RESEARCH PROPOSAL

This is to inform you that Graduate School Board, at its meeting of 13th June, 2018, approved your Research Proposal for the M.P.H. Degree entitled **"Compliance to Prenatal Iron/Folic Acid Supplementation and Associated Barriers among Pregnant Women Attending Antenatal Clinic in Machakos County, Kenya".**

You may now proceed with your Data collection, subject to clearance with the Director, Ethics Office, Kenyatta University and the Director General, National Commission for Science, Technology and Innovation.

As you embark on your data collection, please note that you will be required to submit to Graduate School completed Supervision Tracking Forms per semester. The form has been developed to replace the Progress Report Forms. The Supervision Tracking Forms are available at the University's Website under Graduate School webpage downloads.

Thank you.

09 JUL 2018

JULIA GITU
FOR: DEAN, GRADUATE SCHOOL

CC. Chairman, Population and Reproductive Health Department

Supervisors:

1. Dr. Joseph Thigiti
   Department of Population and Reproductive Health
   Kenyatta University
2. Dr. Gilbert Munyoki
   C/o Department of Medicine and Therapeutic
   Kenyatta University

Appendix 5 Research Authorization

KENYATTA UNIVERSITY
GRADUATE SCHOOL

E-mail: dean-graduate@ku.ac.ke
Website: www.ku.ac.ke

P.O. Box 43844, 00100
NAIROBI, KENYA
Tel. 8710901 Ext. 57530

Our Ref: Q139/CTY/PT/28792/2014

DATE: 2nd July, 2018

Director General,
National Commission for Science, Technology
& Innovation
P.O. Box 30623-00100,
NAIROBI

Dear Sir/Madam,

RE: RESEARCH AUTHORIZATION FOR MATATA S. MUSYOKI – REG. NO. Q139/CTY/PT/28792/2014

I write to introduce Mr. Matata S. Musyoki who is a Postgraduate Student of this University. He is registered for M.P.H. degree programme in the Department of Population & Reproductive Health.

Mr. Musyoki intends to conduct research for an M.P.H. Proposal entitled, "Compliance to Prenatal Iron/Folic Acid Supplementation and Associated Barriers among Pregnant Women Attending Antenatal Clinic in Machakos County, Kenya".

Any assistance given will be highly appreciated.

Yours faithfully,

09 JUL 2018

MRS. LUCY N. MBAABU
FOR: DEAN, GRADUATE SCHOOL

JG/rwm