DETERMINANTS OF IRON AND FOLIC ACID SUPPLEMENTATION ADHERENCE AMONG WOMEN OF REPRODUCTIVE AGE IN KILIFI SOUTH SUB COUNTY, KILIFI 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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DEDICATION

I dedicate this thesis to my husband Raphael Mwongela, my daughter Georgia Alora, my dad Henry Machini and my mum Rose Kwamboka. I highly appreciate your support and encouragement.

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ABBREVIATIONS AND ACRONYMS

ANC: Antenatal Clinic

APGAR: Appearance, pulse, grimace, activity, respiration.

CHV: Community Health Volunteer

DD: Dietary Diversity

DNA: Deoxyribonucleic Acid

FAN: Faith to action Network

Hb: Hemoglobin

HDI: Human Development Index

ICRH: International Centre for Reproductive Health

IFAS: Iron Folic Acid Supplementation

IPT: Intermittent Preventive Treatment

KABP: Knowledge Attitudes Beliefs and Practices

KDHS: Kenya Demographic Health Survey

KSPA: Kenya Service Provision Assessment

LBW: Low Birth Weight

MIYCN: Maternal Infant and Young Child Nutrition

MNCH: Maternal Newborn and Child Health

MoNHSR&C: Ministry of National Services Regulation &Coordination of Pakistan

NDMA: National Drought Management Authority

NKAP: National Knowledge Attitude and Practices

RBC: Red Blood Cells

SP: Sulfadoxine Pyrimethamine

SPSS: Statistical Package for Social Sciences

WHO: World Health Organization

DEFINITION OF OPERATIONAL TERMS

Adherence: to commit to taking a given supplement or drug as recommended.

Anemia: It is a condition of the body where the levels of hemoglobin (Hb) are less than 11g/dl, resulting in low capacities of oxygen that are carried in the body.

Antenatal Care Clinic (ANC): It refers to a hospital unit that specializes in check-ups for pregnant mothers and during the check-ups, medical and nutrition attention is recommended.

Appearance, Pulse, Grimace, Activity, Respiration (APGAR) score: It refers to an Infant's numerical expression that is normally determined at birth within sixty seconds and it is based on the respiratory efforts, the heart rate, tone of, uncle, color, and irritability of the reflex.

Hemoglobin: The protein that is responsible for carrying oxygen in the body.

Iron Deficiency Anemia (IDA): It is when the red blood cells in the human blood that form hemoglobin are in shortage because the body lacks iron.

Iron deficiency (ID): A situation in which the body has less than 3g of iron to the point it cannoteffectively supply the required needs.

Neural tube defects: These are health conditions that are present at birth and are defects of thebrain and spinal cord.

Parity: The number of pregnancies a woman has been able to carry to a gestational age that isviable inclusive of stillbirths and live births.

Perinatal: The period that starts on the 20^{th} week and ends at the 28^{th} week during the gestationperiod and ends within the 1^{st} and 4^{th} weeks after childbirth.

Supplement: Any nutrient added to a food or given in pure form to make up for a deficiency and meet the recommended amounts.

ABSTRACT

Iron Deficiency Anemia (IDA) among expectant women causes severe consequences for both productive and reproductive health, resulting in a major public health problem. Iron Folic Acid supplementation (IFAS) is the foremost approach put in place to curb pregnancy-related anemia. Despite this implementation, poor adherence remains to be a big problem. The Kenyan Ministry of Health recommends that pregnant women take 60mgs of iron and 400 µg of folic acid daily from conception till birth. In Kilifi County, 22.2% of pregnant women were reported to adhere to IFAS intake in the year 2017. The major objective of this research was to find out the determinants of IFAS adherence among women of reproductive age, with children 0-23 months in Kilifi South Sub-County, Kilifi County, Kenya. The study aimed to establish the proportion of women who were anemic, the proportion adhering to IFAS intake and how social, economic, demographic and health system factors influenced IFAS intake. A total of 324 mothers were recruited. The research was conducted in two purposively selected public hospitals at the community level, where mothers were selected using cluster sampling. A cross-sectional study design was used. Qualitative data was collected through Focus Group Discussions (FGDs) and Key Informant Interviews (KIIs). Quantitative data was collected using structured questionnaires. Qualitative data was analyzed thematically. Analysis of Quantitative data was conducted using the Statistical Package for Social Sciences version 25. A descriptive summary was made before testing relationships. Association between dependent and independent variables was determined using Chi-square and logistic regression at $p<0.05$. Odds Ratio was used to test the strength of association. The Graduate School of Kenyatta University approved the research, ethical approval was given from the Kenyatta University Ethics and Review Committee, permit to do the research was given by the National Commission for Science, Technology and Innovation and permits were also obtained from the county government of Kilifi, department of health services, both county and sub-county offices. Adherence to IFAS intake in Kilifi South subcounty was low at 31.2% below the required 65% but higher than that of the national level. Factors positively associated with IFAS intake included education level of mother (x^2 =16.884; df=4; p=0.002), age(p=0.03, OR=1.26), monthly income (p=0.044, OR=1.622), Number of ANC visits (x^2=7.586; df=4; p=0.000), knowledge of IFAS and its importance (x^2=7.586; df=2; p=0.023), knowledge of anemia (x^2=8.020; df=1; p=0.005), knowledge of anemia causes (x^2=14.575; df=1; p=0.000), knowledge of effects of anemia in pregnancy (x^2=17.332; df=1; p=0.000), Being anemic during pregnancy (x^2=22.877; df=1; p=0.000; OR=3.35) and challenges faced when taking and acquiring IFAS (x^2=4.717; df=1; p=0.03). Some of the challenges listed were late ANC attendance (57.1%), side effects (53.4%), forgetfulness (32.4%), long distance to the facility (59.4%) and stockouts (29.9%). Anemia was found to be high at 69.4%. The study concluded that mothers who sufficiently took IFAS had improved hemoglobin levels by delivery time. It recommends that the Kilifi County health department and stakeholders address knowledge gaps on IFAS and anemia, create awareness on early ANC registration among pregnant women, ensure enough stock of the supplements and strengthen patient referral system by community health volunteers.

CHAPTER ONE: INTRODUCTION

1.1 Background of the study

Iron deficiency is said to be the leading nutrient deficiency in the world, affecting over 1.9 billion people across all ages accounting for 24.3% prevalence (GBD 2021 Anaemia Collaborators, 2023). This represents over 18% of the global population (James *et al*., 2018). Affected groups include women of reproductive age at 29.6%, non-pregnant women at 29.6%, pregnant women at 36.5%, children aged 6 to 59 months and under-fives at 60.2% which is highest in Africa (WHO, 2021). Men are the least affected with a prevalence of 22% (Murray *et al*., 2020). Strategies that have been put in place in controlling iron deficiency anemia include supplementation of iron and folic acid (IFAS), food fortification and dietary diversity of foods rich in vitamin B12, Folate, and Iron. Creating awareness and nutrition education are major ways to help improve IFAS intake among pregnant women (Yaya *et al*., 2020). Close to 50% of anemic conditions are caused by deficiency of iron in the body, which results in low hemoglobin levels. Among the 26 risky factors associated with the disease, it has been ranked ninth burden for occurrence of anemia (WHO, 2019).

Pregnancy-related anemia causes adverse health issues including morbidity, growth restrictions, birth defects, and mortality. Studies indicate that 65% of disability-adjusted years of life and 71% of the burden of mortality in the world are anemic cases from African regions (Kassa *et al*., 2019). Maternal iron deficiency causes newborn hemorrhage and birth defects in newborns, maternal hemorrhage, membrane rapture, fatigue, decreased work capacity, productivity and death in mothers. Maternal folate deficiency causes neural tube defects, preterm deliveries, low birth weights, birth anomalies, decreased cognition, motor and physical development of children and other

pregnancy complications (WHO, 2017). These effects and impacts of anemia among expectant mothers cannot be assumed since they affect national development either directly or indirectly (Getachew *et al*., 2018).

Anemia prevalence in Kenya is estimated at 40.3% (World bank, 2019). It is projected that 6 out of 10 pregnant women have anemia, which results in 1 out of 10 maternal deaths and 2 of 10 neonatal deaths (MOH, 2017). The WHO, in its Global Nutrition Report, had targeted maternal anemia reduction by 50% in the year 2025 which was reported to be 100 years behind (WHO, 2020). The coastal region is said to have the highest pregnancy anemia prevalence at 72.8% (Odhiambo & Sartorius, 2019). Anemia prevalence has been categorized by the WHO as <5 % not a public health problem, 5–19.9% as mild problem in public health, 20–39.9 % as moderate problem in public health and ≥40% as a severe problem in public health. During pregnancy, it is considered to be severe anemia when hemoglobin level is less than 7.0 g/dl, moderate anemia when hemoglobin level is between 7.0 - 9.9 g/dl, and mild when hemoglobin level is between 10.0 - 10.9 g/dl (WHO, 2017).

Initiatives that have been put in place by the global health community include WHO guidelines for the recommended dose of IFAS during pregnancy. The aim is to reduce anemia prevalence and promote better outcomes among pregnant women. The dosage includes 30-60 mg of elemental iron and 0.4 mg(400mcg) of folic acid. Similar regimes have also been provided for non- pregnant women who are at risk. Adherence to IFAS is consuming 65% of the tablets or more. This is equivalent to taking them for at least 4 days a week for 6 months or for more than 90 days (WHO, 2019). Being adherent to these regimes is crucial in enabling pregnant women attain desired health outcomes. However, numerous factors have been said to affect adherence globally. Studies have highlighted factors such as socio-economic, cultural, health system and individual related factors like side effects and lack of knowledge on anemia (Derso *et al.*, 2018).

In low- and medium-income countries (LMICs), adherence challenges during pregnancy are worsened by resource constraints, poor health infrastructure and

inefficient systems that affect sufficient supply of supplements and medicines. On the contrary, high-income countries, factors like personal preferences and health literacy may apply to the fore. This disproportion emphasizes the complexity of IFAS adherence in pregnancy and the need for interventions. Furthermore, interventions majored on improving adherence can extensively contribute to achieving Sustainable Development Goals (SDGs) related to maternal child health, which is the SDG 3 (Karyadi *et al*., 2023).

Despite the importance of IFAS in improving maternal health outcomes, gaps still exist in comprehending the determinants of its adherence, especially in extensive social, cultural and economic settings. While existing research has formulated valuable insights into challenges and enablers, there is need for extensive research that considers factors related to individual and system factors. This study will be critical in developing targeted interventions to improve adherence of IFAS, reducing anemia burden and promoting better mother and child health outcomes.

1.2 Statement of the problem

A micronutrient survey carried out in Kenya showed the number of women who were pregnant with anemia from 2016 to 2019 increased approximately by 90.1%, with the prevalence being highest in the coastal region, where Kilifi County is situated at 72.8% (Odhiambo & Sartorius, 2019). A study carried out in 2017 in Kilifi determined the number of pregnant mothers who consumed IFAS for 60 days or less to be 69.8%, 60-89 days was 8 % and those who took IFAS for 90 days and above was 22.2 %, which falls below the recommended dose of 65% by WHO (Ochola, 2017). Still, even with the implementation of IFAS programmes, intake is still low and anemia prevalence in Kilifi remains high. Food security in the county is termed as stressed (IPC2) causing a threat on nutrition status of pregnant women.

During pregnancy, proper nutrition is essential to promote the healthy status of the mother and child. Kilifi County presents a unique context for studying these determinants. As a region with high poverty levels, limited access to healthcare, and persistent cultural and educational barriers, Kilifi County experiences some of the highest anemia prevalence rates in the country. Furthermore, women in this area face significant challenges, such as long distances to health facilities, inconsistent availability of supplements, and socio-cultural beliefs that influence health-seeking behaviors. These factors collectively contribute to low IFAS adherence rates, necessitating targeted research to identify actionable solutions (NDMA, 2023). With the increasing number of pregnancies in Kilifi, with teen pregnancies being on the rise, there is a necessity for health education and promotion on IFAS intake and its importance in anemia prevention. Younger women of age below 20 years and above 30 years were reported to exhibit anemia in the study area. Higher anemia prevalence was observed among pregnant women with no formal education. Pregnant women with no or temporary employment have the highest anemia prevalence (Otieno *et al*., 2024).

1.3 Justification

Comprehending the determinants of IFAS adherence is important in developing effective interventions fitted to the local context. As guided by WHO guidelines, the Kenyan ministry of health has established several approaches to promote IFAS (WHO, 2020). However, low adherence rates indicate inadequacy in the existing approaches. Conducting research on determinants of IFAS adherence is therefore critical to understanding the individual, health system, and contextual challenges that contribute to poor adherence. Such evidence is necessary to inform locally relevant strategies aimed at increasing adherence, thereby contributing to the reduction of anemia burden.

This study will provide data that may be used to inform revision and adjustment of existing policies to improve IFAS adherence (Otieno *et al*., 2024). The study is in line with the Kenyan vision 2030 which focuses on improving maternal and child health. Additionally, it supports sustainable development goal 3 (ensure good health and well-being) (Fsd Kenya, 2025). The study may contribute to improving health outcome of WRA by addressing IFAS adherence. Lastly, evidence from this study may be used to inform interventions not only in the study area, but in the neighboring counties and others, that have similar challenges. Insights from the study may be valuable for scaling up successful strategies in IFAS adherence across Kenya.

1.4 Research questions

Research questions were constructed to provide room for the identification of IFAS adherence rate among participants, anemia prevalence, and identify social, cultural, economic, demographic and health system factors affecting adherence.

1. What is the proportion of women who are anemic among women of reproductive age with children less than 24 months in Kilifi South Subcounty?
2. What is the proportion of women adhering to IFAS intake among women of reproductive age with children less than 24 months in Kilifi South subcounty?
3. What individual factors are associated with IFAS adherence among women of reproductive age, with children less than 24 months in Kilifi South Subcounty?
4. What health system factors are associated with IFAS adherence among women of reproductive age, with children less than 24 months in Kilifi South Subcounty?

1.5 Hypothesis

1. There is no significant association between individual factors and adherence to IFAS intake among women of reproductive age with children less than 24 months in Kilifi South Subcounty.
2. There is no significant association between health system factors and adherence to IFAS intake among women of reproductive age with children less than 24 months in Kilifi South Subcounty

1.6 Objectives

1.6.1 Broad objective

The study aimed at assessing the determinants of IFAS adherence among women of reproductive age, with children 0-23 months in Kilifi South Sub County, Kilifi County.

1.6.2 Specific objectives

Specific objectives were constructed in line with study questions and to clearly illustrate literature review and for clear discussion of results.

1. To estimate the proportion of women who are anemic among women of reproductive age, with children less than 24 months in Kilifi South sub-county.
2. To determine the proportion of women adhering to taking IFAS among women of reproductive age with children less than 24 months in Kilifi South sub-county.
3. To identify individual factors associated with IFAS adherence among women of reproductive age, with children less than 24 months in Kilifi South sub county.
4. To determine health system factors associated with IFAS intake among women of reproductive age, with children less than 24 months in Kilifi South sub

county.

1.7 Significance of the study

This study will provide valuable insights into the factors influencing adherence among WRA. Firstly, Results from this research may be used to benefit WRA (15-49) years, specifically pregnant women. Findings may help identify challenges to IFAS adherence. This will help reduce iron deficiency anemia prevalence and the associated complications during pregnancy. Secondly, healthcare providers and policy makers may benefit from this study, as it will generate evidence-based recommendations for promoting IFAS programs at community and hospital levels. By understanding factors influencing adherence, health authorities can establish effective educational programs, enhance service delivery and availability of IFAS programs. Results will be shared through workshops, policy briefs and interactions among health professionals to integrate maternal health initiatives. Additionally, NGOs and CHVs engaged in mother and child health programs may benefit by gaining information regarding challenges women face in IFAS adherence. These insights may enable the development of culturally appropriate interventions that address misconceptions and other barriers to proper adherence. Findings may be disseminated through community outreaches, CHV training sessions and routine health forums to improve health outcomes.

1.8 Limitation and Delimitation

1.8.1 Limitation

Illiteracy among study participants was one problem encountered during data collection. Even with extra oral explanations of some questions, misinterpretation was observed among some participants. Data was collected by participants' reply (self-reporting). Recall bias is likely to have been introduced and this may contribute to

invalid conclusion.

1.8.2 Delimitation

The issue of illiteracy was addressed by asking and providing further explanations of the questions in Swahili language. Both the packet and the IFAS tablets were presented to each participant to enable them to recall about the tablets. The Mother and Child Health booklets were referred to for more information on some questions. Use of FGD guide and KII guide provided more information that was used to supplement quantitative findings.

1.9 The Conceptual Framework

Socio-economic, demographic, cultural, other individual factors and health system factors have a major impact in affecting how mothers access IFAS. In areas with poor infrastructural development, chances of low access to health facilities due to lack of transport means and high costs are higher than in towns. Adherence is affected by one's knowledge, attitude, beliefs, and practices which can significantly affect IFAS consumption. Frequency of ANC attendance, gravida, parity, gestation period, side effects and forgetfulness are factors related to the mother that can affect IFAS uptake. Patient counseling, health promotion, family support and positive behavior change can design an apprehension of the importance of consuming IFAS as a variable that is intermediate in improving the uptake of IFAS. (Devkota *et al*., 2017). Figure 1.1 illustrates the link between independent, intermediate and dependent variable.

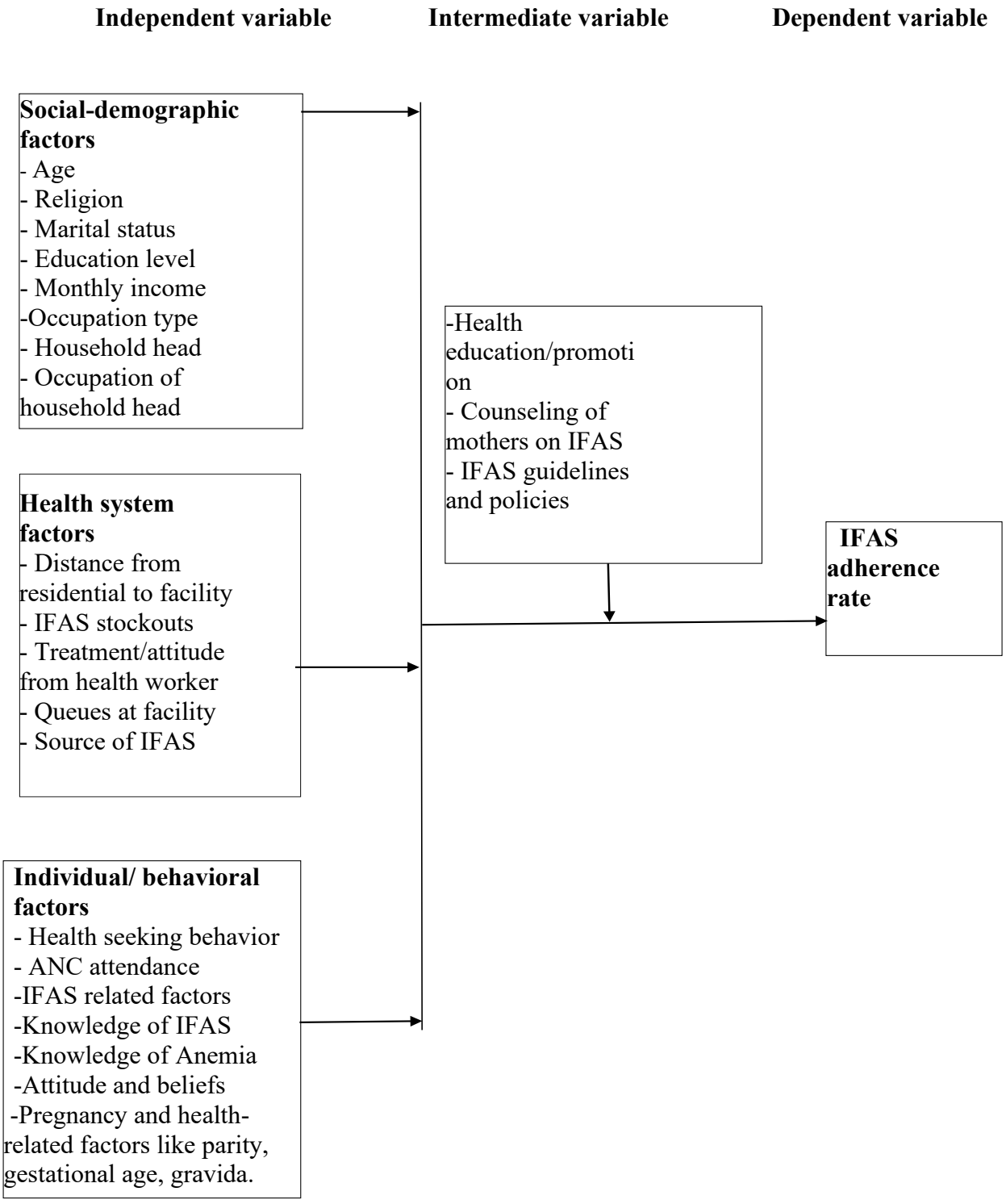

Figure 1.1: Conceptual Framework on factors associated with IFAS adherence.

Source: Constructed from Literature Review

CHAPTER TWO: LITERATURE REVIEW

2.1 Introduction

This chapter constitutes information from previous studies that relate to the conceptual framework, study objectives and which were important in answering the study questions. The literature reviews highlighted knowledge gaps that were addressed by the research.

2.2 Overview of anemia in pregnancy

2.2.1 Introduction

The World Health Organization defines pregnancy anemia as having hemoglobin levels of (>110 g/d) as no anemia, (100-109 g/dl) as mild anemia, (0–99 g/dl) as moderate anemia and (< 70 g/dl) as severe anemia. Altitude and smoking are some of the factors that can alter these cut-off values (WHO, 2021). Anemia occurs as a result of reduced oxygen-carrying capacity in blood when hemoglobin levels drop below normal levels. Physiological changes during pregnancy cause an increase in plasma volume, by about 40–45% more than in nonpregnant women. This causes blood volume to expand by 15% more in pregnant women than in nonpregnant women. Increase in blood and plasma volume is meant to provide stores for the growing fetus, placenta, tissue accretion, and intrapartum potential for blood loss. When there is not enough hemoglobin to carry oxygen around the body, anemia occurs (WHO, 2021). Iron helps in formation of hemoglobin, hence if iron is taken insufficiently, low hemoglobin levels occur causing low oxygen carrying capacity. The daily requirement of a woman of childbearing age who is non-pregnant is 1.5 mg of iron. This requirement increases to around 6–7 mg/day (a total of 1000 mg) during pregnancy. The increased iron demand

should be met by more intake and absorption. Women who are pregnant are at more risk of developing other types of anemia affecting women of childbearing age. They include hereditary anemia, aplastic anemia and sickle cell anemia (Jain *et al*., 2019).

2.2.2 Types of anemia in pregnancy

Iron deficiency anemia majorly occurs among pregnant women. Majority of the women who are pregnant and not taking the required number of IFAS, have hemoglobin levels below 11 mg/dl. Fetal development and growth, placenta growth and the nature of pregnancy call for increased iron intake, which need to be met by diet and supplementation (Garzon *et al*., 2020). Factors that contribute to depleted iron stores include, inadequate iron absorption, multiple pregnancies with timing less than two years apart, teen pregnancy that causes chronic blood loss, and low iron levels before pregnancy. Common clinical symptoms are lethargy, fatigue, headache, burning sensation in the tongue, and intake of non-dietary substances (pica) (Elsevier *et al*., 2020).

Deficiency of folic acid results in megaloblastic anemia. It is said to be the second cause of nutrition deficiency anemia. The derivative form, FH4, is necessary for appropriate DNA synthesis and production of amino acids. Folate demands during pregnancy increase to cater for fetal growth and increased maternal erythropoiesis (Hoffman et al., 2018). Pernicious anemia occurs when the small intestines cannot absorb enough vitamin B12 causing a decrease in the number of red blood cells. In order for vitamin B12 to be well absorbed from the intestines, a binding protein called the intrinsic factor (IF) is required. When the body will not produce enough IF, then vitamin B12 will not be absorbed appropriately resulting in this type of anemia (Anusha *et al*., 2022).

2.2.3 Causes of anemia during pregnancy

Anemia causes can be categorized into nutritional causes, environmental or non-nutritional causes and individual factor causes. Nutritional deficiencies occur as a result of iron, folate and vitamin B12 insufficiency. They are caused by inadequate micronutrient consumption in diet, hereditary disorders or inhibitors that cause abnormalities in nutrient absorption, losses during hemorrhages, increased requirements in rapid growth like in adolescence or pregnancy, and insufficient utilization of hemopoietic nutrients (WHO, 2020). However, the major cause has been found to be iron deficiency accounting for over 75% of pregnancy anemia cases (Hoffman *et al*., 2018). Other micronutrient deficiencies that are less common and yet contribute to anaemia include vitamins A, B2, B6, B9, B12, D, E, C and essential minerals like copper and zinc. Iron is the major component for hemoglobin formation, but these other micronutrients are required and have different functions in iron absorption and immune functioning (WHO, 2020).

Non nutritional causes of anemia include acute and chronic conditions like hookworm infestation, schistosomiasis, helicobacter pylori infection, malaria, tuberculosis, HIV, cancer, genetic conditions including thalassemia, and sickle cell trait (WHO, 2019). Individual factor causes include lack of knowledge on proper micronutrient rich foods and family or community values that hinder intake of proper diet, low education levels, rural living, poverty, inadequate health care, inadequate maternal and childcare, high parity and short birth spacing that contributes to nutritional or other type of deficiency anemia. (WHO, 2020).

2.2.4 Prevalence of anemia.

Globally the proportion of women who are anemic is estimated at half a billion with

37% being pregnant women and 30% being women of reproductive age. The highest prevalence is observed among children under five years in the African region at 60.2% (WHO, 2019). Most developed countries and some developing countries, have low anemia prevalence. For example, in Colombia it is estimated at 22% and in Mexico at 20%. In the United States at 12 %, Australia at 20%, China at 19% and Singapore at 18%. Low prevalence in these countries is because of better and stronger healthcare systems, better supplementation programs, low poverty rates and effective public health systems (GBD 2021 Anaemia Collaborators, 2023). In India it is estimated at 50% while in Pakistan at 44% (World Bank, 2019). Prevalence is high in these countries probably because of socio-economic inequalities and limited access to maternal health care (Givens *et al*., 2024).

Anemia prevalence in Southeast Asia and Africa is estimated at 48.7% and 46.3% respectively (Liyew *et al*., 2021). In a subgroup analysis carried out to determine anemia prevalence in pregnancy in various regions of Africa, East Africa had the lowest prevalence at (33.9%) and Western Sub Sahara had highest prevalence at 39.3%. However, a greater prevalence of 41.4% was observed in studies done at facility level. Prevalence in countries included Ethiopia at 50.1%, Sudan at 53%, Guinea at 71% (Fite *et al*., 2021), Rwanda at 18.2%, Tanzania 57% and Mali 64.3% (Zegeye *et al*., 2021).

In Kenya, according to the data from global health observatory data repository, anemia in pregnancy is estimated at 40.3% (World Bank, 2019). Prevalence in these countries remains high due to inadequate health infrastructure especially in rural areas, limited public health interventions, high poverty levels and cultural barriers that limit adherence to preventive interventions (Zegeye et al., 2021).

In coastal region, anemia prevalence is estimated at 72.8% (Odhiambo & Sartorius,

2019). Pregnancy-related anemia in neighboring Kwale County was 62.8% (Nyamu *et al*., 2020). In a study carried out between 2016 and 2019 in Kenya, the estimated number of anemia cases among pregnant women increased by 90.1% from 2016 to 2019. Moderate pregnancy-related anemia prevalence increased from 16.8% to 30.1% in 2019 while severe anemia increased from 7.1% in 2016 to 16.6% in 2019. Overall, 45.1% of the approximated cases occurred in malaria-endemic regions, with the highest proportion in the coastal endemic zone at 72.8% (Odhiambo & Sartorius, 2019).

2.2.5 Anemia effects during pregnancy in infants and mothers

Pregnancy anemia can result in maternal and perinatal adverse effects. Iron and folic acid deficiency cause symptoms such as impaired memory, decreased motor abilities, and mental development delay in children. Infants are born with birth defects including low birth weight (LBW), preterm births, stillbirths, congenital anomalies, decreased appearance, pulse, grimace, activity, and respiration (APGAR) score of the fetus, intrauterine growth restriction, neuro tube defects and infant deaths (WHO, 2020). Preterm births are a major cause of infant deaths in low- and middle-income countries (Georgieff *et al*., 2020).

In mothers, anemia during pregnancy causes morbidity and mortality (WHO, 2020). There is an increased risk of preeclampsia, and it is higher in pregnant women with severe anemia. Studies suggest that there are probabilities of linkages between anemia and postpartum hemorrhage, pulmonary edema, preterm labor, inability to push during the second stage of labor, Cognitive abnormalities, miscarriages and impaired lactation. Symptoms such as lethargy and fatigue also reduce the productive state of a pregnant woman (Juul *et al*., 2019).

2.2.6 Programmes to mitigate anemia in pregnancy

Programmes established to prevent nutritional anaemia have been structured to provide iron, folate, vitamin A, zinc and other micronutrients through supplementation, fortifying foods, provide dietary diversity and food security, improving agricultural practice, food distribution, nutrition education and women empowerment (WHO, 2020).

2.2.6.1 Interventions to address nutritional causes of anemia

Interventions include micronutrient supplementation, food fortification and improving dietary diversity. Micronutrient supplements with both iron and folic acid (IFAS), have been recommended for pregnant women and women of childbearing age. Systematic reviews showed that consuming IFAS for at least 90 days when pregnant, reduces maternal anemia by close to 70% and even improves physical performance (WHO, 2017).

Food fortification has been deliberated as a low-cost intervention to mitigate nutritional deficiencies in areas of widespread anemia. At the moment, about eighty countries have established programmes on fortifying foods with folate. Mandatory folic acid food fortification programs were approximated to prevent 18% of all potential folic acid preventable (FAP) spinal bifida and anencephaly cases worldwide in 2017 and 22% of cases in 2019 (Kancherla *et al*., 2021). Evidence showed that fortification of flours was associated with a 2.4% decrease in anaemia occurrence after adjusting factors like malaria and Human Development Index (HDI). These studies showed that anemia prevalence remained unchanged in countries that did not fortify foods (Centeno *et al*., 2019).

Dietary diversity increase, food security and sustainable agriculture are other measures to help address nutritional anemia. In a systematic review in Ghana, an improper diet rich in iron and folic acid was associated with anaemia during pregnancy and dietary diversity score was the main measure of hemoglobin concentration (Ayensu *et al*., 2020). In HIV positive mothers, poor quality diet has been stated to cause anaemia. An evaluation done by Helen Keller International on food security programmes, indicated that home food production contributed positively to reducing anemia, night blindness and stunted growth (Haselow *et al*., 2017). In another study in Cameroon, dietary diversity that included consuming more than five food groups positively affected hemoglobin levels among pregnant women regardless of pregnancy age. More than 80% of anemia cases were linked to dietary diversity (Jugha *et al*., 2021).

2.2.6.2 Interventions to mitigate non-nutritional anemia

In a meta-analysis of studies done in Africa, South America, Asia and Oceania, evidence proved that reducing hookworm intensity improved hemoglobin concentrations (Ness *et al*., 2020). Insecticide-treated nets (ITNs) have been primarily recommended by WHO in malaria prevention among pregnant women. ITNs have been found to reduce two-thirds of the malaria burden and a 17% reduction in mortality cases in sub-Saharan Africa (Koeneker *et al*., 2018). Another intervention was to reduce HIV cases among pregnant women. WHO has provided guidelines on HIV management and prevention during pregnancy for mothers and infants. Information from a study done in Ethiopia, antiretroviral treatment of HIV/AIDS in children was associated with a 60% reduction in anemia among children (Wagnew *et al*., 2018).

2.2.6.3 Programmes to deal with individual based factors that influence anemia

Economic growth is one major intervention to increase a nation’s income, and with this,

people's way of seeking healthcare will change positively since healthcare will be affordable. In a certain study, anemia reduction was seen to improve with same magnitude as economic growth. Women empowerment is another intervention. When women are empowered, they are able to seek better health services, jobs and education (WHO, 2020). In another meta-analysis of studies done in Sub-Saharan Africa, Poverty reduction was seen to help improve women's sociodemographic and other characteristics which had an impact on childhood nutrition. When pregnant women were given IFAS prescription that was to be purchased, only 40% sought the supplements meaning the cost was a hindering factor to purchasing the tablets (Yaya *et al*., 2020).

2.3 Iron folic acid supplementation in pregnancy

2.3.1 Overview of supplementation with iron and folic acid in pregnancy

Iron and Folic Acid supplementation (IFAS) for pregnant women is a major intervention recommended by the WHO and implemented by the Ministry of Health (MOH) to aid in curbing maternal anaemia in Kenya. Pregnant mothers are recommended to attend antenatal clinics at least once a month immediately after conceiving and hence, IFAS should be provided to mothers as part of antenatal care services (MOH, 2017). Women are recommended to start consumption of IFAS before conception. The required dosage should be taken for at least 90 days throughout the pregnancy (WHO, 2019). The dosage of a woman diagnosed with anemia during pregnancy should be increased to 120 mg daily until her hemoglobin levels normalize to 11mg/dl or higher. In areas of moderate and high malaria occurrence, the WHO recommends intermittent preventive treatment in pregnancy (IPTp) with low doses of folic acid (40mcg) daily and sulfadoxine-pyrimethamine (SP) to aid in malaria

prevention. IPTp reduces severe effects of malaria on the mother and fetus, including maternal and fetal anemia, and low birthweights (Hodin, 2017).

The WHO recommends different dosage for iron and folic acid for all women of reproductive age, depending on anemia prevalence in the geographical location (WHO, 2020). For women of reproductive age, in areas where anemia prevalence is between 20-40 %, recommended dosage is 120mg iron and 2800mcg folic acid weekly. In areas where prevalence is greater than 40%, recommended dose is 30 to 60mg iron and 400mcg folic acid daily for three consecutive months. For pregnant women in areas where prevalence of anemia is less than 20%, 120mg iron and 2,800mcg folic acid weekly is recommended. In areas where the prevalence of anemia is between 20 and 40%, recommended dosage is 30 to 60mg iron and 40mcg folic acid daily while in areas of high anemia prevalence above 40%, 60mg iron and 40mcg folic acid daily is recommended (WHO, 2019).

2.3.2 Adherence to IFAS and its measures

Adherence is defined as a pregnant woman faithfully following a prescribed medication or supplements dose. For IFAS supplementation this should be greater than 65% of the total recommended IFAS dose in pregnancy. It begins with a mother taking the responsibility of attending antenatal clinics, getting the supplements, and taking them as required and in the right dose (Lutsey *et al*., 2017). Diverse researchers have used different methods to test for adherence to IFAS. In a research carried out in Kenya, compliance was tested by recording IFAS intake for the last seven days, and 70% of intake was considered compliance (Kamau *et al*., 2020). In another research done in Ethiopia, it was measured by pill intake recording throughout pregnancy, and 80% intake was considered compliance. Failure to take two or more doses by the pregnant

woman was considered non-compliance (Obsa *et al*., 2021). The current research used the recommended dose by WHO, which is taking IFAS for more than 90 days to measure adherence.

2.3.3 Supplementation with iron and folic acid prevalence among pregnant women

Results from the Health and Demographic Health Survey of Philippines of 2017 indicated a 25.8% adherence rate of IFAS among pregnant women (Felipe-Dimog *et al*., 2021). Results from a systematic review of studies done in sub-Saharan Africa indicated that across twenty-two sub-Saharan countries, pooled adherence rate was 28.7%. Countries like Burundi had low adherence at 14 % and others like Senegal having high adherence at 73%. Much lower prevalence was observed in Kenya at 10.6% (Fite *et al*., 2018). Another study carried out in Northern parts of Tanzania indicated adherence rate to be 17.2% (Ssentongo *et al*., 2019). Adherence in Malawi was recorded at 37% and that of Ethiopia at 55% (Birhanu et al., 2018). High adherence rate to IFAS was reported in South Africa at 93 % (Mbhenyane &Cherane, 2017). In a meta-analysis carried out in Asian region, a study conducted in Iran indicated adherence rate at 71.6%. In the same analysis, a study in Egypt showed one-third of pregnant women did not take IFAS during pregnancy. In a study in India, findings indicated 64% adherence rate among pregnant women (Fite *et al*, 2018).

In a knowledge, attitude, beliefs and practices (KABP) survey carried out in Kilifi in 2017, results showed the number of pregnant mothers who consumed IFAS for 60 days or less to be 69.8%, 60-89 days was 8 % and those who took IFAS for 90 days and above was 22.2 %, indicating low adherence at 22.2% (Ochola, 2017).

2.3.4 Importance of iron and folic acid supplements during pregnancy

Iron supplements help in reduction of low birthweight risks, reduces risk of maternal anemia, reduces risk of iron deficiency, provides enough blood stores in the body during and after delivery and helps to sustain strength during pregnancy. Folic acid on the other hand reduces risks of neural tube defects in infants, helps in iron absorption and prevents microcytic anemia that could be caused by iron deficiency (WHO, 2019) Intake of the combined form of folic acid (0.4mg/400ug) and iron (40 mg) is beneficial to the mother in that she will consume fewer tablets and hence increase dose intake and improve adherence. Some countries provide the sugar-coated form of the combined tablets, hence will help reduce side effects (MOH, 2017). The Kenya policy guideline on combined IFAS recommends intake of 60 mg of elemental iron and 400ug of folic acid which includes one tablets daily for all pregnant women. Consumption should begin as early as a mother conceives and continue throughout pregnancy till birth (WHO, 2019). The tablet should be taken with meals to avoid side effects that come along with taking IFAS on an empty stomach like epigastric pain, nausea, vomiting, diarrhea, and constipation. Mothers should emphasize avoiding intake of in inhibitor consisting of foods like tea and coffee that inhibit iron absorption. Mothers should emphasize eating vitamin C rich foods like fruits and vegetables, lean meats, well-cooked blood, fermented and germinated legumes that enhance iron absorption (Shubham *et al*., 2020).

2.3.5 Programmes formulated to help in IFAS adherence.

There are guidelines released by WHO on improving antenatal care (ANC) and they include a comprehensive set of the nutrition interventions required during pregnancy. Effort needs to be employed to ensure that policy and programme actions reflect

nutrition services given in hospitals. Quality and equality should be observed (WHO, 2020). Information concerning a training programme which was implemented in Bangladesh from 2012 to 2017 showed that efforts in health care provider training increased IFA supplementation adherence. Increased knowledge of IFAS in both pregnant women and health workers was reported, which therefore positively affected IFAS intake (Sendeku, Azeze, & Fenta, 2020).

In Nepal**,** a programme on Maternal, newborn and child health (MNCH) was implemented. It involved carrying out home visits to enlighten women on the importance of IFAS targeting increasing IFAS consumption. Pregnant women were counseled on the benefits of IFAS and calcium supplements, the consequences of deficiency in IFAS and calcium, dosage, how to deal with IFAS side effects and foods that inhibit absorption of these nutrients. Family members participated to ensure pregnant women took supplements as required (Kim *et al*., 2017).

A study in India, the programme established consisted of women in the treatment and comparison group, where those in the intervention were given home reminder tools for IFAS consumption. Other practices were assessment home visits for the treatment group. A proportion of 85% in the intervention group consumed 100 IFAS tablets while 38% took the tablets for more than 100 days in the comparison group. (Prinja *et al*. 2017).

In another study done in Africa and Asia, health care systems strengthening, and health care giver capacity was implemented. It had been discovered that training health care workers and community health workers in IFAS distribution in the community and on counselling pregnant women, was associated with increased consumption. This is because the provided advice was a major platform to increase knowledge and awareness

among pregnant women hence increasing uptake (Siekmans *et al*., 2019). In another study done in low- and middle-income countries, community distribution of the supplements was termed a successful approach to not only enable women to attend ANC early but also allowed them start early consumption of IFAS during pregnancy (Kavle *et al*., 2018).

Research successfully carried out in the Western region of Kenya found that the implementation of the counselling programs on nutrition and the policy on IFAS in Kenya was termed weak and the desired outcomes have not been achieved. Factors that contributed to the delayed implementation are supplements shortage, late booking for ANC, the side effects of the drugs and being issued with many pills at a time (Riang'a *et al*., 2020). In another study in central Kenya, an evaluation of community approach to distribute IFAS from door to door indicated increase in IFAS intake and hence an improvement in hemoglobin levels among pregnant women. Some activities mentioned to be beneficial by mothers were regular supply of IFAS by CHVs which saved the mothers the costs of going to clinics, free health education on importance of IFAS and how to manage side effects and follow ups (Kamau *et al*., 2020).

2.4 Individual factors influencing adherence to IFAS intake

2.4.1 Social, Economic, Cultural and Demographic Factors.

Social, cultural, economic and demographic factors play a major role in affecting one's health habits. Different associations between age and IFAS intake are explained in different studies. In one study, adherence was seen more among older women than in women of young age. This could be because older women know the benefits of IFAS from experience in their previous pregnancies of iron deficiency, and therefore can be more consistent (Getachew *et al*., 2018). In a study in Australia, poor utilization of ANC

services was almost twice as high in women of older age, above 30 years than young women of age between 15-30. Factors that affected seeking ANC included, low socio-economic status and social stigma especially for young pregnant teens, lack of social support and costly transport means to health facility (Shee *et al*., 2021). In studies in West Africa, household monthly income was associated with IFA adherence. Women with much lower income were less likely to adhere to IFAS intake than those with more income because mothers with income are likely to seek health services whereby counselling on the importance of IFAS was included (Agegnehu *et al*., 2019). In a study in India, pregnant women from wealthy homes were less likely to adhere because they had good health and could buy the supplements whenever they felt they needed them. Some of the causes identified for low adherence were education levels, their occupation and household income (Selvaraj et al., 2017).

Religion and ethnicity were found to negatively affect the level of adherence. However, in one study, Muslims who were non-Indigenous and non-Muslim who were non-Indigenous were 15% and 45% respectively less likely to be compliant than those of other ethnicities (Felipe- Dimog *et al*., 2021).

Support from family members may encourage a pregnant woman to be consistent in taking the supplements regularly. In one study done in Bangladesh, women were motivated to take the supplements when someone was encouraging them. Women whose partners highly encouraged and supported them were more likely to adhere to IFAS and calcium supplements as compared to those who were not being supported by their partners. Early and continuous ANC visits contributed to the intake of additional 46 IFA and 53 calcium supplements (Nguyen *et al*. 2017).

2.4.2 Education and knowledge of IFAS and anemia

Findings from a study carried out in Ethiopia indicated that educational status of participants was significantly associated with IFAS adherence. Probability of adherence to IFAS was 9.27 times higher among participants who had primary level education and above as compared to study participants who did not have any formal education (Agegnehu *et al*., 2019). In another study done in Ethiopia, having secondary and above education level was positively associated with increased IFAS intake among pregnant mothers. This is likely because, educated women can stick to a healthy habits like ANC attendance and IFAS intake as advised by health care giver (Sendeku *et al*, 2020). From a previous study in Bangladesh, higher maternal knowledge of IFAS was highly associated with increased consumption of IFA and calcium supplements. Women with low knowledge consumed 19 more tablets, those with medium knowledge consumed 23 more IFA supplements and 23 more calcium supplements, while those with high knowledge consumed 31 more IFA supplements and 30 more calcium supplements (Nguyen *et al*..2017). In a meta-analysis of sub-Saharan Africa countries studies, mothers with IFAS knowledge had a 2.71 times probability of being adherent compared to those who did not have knowledge of IFAS (Fite *et al.,* 2018). Results from another meta-analysis showed that women who had some knowledge of anemia had a 5.42 times more chance of being adherent compared to those who did not (Derso *et al*, 2018).

2.4.3 Pregnancy, health and supplement related factors

Side Effects like nausea, constipation, and vomiting are symptoms that mostly come with the early stages of pregnancy, and iron supplements may contribute to the condition. Still, little evidence exists that low adherence is caused by the side effects. Previous research reported that 40% of mothers stating side effects as reasons to stop

IFAS intake (Getachew *et al*., 2018). Absorption of the supplements that are consumed is enhanced when taken on an empty stomach. However, this has been reported to cause side effects like nausea and epigastric pain. Therefore, lower doses should be taken after meals (Thompson *et al*., 2020).

In a meta-analysis, in countries like Kenya, Senegal and Ethiopia, mothers reported stockouts and therefore did not get enough stock to last a month when they went for ANC visits. Being told to buy tablets at other pharmacies was unaffordable to most of them decreasing the likelihood of having the supplements hence not able to meet the required dosage (Siekmans *et al*., 2019).

The state of first-time pregnancy was associated with increased IFAS intake in a certain study. This was linked to the fact that a first-time mum was very careful to ensure they meet all pregnancy requirements including consuming IFAS to ensure they deliver a healthy baby and be healthy themselves. Pregnant women who had less than two children were more likely to adhere compared to those who had more than three children. Parity was associated with an increase in consuming iron and folic tablets probably because of pregnancy related experience (Mohamed *et al*., 2022).

Misinformation and misperception about IFAS were some beliefs found to affect intake. Misconceptions included intake of IFAS leads to giving birth to a baby with burned skin, fear of giving birth to a big baby, spot-on teeth for children and face of mothers, could cause difficulties when giving birth and that the supplements did not benefit the baby at all. It was also discovered that most pregnant women who felt healthy did not bother consuming the supplements as a result of ignorance and negligence (Niguse & Murugan, 2018).

2.5 Health system-related factors that determine adherence

2.5.1 Health facility related factors

In a study carried out in North Tanzania, distance from place of residence to health facility was found to be associated with IFAS intake. Women who resided in areas that were 60 minutes or more away from the hospital were less likely to adhere to the IFAS program compared to those who lived near the facility or pharmacy. This is because the facilities were close and the women could spend less time and money to get to the facility, hence increasing their chances of ANC attendance (Niang *et al*., 2017). Research carried out in Kenya found that in most health facilities, there were frequent stock-outs and this affected IFAS intake rates (Kamau *et al*., 2019). In another study, shortage of staff resulting in long queues was found to discourage expectant mothers from attending ANCs. (Riang'a et al., 2020).

In another study done in Kenya, health workers were identified to be forgetful in educating pregnant women on the side effects of IFAS, and how they can deal with them, and this contributed to low compliance (MOH, 2017). In a meta-analysis done in Ethiopia, healthcare providers reported a lack of IFAS trainings and were therefore forced to make decisions based on their own experiences. Some of them were not aware of any existing IFAS guidelines (Siekmans *et al*., 2019).

Results from a meta-analysis of studies carried out in west Africa showed that pregnant women who attended four or more ANC visits were two times more likely to adhere than those who attended four visits and below. Results from another meta-analysis of studies done in Asia, including Indonesia, Nepal, India, Pakistan, and the Philippines showed that pregnant women who attended 3 ANCs or more were more likely to adhere. It was observed that antenatal care-seeking visits seemed to be an effective way of

reaching women in increasing the likelihood of IFAS uptake (Fite et al., 2018). Time of commencement was associated with adherence. A study in Tanzania showed that women who began ANC attendance in the first trimester were more likely to adhere to the IFAS program 3.7 times more unlike those who started ANC in second or third trimester. Possible reasons could be due to appropriate counselling and advice given to the mothers early enough on preventive measures, consequences of not taking IFAS and those of anemia and health information that created behavior change. Late ANC visits were attributed to beliefs, perceptions, distance to facility and fear of HIV test results. This could affect the number of tablets consumed since they are given during ANC visits (Lyoba *et al*., 2020).

In Kenya, the proportion of pregnant women who attend ANC four times or more is estimated at 47% and only 15% have been reported to attend ANC in first trimester. Reasons for delayed ANC visits is ignorance, whereby mothers think their pregnancies are healthy the fact that they do not feel any ill symptoms and fear of HIV test results. Other reasons that have been reported include insufficient time for hospital visits, money for transport, long distances to the clinic and lack of knowledge on when to start ANC clinics (MOH, 2017).

2.5.2 Policy regulation, Guidelines and Health Promotion

In a study done in Ethiopia, IFAS importance information given during ANC was strongly connected to increasing Adherence. Educating pregnant women on IFAS accompanied by appropriate explanation on the correct dosage improved intake. Studies show improved awareness, effective sensitization, and health promotion on IFAS in pregnancy to have a great effect on increasing adherence (Gebreamlak *et al*., 2017). Results from a metanalysis of studies done in Africa showed variations in responses on

proper IFAS dosage and duration from health care workers both within and across countries. Inadequate tools and skills for counselling before IFAS issue were reported. In Senegal, 40% of health care givers were reported not to give advice and counselling to mothers (Siekmans *et al*., 2019).

2.6 Adherence to IFAS intake and Anemia occurrence

In a study carried out in 2019 in Nepal, the IFAS uptake rate was 58% among pregnant women and 42% of mothers were anaemic. Anaemia was 24 times more likely to occur among pregnant women who were non adherent. Anemia was 3 times less likely to occur in those who took an iron-rich diet (Krishna et al., 2019). Knowledge of anaemia status was found to be important in contributing to a pregnant women's IFAS intake (Kumar & Priya, 2018). In an evaluation of Community-based approach programme of IFAS distribution by CHVs in Kenya, most mothers reported that the programme was beneficial in helping them increase their IFAS consumption which contributed to an improvement in their hemoglobin levels (Kamau *et al*., 2020).

2.7 Summary of literature review

Adequate intake of iron and folic acid supplements has been scientifically proven to improve hemoglobin levels among pregnant women, hence a reduction in anemia disease (WHO, 2019). Anemia has caused effects on infants, young children and mothers and also has an overall effect on the economy by reducing productivity of women of reproductive age in societies (Getachew *et al*., 2018). Adherence to IFAS can only be achieved by faithful consumption of required doses and can be determined by tablet counting and consumption for 90 days or more. From reviewed studies, different factors have been identified to affect adherence to IFAS during pregnancy including individual factors (social, economic, demographic, cultural, pregnancy,

health and supplement-related factors) and health system factors. Specific factors that were concluded to show association with adherence were age of mother, education level, economic status, religion, timing of ANC visits, number of ANC visits, knowledge of anemia and knowledge on IFAS and side effects (Felipe- Dimog *et al*., 2021).

2.8 Gaps in literature review

Most studies have focused on social, cultural, economic, demographic, facility related aspects and not putting more attention to other individual factors that are related to the supplements and pregnancy like side effects, dosage, misconceptions, ignorance of mothers and other health system related factors like attitude of workers, policy and guidelines in association to IFAS adherence. The current study tried to address these questions. Most studies have not been able to identify any relationships between IFAS intake and improvement in blood hemoglobin levels. On the contrary, most studies and meta-analyses are those from different parts of the globe and other parts of Kenya, and no published information exists in the study area to determine factors associated with IFAS adherence among pregnant women. This study identified gaps in knowledge and factors affecting adherence among pregnant women. The study therefore identified current adherence rate to IFAS and anemia prevalence rate among women of child-bearing age in the county. The research has provided recommendations that might be employed to help improve IFAS intake hence contributing to reduction in anemia prevalence during pregnancy.

CHAPTER THREE: MATERIALS AND METHODS

3.1 Introduction

This chapter comprises the materials and methods that were used in data collection, entry, analysis and presentation. It also explains the study design, variables, location, sampling techniques, population, sample size determination, pretesting, research instruments, validity, reliability, data collection techniques, methods for data analysis and ethical aspects considered for the study.

3.2 Research Design

The study design chosen was a cross-sectional design. It was selected because it enabled data collection at a specific time (February-April 2022). Both qualitative and quantitative approaches were used in data collection to allow determination of factors influencing IFAS adherence mainly from participants' self-reporting. In addition, the study design provided room for data to be collected from a large sample. Data analysis was done based on the study objectives. The researcher was able to summarize findings for interpretation and establish relationships.

3.3 Study Variables

3.3.1 Independent Variables

Independent variables to explain the variation in IFAS intake were classified into individual factors including social, economic, demographic, cultural, knowledge, attitude, and beliefs on IFAS adherence, other individual factors; pregnancy, supplement and health related factors, health system factors; availability of supplements, distance to facility, ANC initiation and number of visits, attitude of healthcare workers, quality of healthcare service and cost of transport to facility.

3.3.2 Intermediate variable

Intermediate variables were availability of policies and guidelines on IFAS use, health promotion, and Nutrition Education for mothers on importance of IFAS, dosage, knowledge on anemia and consequences.

3.3.3 Dependent Variables

In this study, the dependent variable considered was IFAS adherence among women of reproductive age with children 0-23 months attending MCH clinics and those at the community. Adherence was calculated by asking mothers to recall the total number of days of IFAS intake for each week in a month. This was repeated for all months of ANC attendance for which IFAS was given. Total days of IFAS intake for the pregnancy was then summed up. Which was then multiplied by total number of months of ANC attendance and for which IFAS was issued. Intake of IFAS tablets for 90 days and above was considered adherence.

3.4 Location of the Study

The research was carried out in Kilifi South subcounty, Kilifi County in Kenya (Appendix i). The region borders Tana River County to the North, Kwale County to the South West, Mombasa County to the South, the Indian Ocean to the East, and the West of Taita Taveta. The area occupies approximately 12,370.8 km^2 square kilometers and the population of people is approximately 1,453,787. The seven sub-counties of the County are Kilifi North, Kilifi South, Rabai, Ganze, Kaloleni, Magarini, and Malindi (KNBS, 2019). From the latest research in 2023, the area received an average rainfall of about 23.3mm and highest amount was recorded in livestock zone at 66.9 mm and no rain at all in the mixed farming zone. The area is facing the alarm stage of the drought cycle. Moderate drought condition was recorded in the first month of the year. Based on the January early warning bulletin,most indicators in Nutrition were reading below normal

indicating a worsening situation of malnutrition. The Food Consumption score was recorded at a decreasing rate while the Coping Strategy Index remained stable compared to that of the previous month (NDMA, 2023). Food security in the county is termed as stressed (IPC 2) with increased cases of malnutrition. This situation puts pregnant women at risk of nutrient deficiency, including iron and folic acid, which are crucial during pregnancy. Proper nutrition in essential for enhancing positive impact for both the mother and child. Moreover, the county is situated in the coastal region which reports high anemia prevalence during pregnancy at 72.8%. The neighboring Kwale county reports pregnancy anemia prevalence at 62.7% (Nyamu, et al., 2020). A combination of factors including food insecurity status, high anemia prevalence and low IFAS adherence rates resulted in the need to conduct the research. The area has low literacy levels with majority of the population having primary education levels (56.7%) and 16.7% having secondary education. The area has a poverty head count of 46.4% with poverty severity at 4.8%. Food poverty headcount is estimated at 48.4% and food poverty severity estimated at 4.9%. The county has no level 6 or 5 health facilities, with only 4 level 4 public health facilities and 9 level 4 private health facilities. There are 19 level 3 public health facilities and 126 level 4 public health facilities. The country is facing a low health worker capacity of 10 per 10, 000 population indicating a big crisis in health service provision. The area is faced with poor access to rural areas with a rural access Index of 35%. Agriculture, forestry and fishing are the main economic activities with a 22.2% contribution to total GCP and 48% population engagement. Crop production and livestock farming are the major farming activities that are practiced (IPF, 2019).

3.5 Study Population.

The study population consisted of 324 women of reproductive age (15–49 years) who

had children aged 0–23 months. These women were recruited both from the community and from those attending mother and child health (MCH) clinics in two purposively selected public health facilities within the study area. Participants from the health facilities were identified through MCH clinic registers and selected using simple random sampling. In the community, women were identified using household lists prepared by Community Health Volunteers (CHVs), and cluster sampling was applied to select participants.

3.5.1 Inclusion criteria

Women of reproductive age between 15 and 49 years with children less than 24 months, who were attending MCH clinics at the selected facilities and those at the community were included in the study. They also must have been willing to give consent (Appendix ii) to voluntarily participate in the study. These mothers must have had their MCH booklets during the time of study for referencing. Six selected healthcare workers who had given consent to participate in the study were chosen for KII interviews.

3.5.2 Exclusion criteria

Women who were of reproductive age between 15 and 49 years with children less than 24 months attending MCH clinics and those at community who were not willing to participate or had a very sick child. Women who had a severe infectious disease like malaria, hookworm infection or advanced chronic condition that could directly cause anemia during the last pregnancy of their current child.

3.6 Sampling Techniques and sample size determination

3.6.1 Sampling Techniques

Kilifi County was purposively selected because as per findings from a previous knowledge, attitude beliefs and Practices (KABP) research, IFAS intake rate was low

and from other previous findings, the coastal region had the highest anemia prevalence. These two factors are considered public health concerns. Another factor considered was the cost of conducting the research. Cluster sampling technique was used to select 324 participants at the community. Community health volunteer (CHV) meeting points in different villages were used as cluster points. The CHVs helped in identification of mothers eligible for the study, who had a child below 24 months and their names were noted. The researcher and research assistants had a target of the number of mothers who were to be interviewed each day. Therefore, mothers were selected randomly from each cluster until the required number for that day was met. A total of 324 mothers were interviewed at community level. Purposive sampling was used to select one level 3 - Mtwapa Health Centre and one level 2 - Junju dispensary from which, five FGDs containing between (8 to 10 members each) were formed. Facilities were chosen considering the health service level and location whereby, one facility was located in an urban center and the other in the interior parts of the subcounty. Mtwapa Health Centre was assigned 3 FGDs while Junju Dispensary was assigned 2 FGDs. This is because, as per the facility registers, Mtwapa Health Centre registered more mothers for MCH services than Junju Dispensary. Focus Group Discussions (Appendix V) (were used to explore community perspectives on factors influencing IFAS adherence. They were incorporated to promote homogeneity and maximize free discussion. The FGDs were done in the two selected health facilities. Participants were selected from a population of women of age 15-49 years who were attending MCH clinics. The MCH register was used to select mothers whom names of their children were registered. Those eligible for the study and willing to participate were randomly selected. Six key informant interviewees were purposively selected from these health facilities. Use of various sampling techniques was employed to reduce information bias.

3.6.2 Sample Size Determination

To determine the sample size, Fisher *et al* formula (Fisher et al., 1991) was employed.

Where $n = \frac{z^2 p\, q}{d^2}$

n is the desired sample size determined from previous sample studies.

Z is the normal standard deviation of 1.96 corresponding to a 95% confidence level.

P is the expected proportion of the study sample. 0.74 was used since p is unknown.

Q is 1.0-p for the binomial distribution.

D is the degree of accuracy whereby 0.05 was used.

To determine the p value, the reference indicator used was vitamin A supplementation consumption rate among fully immunized children in Kilifi County, which according to the KDHS 2014, was 74%. The P value was therefore assumed to be 0.74. The estimate was chosen because it was determined in the same region and could yield a sample size that was economically manageable. Additionally, the value is an estimate of uptake of a similar public health supplementation intervention in the same region.

Assuming an 85% response rate, the sample size was calculated as:

$n = \frac{(1.96)^2 \times 0.74 \times 0.26}{(0.05)^2} = 295$

Sample size of 295 participants

To cater for non-respondents, 10% of the sample was added making the sample size to be 324.

3.7 Construction of Research instruments

3.7.1 Data collection instruments

A structured questionnaire was used for quantitative data collection. It was sub-divided into various sections based on study objectives, research questions and conceptual

framework. The first one included questions on social, cultural, demographic and economic factors. Questions here inquired about age, religion, marital status, occupation, household size, education level, employment status and cultural activities and beliefs associated with IFAS intake. The second section included questions related to health seeking behavior during pregnancy. The third section included questions on IFAS intake and its determinants. The fourth section included questions on knowledge on foods sources of iron and folic acid. The fifth section included questions on knowledge of anemia, causes and consequences. The last section included questions on health system related factors and associated with IFAS intake among mothers (Appendix III). Qualitative data was conducted using KII guide (Appendix IV) and FGD guide (Appendix V). The KII guide was used to capture opinions of health providers and policy makers. The FGDs guide was used to explore the beliefs, attitude, barriers and knowledge of IFAS adherence among WRA. Data collection tools were adopted from previous validated studies and modified to suit the local Kilifi context. The questionnaires were clear and unambiguous, and more explanations were given in scenarios where a participant could not understand the question contributing to reducing recall and information bias.

3.8 Pre-testing

Pre-testing of data collection tools was done at the community and at Vipingo Rural Health Centre. The hospital was chosen since it has similar characteristics in terms of service delivery to that of the other selected facilities and also located within the same setting as the sampled facilities. Thirty-two participants who make up 10% of the sample size were engaged for the pre-test for three days. Two key informant interviews and one focus group discussion were conducted. Pre-testing of the questionnaire revealed minor ambiguities and unclear wording in some questions. As a result, revisions were

made to improve clarity, flow, and comprehension. The language was simplified, redundant items were removed, and response options were adjusted to ensure consistency and ease of understanding among participants.

3.8.1 Validity of the study

Appraisal of the questionnaire was done by supervisors to ensure it was eligible for collection of data. Research assistants underwent training before the data collection period. Pretested questionnaires were used to crosscheck on content coverage of the study tool based on the study parameters and appropriate changes were done. This was to ensure it measured what it was intended to measure based on research objectives and questions. Use of simple random sampling to decrease selection and information bias boosted chances of internal validity while use of a larger sample size with participants from both rural and urban center improved external validity.

3.8.2 Reliability

Reliability was attained by making sure that the questionnaires were standard and showed similarity in yielding consistent results. This was met by test- retest. Research assistants were qualified diploma holders in Nutrition, and they were trained well on how to conduct the data collection process. Upon submission of questionnaires by the research assistants, the tools were checked to ensure all questions were well answered and if any was left un-attempted, research assistants were called upon to recollect data on the missing items. These contributed to reducing information bias.

3.9 Data Collection Techniques

Techniques for collecting data varied in accordance with the type of data collection tool used.

3.9.1 Quantitative data collection techniques

Quantitative data collection was done by the researcher and two research assistants. Researchers were introduced to the study participants by CHVs. Clearance letters from the county and sub-county health department were presented and a brief description of what the study was about was given by the researcher. A structured questionnaire which included both multiple-choice questions and yes/no questions was used. The researcher and research assistants administered the questions to 324 participants whereby, the questions were read to the participants and their responses were recorded accordingly. The interviewer read the questions and interpreted them to Kiswahili for easy understanding of the participants.

Each interview took 20 to 30 minutes. Before commencing the interviews, the purpose of the study was briefly explained. Participants were taken through the informed consent upon which those who agreed to participate signed the form. A packet of Ferrolic-LF (red in color) and tablets were presented to each participant and asked to recall about them as they were asked questions. Those who could not recall were encouraged to relate to any events during which they took the tablets whether at home or at ANCs. More time and more explanations were provided for questions which a participant was not able to answer. Unclear statements were probed with simple questions to help one understand and recall better. The diagnosis of anemia among study participants was based on documented hemoglobin (Hb) levels that were measured and recorded during their pregnancy. These Hb measurements were obtained from the participants' antenatal clinic (ANC) records or mother–child health (MCH) booklets, where hemoglobin testing is routinely conducted as part of standard ANC laboratory investigations. As per WHO cutoffs, the study classified participants as anemic or non-anemic based on their recorded Hb values. The cut off used was 11.0

g/dl, whereby those with hb above 11.0 g/dl were considered non-anemic while those with hb below 11.0 g/dl were considered anemic.

The booklets have a section that contains most information about the mother during antenatal clinic visits. The MCH booklet provided clear information on some of the questions including those related to age, parity, marital status, education, number of ANC visits, hemoglobin levels during pregnancy and pregnancy order. All mothers had their MCH booklets. The researcher and assistants used table 3.1 to guide mothers to relate, remember and count number of days of IFAS intake.

Table 3. 1: Guide to total number of days of IFAS intake count

Month of ANC visits	Week 1 Total days	Week 2 Total days	Week 3 Total days	Week 4 Total days	Total
1st					
2nd					
3rd					
4th					
5th					
6th					
7th					
8th					
9th					

3.9.2 Qualitative data collection

Participants were introduced to the researcher and research assistants by the nurses in charge of the selected facilities. Participants were taken through the consent form and those who agreed to participate signed it. Focus Group discussions were done by the researcher and research assistants, and they were done with guidance of the FGD guide (Appendix V). Interviews were conducted at the point of exit after the women had accessed outpatient services in mother and child health clinics. Key Informant Interviews (KIIs) were carried out by the researcher with guidance of the key informant interview guide to collect qualitative data (Appendix IV). Research assistants were well-trained in the data collection exercise. They were educated on the objectives of the

study, how to select study participants and the sampling techniques to be used, to ensure participants give consent before interviews begin. They were also trained on how to ask questions correctly without deviation or leading participants to the answers, and how to fill the questionnaires correctly. Both FGDs and KIIs guides included probe questions, follow-up form of questions, and exit questions. All participants were given enough time to give their answers and at the same time ensuring that their time was not wasted. Each FGD had a total of 8 to 10 participants. Time taken was between 60 minutes to 90 minutes. Informed consent was obtained from each member who participated in the FGDs and KIIs before the commencement of the interviews.

3.10 Data Analysis

3.10.1 Quantitative data analysis

Quantitative data was summarized and converted to numerical form in excel then exported to the Statistical Package for Social Sciences (SPSS) version 25 for final analysis. Descriptive analysis was used to determine percentages, average, frequencies and confidence intervals of various factors. Additionally, tables, graphs, charts and cross-tabulations were used to present data from descriptive analysis. Chi-square ($\chi 2$) test and regression analysis were used to determine statistical significance of association between the independent and the dependent variables at a 95% confidence interval (CI). The strength of association was determined using Odd Ratio (OR). To measure objective 1 and 2, proportion and 95% confidence interval were used. To measure objective 3 and 4, chi-square test and logistic regression were used.

3.10.2 Qualitative data analysis

Thematic analysis was used to analyze qualitative data. It included classifying and coding data. Written responses from KIIs and FGDs were carefully classified and categorized into themes. The themes were then used to complement analyzed

quantitative results.

3.11 Logistical and Ethical Considerations

Approval to do the research sought and given from the Graduate School of Kenyatta University (Appendix X). Clearance to engage in study was acquired from the Ethical Review Committee of Kenyatta University (Appendix IX). Permit to conduct research was granted by the National Commission for Science, Technology, and Innovation (NACOSTI) (Appendix VIII). Permission was also granted by the Kilifi County department of Research (Appendix VI) and Kilifi South subcounty Office of the Medical Officer (Appendix VII). All participants received a well-written and detailed consent (Appendix II). Engaging in the exercise was voluntary and at any time the participant was uncomfortable doing the interview, they could withdraw or decline willingly as they had a right. The study observed privacy and confidentiality. Only one participant was underage at 15 years and was accompanied by the mother. The consent was sort from the mother before being involved in the study.

CHAPTER FOUR: RESULTS

4.1 Introduction

This chapter focused on study findings and analysis. They were presented in charts, figures, texts, percentages and tables. It comprises results for individual factors including, social, demographic and economic factors, health system factors and anemia prevalence rates and their association with IFAS adherence.

4.2 Individual factors of study participants

4.2.1 Socio-Demographic characteristics of research participants

Table 4.1 shows results of the socio-demographic attributes of those who participated in the study. A large proportion of participants (80.2%) were of age 15-30. The youngest participant was 15 years and the oldest was 45 years old. The mean, median and mode age were 25, 25 and 22 years respectively. Participants who were married were 276 (85.2%) while 33 (10.2%) were single or never married. Majority of the participants, 52.5%, had attended primary school, 34% had secondary school education, 5.2% had attained education at university/college level while 5.2% did not attended school. Majority of the participants, a proportion of 86.4%, had a household size of between 3 and 6 people. The most dominant religion was Christianity with 71% of the participants while Muslims were 27.5%.

Table 4. 1: Sociodemographic characteristics of research participants

Variable	Category	Frequency	Percentage
Age	15-20 years	67	20.7%
	21-25 years	95	29.3%
	26-30 years	98	30.2%
	31-35 years	38	11.7%
	36-40 years	23	7.2%
	41-45 years	3	0.9%
Marital status	Single	33	10.2%
	Divorced	2	0.6%
	Separated	11	3.4%
	Widowed	2	0.6%
	Married	276	85.2%
Education Level	Did not attend	17	5.2%
	Primary	170	52.2%
	Secondary	110	34%
	University/college	17	5.2%
	Other	9	2.8%
	Did not answer	1	0.3%
Household size	3	95	29.3%
	4	80	24.7%
	5	58	17.9%
	6	47	14.5%
	7	20	6.2%
	8	13	4%
	9	6	1.9%
	10	3	0.9%
	11	2	0.6%
Religion	Christian	230	71%
	Muslim	89	27.5%
	Traditional religion	2	0.6%
	None	1	0.3%
	Did not answer	2	0.6%
Misconceptions affecting adherence	Yes	89	27.6%
	No	234	72.4%

4.2.2 Socioeconomic attributes of research participants

Results in table 4.2 show that a large proportion (63.6%) of the participants were unemployed followed by 16.4% who had their own small businesses. Participants who received monthly income of 1000 shillings and above were 34% while 52.5% did not receive any income. In most households, 267(82.4%) husbands were the bread winners while only 21(6.5%) mothers provided for their families.

Table 4. 2: Socioeconomic attributes of research participants

Variable	Category	Frequency	Percentage
Occupation	Unemployed	206	63.6%
	Farmer	9	2.8%
	Business owner	53	16.4%
	Government employee	11	3.4%
	Private company	40	12.3%
	Part time Jobs	5	1.5%
Monthly income	100-300	2	0.6%
	300-500	9	2.8%
	500-1000	9	2.8%
	Above 1000	110	34%
	None	170	52.4%
	Did not answer	24	7.4%
Household head	Female-headed	21	6.5%
	Husband	267	82.4%
	Father-in-law	12	3.7%
	Mother-in-law	2	0.6%
	Other	21	6.5%
	Did not Answer	1	0.3%

4.2.3 Antenatal care clinics attendance related factors of study participants

Table 4.3 shows results on ANC attendance whereby 97% of the participants attended ANC at least once during pregnancy of their child below 23 months while 2.8% did not attend ANC. Majority of participants 185 (57.1%) attended first ANC visit in their second trimester, 78 (24.1%) in first trimester and 60 of them in the third trimester accounting to 18.5 %. The median, mean and mode first ANC attendance gestation age was 5, 6 and 4 months respectively. The proportion of participants who attended antenatal clinics for 4 months and above was 50.3% while those who attended only once was 12.2%. Participants who attended ANC for check-up to ensure their health and that of their unborn child was okay accounted to 66%.

Table 4. 3: Antenatal clinic attendance related factors of study participants

Variable	Category	Frequency	Percentage
Attended ANC during pregnancy	Yes	315	97.2%
	No	9	2.8%
Number of antenatal clinic visits	Once	39	12.2%
	Twice	51	15.7%
	Three times	66	20.4%
	Four times or more	163	50.3%
	Did not answer	5	1.5%
Gestation age at first ANC visit	First trimester	78	24.1%
	Second trimester	185	57.1%
	Third trimester	60	18.5%
	Did not answer	1	0.3%
Attended ANC to monitor progress of pregnancy and get advice	Yes	214	66%
	No	109	33.6%
	Did not answer	1	0.3%

4.2.4 Supplement related factors of study participants

Results in figure 4.1 show that 67.6% of the participants consumed IFAS for less than 90 days while 101 (31.2%) took IFAS for 90 days and above. Mothers who had access to IFAS for at least once throughout their pregnancy were 92%. Mothers who reported experiencing challenges in acquiring IFAS were 71.9% while 53.4% agreed to have experienced side effects after consuming the supplements. Participants who took the supplements without forgetting were 67.3% while 32.4% forgot to take the tablets at times.

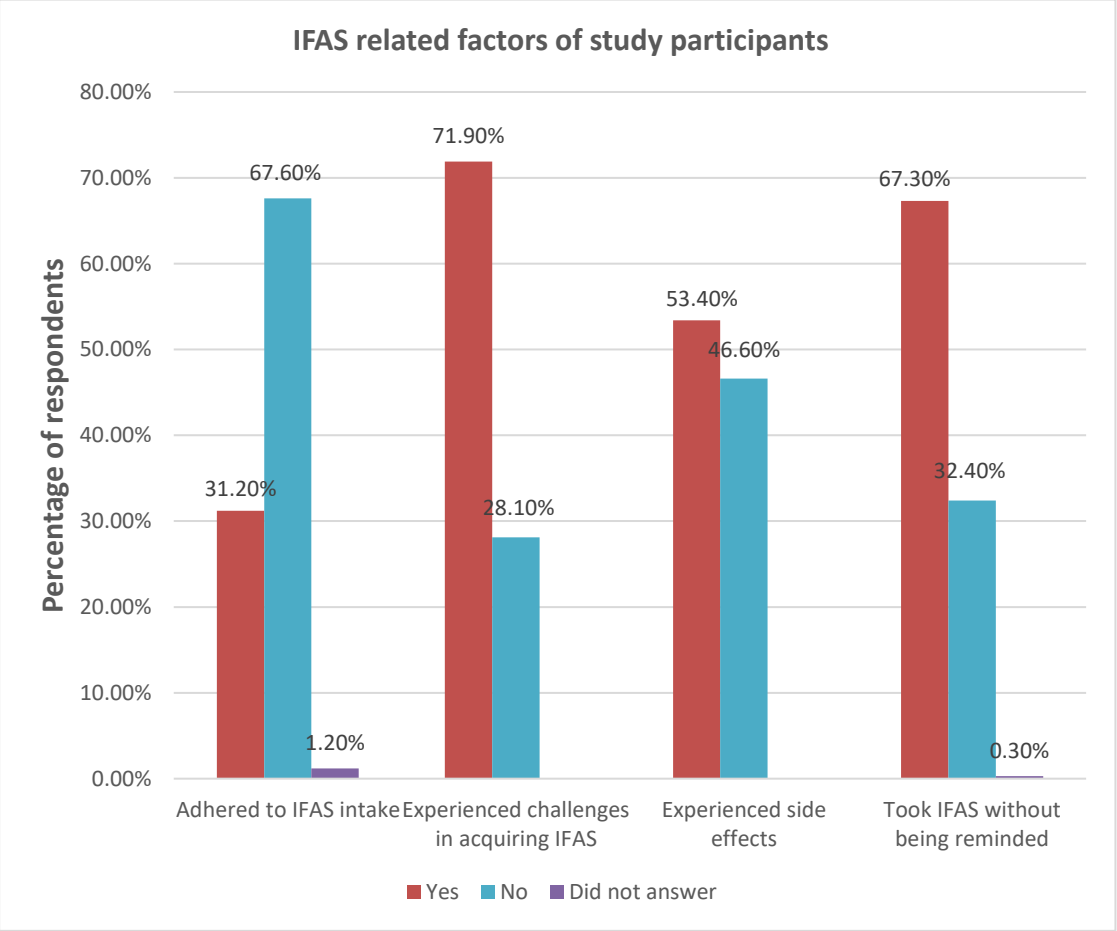

Figure 4. 1: IFAS related factors of study participants

4.2.5 Knowledge of IFAS of study participants

Figure 4.2 shows results on knowledge of participants on IFAS. It was noted that 27.5% of the mothers had been educated and counselled about side effects of IFAS while 72.2% did not recall being educated on side effects. Qualitative results indicated that most of the information was from healthcare workers during ANC health sensitizations. Participants who had been educated on the reasons and benefits of taking the supplements were 84.3% while 15.7% of them reported not to have been educated on reasons for taking IFAS. Most mothers, accounting to 95.1% were educated on the right dose of IFAS to take.

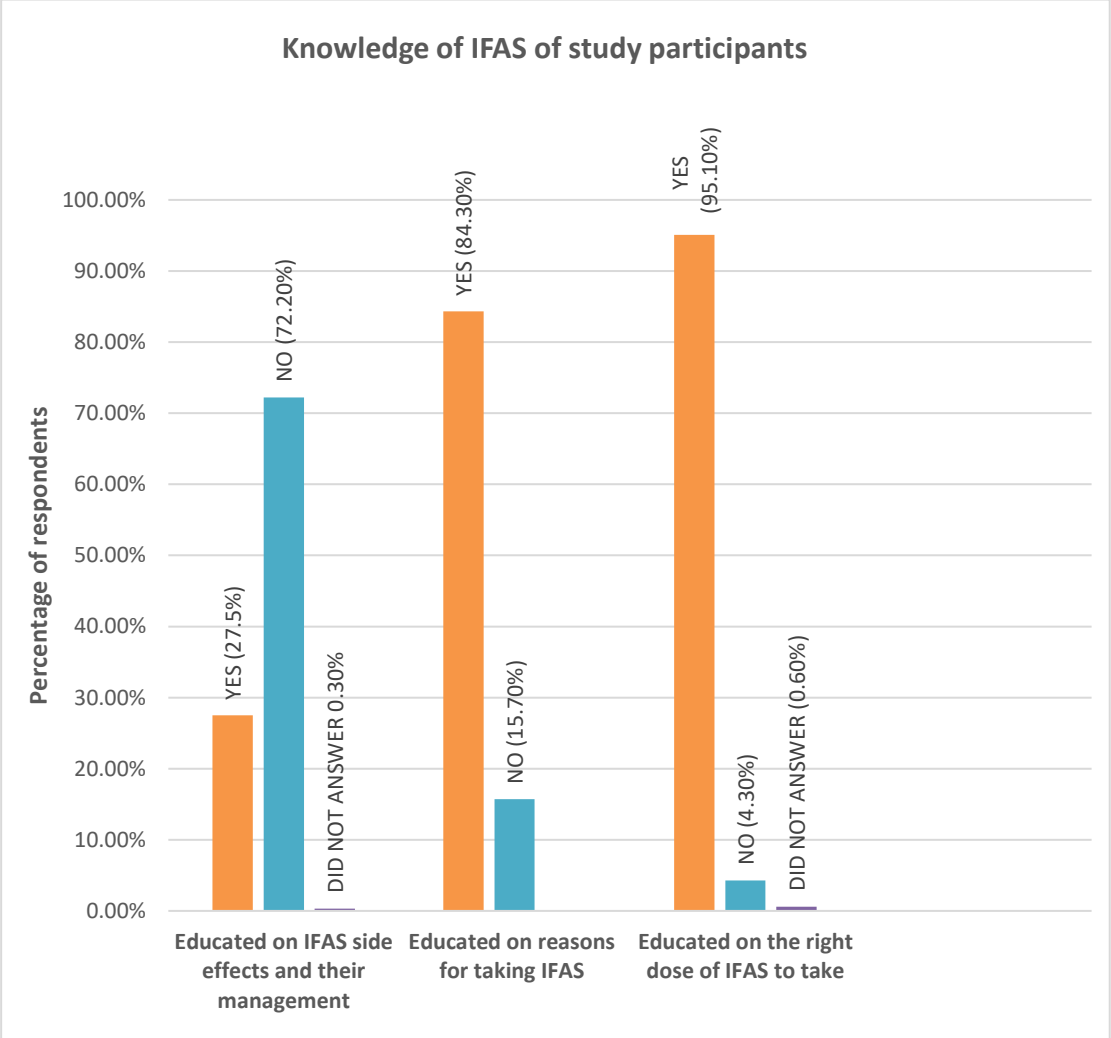

Figure 4. 2: Knowledge of IFAS of study participants

4.2.6 Knowledge of anaemia of study participants

Results in table 4.4 show that 64.2% of participants reported knowing what anemia is while 35.8% did not know about the disease. Those who reported to be educated about the causes of anemia were 50.6% while 49.4% did not know. Participants who knew the effects of having the disease while pregnant were 48.8% and 60.8% thought there was a relationship between adequate IFAS intake and being at low risk of getting anemia. The research found 69.4% of the mothers to be anemic while 29.9% were not.

Table 4. 4: Knowledge of anaemia of study participants

Variable	Category	Frequency	Percentage
Educated and knows what anemia disease is	Yes	208	64.2%
	No	116	35.8%
Diagnosed with anaemia during pregnancy of last child below 23 months as per medical records	Yes	225	69.4%
	No	97	29.9%
	Did not answer	2	0.6%
knows causes of anaemia	Yes	164	50.6%
	No	160	49.4%
	Total	324	100%
Educated on effects of having anemia while pregnant	Yes	158	48.8%
	No	165	50.9%
	Did not answer	1	0.3%
Thinks there is a relationship between IFAS adherence and anaemia occurrence	Yes	197	60.8%
	No	89	27.5%
	Do not know	37	11.4%
	Did not answer	1	0.3%

4.3 Health system related factors of study participants

Figure 4.3 shows results for some of the inquiries on health system related factors that affect IFAS adherence. More than half of the mothers, a proportion of 59.9% stated that the facilities were far while 40.5% stated that facilities were accessible. Most participants, a proportion of 81.06% accepted to have experienced long queues at the facility while 18.94% did not. Participants who experience good treatment from health care workers were 86.34% while 4.04% reported to have been treated badly during ANC visits by healthcare providers. Participants who reported to have experienced stockouts were 29.9%. Most mothers, (93.8%) got IFAS from public hospitals where they attended ANC, 4.9% from private hospitals and 0.3% from private pharmacies. Results from KIIs indicated that most facilities put effort to follow IFAS guidelines and clinical manuals when issuing IFAS.

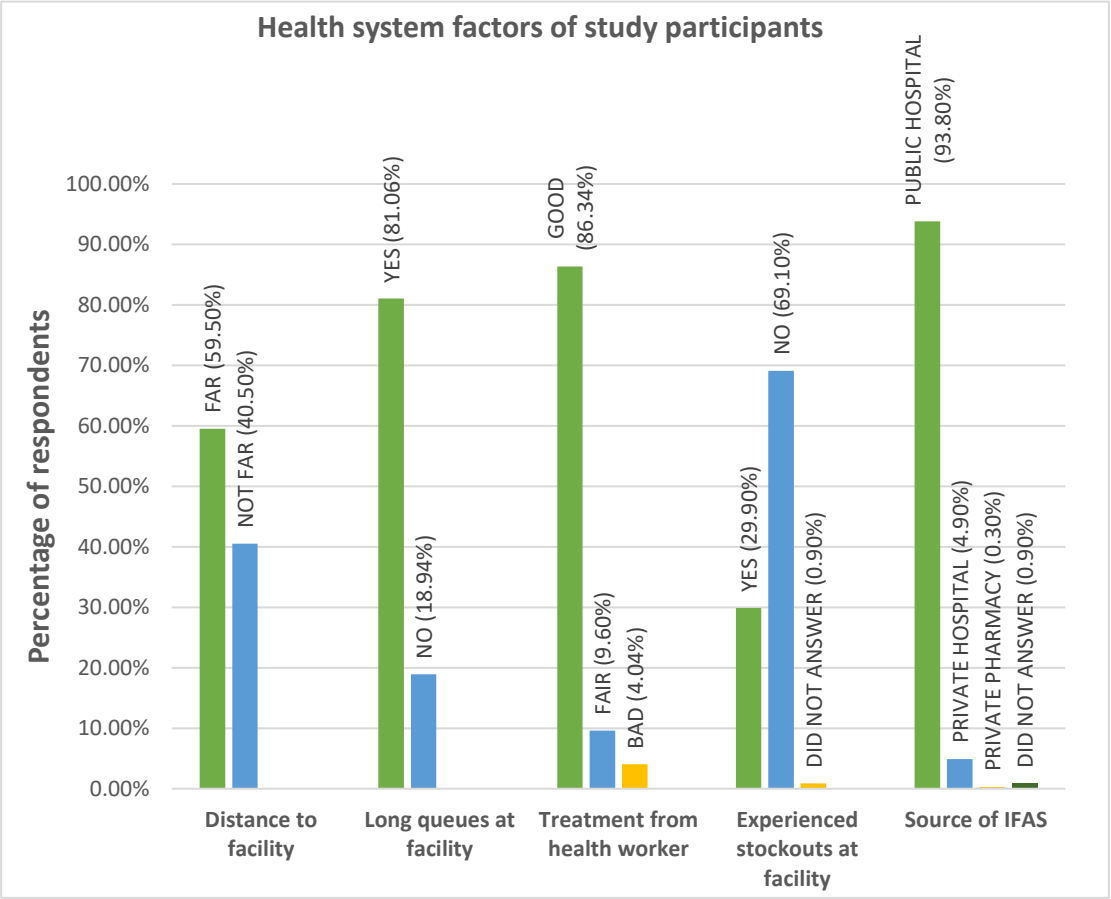

Figure 4. 3: Health system related factors of study participants

4.4 Association between individual factors and IFAS adherence

4.4.1 Relationship between sociodemographic and socioeconomic factors and IFAS adherence

Table 4.5 shows results of the association between individual factors and IFAS adherence. Majority of the mothers who adhered were of age between 21-30 years. A large percentage of mothers who attained university or college education, 70.6% adhered to taking IFAS while 29.4% of them were not adherent. The proportion of Christians 75(32.9%) who adhered was more than that of Muslims which was 24 (27.6%). A proportion of mothers of 34.3% who earned monthly income more than 1000 Kenyan shillings were adherent compared to 11.1% and 29.2 who earned less than 1000 Kenyan shillings and no income respectively. A large percentage of 70.6% was seen among unemployed mothers who were non adherent compared to 29.4% who adhered. The highest proportion of adherent mothers was observed among those who had their own businesses at 42.3%. Higher adherence was also seen among mothers whose household head income was above 1000 Kenyan shillings. A large percentage of participants who had misconceptions on IFAS (76.1%) were non-adherent. Using Chi-square test of association, education level showed significance of association ($p=0.002$) while age ($p=0.341$), marital status ($p=0.453$), religion ($p=0.659$), monthly income ($p=0.296$), occupation ($p=0.394$) and misconceptions ($p=0.065$, OR=1.69) did not show significance of association.

Table 4. 5: Chi-square test analysis of association between individual factors and IFAS adherence

Variable	Category	Non-Adherence 30-89 days	Adherence 90-240 days	Chi-square
Age	15-20 years	50(76.9%)	15(23.1%)	X^2= 5.659
	21-25 years	61(64.9%)	33(35.1%)	P=0.341
	26-30 years	68(70.1%)	29(29.9%)	df=5
	31-35 years	26(68.4%)	12(31.6%)	
	36-40 years	12(52.2)	11(47.8%)	
	41-45 years	2 (66.7%)	1(33.3%)	
Marital status	Single	19(61.3%)	12(38.7%)	X^2=3.665
	Divorced	2(100%)	0(0.0%)	df=4
	Separated	6(54.5%)	5(45.5%)	P=0.453
	Widowed	2(100%)	0(0.0%)	
	Married	190(69.3%)	84(30.7%)	
Education level	Did not attend school	9 (52.95)	8(47.1%)	
	Primary level	125(74.4%)	43(25.6%)	P= 0.002
	Secondary	73(67%)	36(33%)	X^2=16.884
	University/college	5(29.4%)	12(70.6%)	df=4
	Technical training	6(75%)	2(25%)	
Religion	Christian	153(67.1%)	75(32.9%)	X^2=1.601
	Muslim	63(72.4%)	24(27.6%	df=3
	Traditional religion	1(50%)	1(50%)	P= 0.659
	None	1(100%)	0(0%)	
Monthly income	100-300	2(100%)	0(0%)	X^2=4.919
	300-500	8(88.9%)	1(11.1%)	df=4
	500-1000	8(88.9%)	1(11.1%)	P= 0.296
	Above 1000	71(65.7%)	37(34.3%)	
	None	119(70.8%)	49(29.2%)	
Occupation	Unemployed	144(70.6%)	60(29.4%)	X^2=5.184
	Farmer	7(87.5%)	1(12.5%)	df=5
	Business owner	30(57.7%)	22(42.3%)	P=0.394
	Private sector employee	26(65%)	14(35%)	
	Government employee	8(72.7%)	3(27.3%)	
	Other-part time	4(80%)	1(20%)	
Head of household income	50-100	1(100%)	0(0%)	X^2=5.214
	100-300	3(75%)	1(25%)	df=5
	300-500	0(0%)	2(100%)	P= 0.390
	500-1000	12(75%)	4(25%)	
	Above 1000	183(68.5%)	84(31.5%)	
	None	20(69%)	9(31%)	

4.4.2 Binary logistic regression analysis of association between individual factors and IFAS adherence

Using binary logistic regression analysis, individual factors which showed significance of association with IFAS adherence were age (p= 0.039, OR= 1.265) and monthly income (p=0.044, OR=1.622). Education level (p=0.148, OR=1.279), marital status (p=0.666), occupation (p=0.283) and monthly income of household head (p=0.305) did not show any significance of association. Table 4.6 shows the results.

Table 4. 6: Binary logistic regression analysis of association between individual factors and IFAS adherence

Variables	Standard error	df	P value	Odds Ratio
Age	0.114	1	0.039	1.265
Education level	0.246	1	0.148	1.279
Monthly income	0.484	1	0.044	1.622
Marital status	-0.46	1	0.666	0.955
Occupation	0.109	1	0.283	1.115
Monthly income of household head	-0.241	1	0.305	0.786

4.4.3 Association between antenatal clinic attendance and IFAS adherence

Association was determined between ANC attendance and IFAS adherence. Table 4.7 shows the results. Highest adherence of 54.9% (89) was observed among mothers who attended ANC 4 times or more. The proportion of mothers who attended ANC to check on pregnancy progress was higher at 34% compared to those who attended ANC for other reasons at 27.1%. Majority of mothers, 119 (69.6%) who experienced side effects were non-adherent compared to 52 (30.4%) who adhered. Using chi-square test analysis, number of ANC visits showed significance of association with IFAS adherence (P=0.000), while experiencing side effects (P=0.634), taking IFAS without being reminded (P=0.172) and attending ANC to check the health of the baby (p=0.214) did not show any significance of association.

Table 4.7: Association between ANC attendance and IFAS adherence

Variable	Non-adherence 30-89 days	Adherence 89-240 days	OR (95% CI)	Chi-square
Number of ANC visits during last pregnancy			3.610 (2.429, 5.364)	X^2=84.785 df=4 P=0.000
Once	34 (87.2%)	5 (12.8%)		
Twice	47 (94%)	3 (6%)		
Three times	63 (95.4%)	3 (4.6%)		
Four times or more	73 (45.1%)	89 (54.9%)		
Attended ANC to be advised on and check on health of the baby			0.723 (0.433, 1.207)	X^2=1.546 df=1 P=0.214
Yes	140 (66%)	72(34%)		
No	78 (72.9%)	29(27.1%)		
Experienced side effects				$X^{2=}$0.226 df=1 P=0.634
Yes	119 (69.6%)	52 (30.4%)	1.121 (0.699, 1.798)	
No	100 (67.1%)	49 (32.9%)		
Took IFAS without being reminded			0.696 (0.413, 1.172)	X^2=1.867 df=1 P=0.172
Yes	143 (65.6%)	74 (34.1%)		
No	75 (73.5%)	27 (26.5%)		

4.4.4 Association between knowledge on IFAS and IFAS adherence

Results in table 4.8 show the association between knowledge on IFAS and its adherence. Among mothers who had knowledge on side effects of IFAS and how to manage them, those that adhered were 29 (32.6%) while 60 (67.4%) were non-adherent. Among those who had knowledge of the benefits of IFAS, 91 (35%) adhered while 169 (65%) did not. Among those educated on the right dose of IFAS to take, 31.9% were adherent while 68.1% were non-adherent. Using chi-square test of analysis, knowledge of IFAS and the benefits (p=0.023) showed significance of association with adherence while having knowledge of side effects and how to manage them (p=0.807) and knowledge of right IFAS doze (p=0.409) did not show significance of association with IFAS adherence.

Table 4.8: Association between knowledge of IFAS and IFAS adherence

Variable	Nonadherence 30-89 days	Adherence 90-240 days	OR (95% CI)	Chi-square
knowledge of side effects of IFAS and how to manage them				X^2=0.06
Yes	60(67.4%)	29(32.6%)	0.937(0.55,	df=1
No	159(68.8%)	72 (31.2%)	1.581)	P=0.807
Knowledge of IFAS and its benefits				X^2=7.586
Yes	169 (65%)	91(35%)	0.423	df= 2
No	45 (83.3)	9 (16.7%)	(0.219,	P=0.023
Do not remember	5 (83.3%)	1(16.7%)	0.819)	
Educated on the right dose of IFAS				X^2=0.682
				df= 1
Yes	207 (68.1%)	97 (31.9%)	0.582(0.159,	P=0.409
No	11 (78.6%)	3 (21.4%)	2.13)	

4.4.5 Knowledge of anemia and IFAS adherence crosstabulation

Table 4.9 shows results of crosstabulation between aspects on anemia knowledge and IFAS adherence. Using chi-square test of analysis, knowledge of anemia (p=0.005), knowledge of causes of anemia (p= 0.000), knowledge of effects of anemia (p= 0.000) and having anemia in pregnancy (p= 0.000) showed significance of association with IFAS adherence. Knowledge of linkage between IFAS adherence and anemia occurrence did not show any significance of association.

Table 4. 9: Association between knowledge of anaemia and IFAS adherence

Variable	Non-adherence 30-89 days	Adherence 90-240 days	OR (95% CI)	Chi-square
Knowledge of anemia disease				X^2=8.02
Yes	129 (62.9%)	76(37.1%)	0.471(0.279, 0.798)	df=1
No	90 (78.3%)	25 (24.8%)		P=0.005
Knowledge of causes of anaemia				$X^{2=}$14.575
Yes	95 (58.6%)	67 (41.4%)	0.389(0.238, 0.636)	df=1
No	124 (78.5%)	34 (21.5%)		P=0.000
Knowledge of effects of having anaemia while pregnant				X^2=17.332
Yes	90 (57.3%)	67 (42.7%)	0.357(0.218, 0.584)	df=1
No	128 (79%)	34 (21%)		P=0.000
Diagnosed with anaemia during pregnancy				X^2=22.877
Yes	171 (76.7%)	52 (23.3%)	3.358 (2.02, 5.582)	df=1
No	47 (49.5%)	48 (50.5%)		P=0.000
Knowledge of linkage between adherence and anaemia occurrence				
Yes	126 (65.3%)	67 (34.7%)	0.789 (1.123, 0.554)	X^2=2.106
No	65 (73%)	24 (27%)		df=2
Do not know	27 (73%)	10 (27%)		P=0.349

4.5 Association between health system factors and IFAS adherence

Table 4.10 shows results of association between health system factors and IFAS adherence. Among mothers who reported that health facility was far from home, 31.4% were adherent. For those who experienced good treatment from health care workers, 33.2% adhered. A large proportion had access to IFAS and 33.2% adhered while 66.8% did not. Using chi-square test of association, factors that showed significance of association with IFAS adherence were access to IFAS during pregnancy (p= 0.030) and challenges encountered during ANC visits (p=0.019). Those that did not show significance of association were, distance to the facility (p=0.940), experiencing long queues at facilities (p=0.503) and type of treatment from health care giver (p=0.382).

Table 4. 10: Association between health system factors and IFAS adherence

Variable	Non-adherence	Adherence	OR (95% CI)	Chi-square
Distance to the facility			1.019 (0.629, 1.649)	X^2=0.006 df=1 p=0.940
Was far	129 (68.6%)	59 (31.4%)		
Was not far	88 (68.2%)	41 (31.8%)		
Long queues during ANC visits			0.810 (0.437, 1.502)	X^2= 0.448 df=1 p=0.503
Yes	174 (67.7%)	83 (32.3%)		
No	44 (72.1%)	17 (27.9%)		
Treatment from healthcare worker			1.205 (2.307, 0.629)	X^2=1.924 df=2 p=0.382
Good	183 (66.8%)	91 (33.2%)		
Fair	24 (77.4%)	7 (22.6%)		
Bad	10 (76.9%)	3 (23.1%)		
Access to IFAS tablets during ANC visits			0.201(0.46, 0.877)	X^2= 5.523 df=1 p=0.019
Yes	199(66.8%)	99(33.2%)		
No	20 (90.9%)	2 (9.1%)		
Encountered challenges when acquiring IFAS			0.537(0.305, 0.946)	X^2=4.717 df=1 P=0.030
Yes	150 (64.9%)	81 (35.1%)		
No	69 (77.5%)	20 (22.5%)		

CHAPTER FIVE: DISCUSSION, CONCLUSIONS AND RECOMMENDATIONS

5.1 Introduction

This chapter comprises of discussions of results relative to specific objectives and literature review. It discusses similarity and differences of results of the study in relation to other studies globally and countrywide. It also gives conclusions in relation to specific objectives, findings and recommendations addressed to WHO.

5.1.1 Anemia prevalence in pregnancy

The study found 69.4% of participants to be anemic during pregnancy. This is high because according to the WHO, anemia prevalence above 40% is a public health problem. Findings were lower than those of studies done in the coastal region by Odhiambo & Sartorius (2019) where prevalence was estimated at 72.8%. Another study done in Kwale county by Nyamu *et al., (*2020) found anemia prevalence to be 62.8%. Findings were higher compared with evidence from a meta-analysis of studies from Australia where prevalence was 20%, Pakistan where prevalence was reported at 41.7% and India at 49.9% (Kinyoki et al., 2021). Findings were close to those of evidence from a meta-analysis of studies conducted in Singapore with prevalence at 67.8% and China at 70% (Fite, Assefa and Mengiste, 2021). Lack of similarity of results could be because of different geographical locations, differences in economic status and differences in health systems services.

Being anemic was significantly associated with IFAS adherence. Participants who were anemic had a probability of being adherent 3.4 times more compared to those who were not anemic. Qualitative results showed that most mothers who sufficiently consumed IFAS had their hemoglobin levels improved by the time they were giving birth. This

was probably because of fear of having unhealthy pregnancies and due to the effort put in by health care providers to advise anemic mothers and equip them with knowledge of a healthy diet and IFAS. These findings were similar to those of studies conducted in India by Haile & Jeba (2017) whereby anemic pregnant women had a 2.3 times chance of being adherent and in Ethiopia where anemic mothers proved to be more adherent than those who were not anemic (Yismaw *et al*, 2022).

5.1.2 Iron folic acid supplementation adherence rate during pregnancy

Adherence to IFAS intake was found to be 31.2%. This is below the required rate by WHO which should be 65% and above. However, compared with findings of a KABP study carried out by Ochola (2017) in the same county where adherence rate was 22.2%, there was an increase in IFAS intake during pregnancy. This may be linked to the increased efforts of national government in conjunction with Kilifi County government and other supportive bodies like International Centre for Reproductive Health (ICRH), Jacaranda Health and other partners to ensure improvement in offering health services during antenatal clinics.

Findings were close to those from studies carried out in Kiambu Kenya by Kamau *et al*., (2020) where adherence rate was 32.7%. Another study done in Ethiopia by Yismaw *et al* (2022) reported adherence rate to be 34.9%. Findings were higher compared with those of a study done in Uganda by the International Initiative for Impact evaluation between 2018 and 2021 which reported adherence rate to be 12%. Another study done in Tanzania by Ssentongo *et al*., (2019) reported adherence rate to be 17.2%. Findings were lower compared with those of a study done in Kakamega county by Bahati (2022) where adherence rate was 60.6%. They were also lower compared to those of a study done in Senegal by Niang *et al*., (2017) where adherence was 51%.

Another study in Nepal by Paudyal et al, (2021) reported adherence rate to be 73.2%. Some of the reasons for inconsistency in adherence rates might be different study techniques, different study methods, difference in health care systems and different health education techniques resulting in different health outcomes.

5.1.3 Individual factors associated with IFAS adherence

Analysis with binary logistic regression showed significance of association with age and IFAS adherence. Qualitative results indicated that young mothers seemed to be more adherent than older mothers. More young mothers were cautious about their pregnancy and attended antenatal clinics to check on progress of their pregnancies and get health education. A mother of age above 35 years reported "*I think since this is my fourth child, there was no need for attending ANC every month unless I was sick. I have learnt from my previous pregnancies on what to do when I get certain symptoms."* These study findings were similar to those of a study carried out in Australia on accessing and engaging with antenatal care, where more antenatal clinic visits and adherence was seen among young mothers aged 15 to 30 years (Shee *et al*., 2021).

There was no statistical significance of association between marital status and IFAS adherence. However, from qualitative results participants who were married were more likely to adhere due to financial support and encouragement from their partners. Mothers who were supported financially by their partners were able to access hospitals for their antenatal clinics. These results were in line with those of a research carried out in India by Nguyen *et al*., (2017) whereby mothers seemed to increase intake when their partner was supporting and encouraging them.

Education level was significantly associated with IFAS adherence. Mothers who had secondary level education and above were well informed on most aspects of IFAS and

anemia compared to those who went to primary school or did not attend school. These findings were similar to findings of a research carried out in Ethiopia whereby having secondary level education and above was highly associated with increased IFAS intake (Sendeku *et al*, 2020).

There was no significance of association between religion and IFAS adherence. Most participants did mention that their capability to take medication or supplements was rather influenced by their own belief but not religion. However, some of the Christian participants mentioned that they were given health talks in church which were of benefit. These findings might have same conclusion as those of a study carried out in India whereby consuming 90 IFAS tablets or more was less likely to occur in Muslim women than in non-Muslim women (Mohamed et al., 2022).

Analysis using binary logistic regression showed monthly income to be significantly associated with IFAS adherence. Qualitative results also indicated that mothers who earned more income were more likely to attend ANC since they could afford transport cost to the facility. A mother reported '*I missed attending some of my clinics because I lacked transport. The facility is very far and I could not afford bike money. I could not manage to walk, so I just waited for the next clinic*.' These results were close to those of a study carried out in West Africa whereby, mothers who were of high economic status were more likely to be adherent than those who were not (Agegnehu *et al*., 2019).

Experiencing side effects did not show any significance association with adherence. However, some participants mentioned that at times they had to stop taking IFAS because of the side effects. Some of the side effects mentioned were nausea, vomiting, stomach pains, bad taste in mouth and change in stool color. Majority of the mothers who experienced side effects were not adherent. This could be because they did not

know how to manage them. On the other hand, mothers who did not experience side effects were more likely to adhere. This discovery was consistent to that of a study carried out in 2020 in India where adherence rate was higher among women who did not experience side effects (Lavanya *et al.*, 2020).

Influence of previous pregnancy experience had an effect on IFAS adherence. Mothers with previous healthy pregnancies or successful home deliveries were less likely to attend ANC, reducing chances for IFAS intake, while first-time mothers were more likely to attend ANC, increasing IFAS adherence. These study findings were similar to those of a study carried out in Australia where more ANC visits and adherence was seen more among young mothers aged 15 to 30 years (Shee *et al*., 2021).

There were no clearly mentioned cultural aspects that were believed to affect adherence but rather, beliefs and misconceptions on IFAS and were mostly related to side effects. Some of the misconceptions reported were IFAS is not good for the baby, does not work nor help and that it makes the baby have dark skin. This is probably because those who had used them insufficiently had experienced very little changes in their hemoglobin levels and did not experience any greater improvement or developed negative attitude especially due to side effects. Another reason could be, due to the change in stool color, some mothers believed the baby's skin could be dark too.

The number of antenatal clinic attendance was significantly associated with IFAS adherence. Most mothers who had 4 or more ANC visits were adherent. Qualitative results proved that mothers who seek early ANC registration were more likely to attend four ANC visits and above and are more likely to meet the recommended 90 day and above dose of IFAS intake. These findings were similar to those of a research carried out in Eritrea in 2018 whereby mothers who attended ANC three times or more were

four times more likely to adhere to IFAS since they got more professional advice and they were issued with IFAS tablets in each visit (Getachew *et al*., 2018). In Ethiopia, a study carried out by Birhanu *et al*., (2018) reported that more ANC visits enabled a mother to get more education on IFAS hence positively affecting IFAS intake.

The research determined first ANC attendance of most mothers to be in the second trimester at 5 months. Some of the reasons for late ANC registration mentioned were, ignorance, laziness, poverty leading to unaffordability of transport costs to facilities, fear of being informed on HIV status for mothers who had multiple partners and lack of time for ANCs especially for employed mothers.

Having knowledge of IFAS had a significance association with IFAS adherence. Among the participants who had been educated on IFAS, 35% were adherent and those who had been educated on the importance of IFAS were almost two times more likely to be adherent. Mothers who had knowledge of IFAS, its importance and dosage were likely to adhere to IFAS intake than those who did not. One theme that stood out was the knowledge influence on IFAS adherence. Mothers who comprehended the benefits of IFAS like anemia prevention, put effort to consume the supplements. Those with limited knowledge did not consume the supplements as required. Another theme identified was misinformation on IFAS. Some mothers had misinformation that IFAS does not work and that it might harm the baby. This might have discouraged them from consuming the supplements. These results were close to those of research done in Ethiopia by Haile & Jeba (2017) whereby, pregnant women who had knowledge of IFAS had a probability of being three times more adherent than those who did not. On the contrary, forgetfulness among healthcare workers to educate mothers on side effects and lack of refresher and on job trainings among health care workers were some reasons

reported for low IFAS intake. This finding was similar to that of evidence from a meta-analysis conducted in West Africa on barriers and enablers of IFAS intake among pregnant women whereby lack of counselling programmes and continuous training among health care workers contributed to low IFAS adherence among pregnant women (Siekmams *et al*., 2018).

The study found knowledge of anemia, its causes during pregnancy, effects of the disease during pregnancy and current anemia status to be positively associated with IFAS adherence. Quite a number of mothers (48.8%) had knowledge of the effects of anemia while pregnant and this motivated them to consume IFAS. Some of the reported effects for having anemia during pregnancy were, having still births, preterm delivery, giving birth to a weak baby, death of mother and infant and loss of blood during delivery. These findings were almost similar to those of a study carried out in Ethiopia whereby women with high knowledge of anemia were more likely to adhere than women who had low knowledge on anemia (Assefa, Abebe & Sisay, 2019).

5.1.4 Health system related factors and IFAS adherence

Distance from home of the participant to the health facility was not associated with IFAS adherence with (p=0.940). However, according to qualitative results, living 1 hour away or more from the health facility reduced the likeliness of seeking health services. One mother stated, "*The hospital is too far, and bike cost is expensive. Sometimes I wanted to go, but I had to choose between buying food for my family or paying for transport. So, I ended up missing my clinic visits at times".* A mother stated, *"I am lucky to be living near the clinic. This saved me from spending money on transport since I could walk and be there on time for the health talks and supplements".* Living closer to the health facility reduced transport costs to the hospitals. These results

were in line with those of a study done in Northern Tanzania whereby women who lived 60 minutes away from the facility were less likely to attend ANC than those living closer to the facility since transport cost was affordable (Lyoba *et al*., 2020, Niang *et al*., 2017). On the contrary, not all participants who lived near facilities attended ANC as required due to ignorance, laziness and lack of time.

Quality of service delivery by healthcare providers was not significantly associated with IFAS intake. Majority of the participants reported to have received good service during ANC visits. However, a few reported that they were treated unfairly and badly by some health care providers. These findings were close to those of a study carried out in Tanzania whereby negative encounter by clients with health workers was reported yet the workers tried to justify they offered good services (Kruk *et al*., 2018). In another study done in Western Cape on perspectives on waiting times in antenatal clinics, patients reported healthcare workers to be rude, worked slow, came late and disregarded patients' complaints (Baron & Kaura 2021).

Experience of long line ups was not associated with IFAS intake. Mothers reported to have been attended to despite the long queues at health facilities. According to qualitative results, long lineups were caused by shortage of qualified health care workers. Heavy workload was reported to affect the quality of services provided during ANC visits. A key informant interviewer reported, "*We have a shortage of qualified healthcare workers which is a big problem. That is why sometimes there are long line ups, most of the time we have students, interns and volunteers over, but not all activities can be assigned to them. So, we need more health care workers.*" Having enough health workers means quality service in terms of counseling on IFAS to pregnant women. In a study carried out in Western Cape, mothers related the long queues to slow service of

health care providers (Baron & Kaura, 2021).

Accessibility to IFAS was significantly associated with IFAS intake. According to qualitative results, mothers who received IFAS sufficiently were able to adhere unlike those who experienced stockouts. One mother stated, "During *most of my clinic visits, the tablets were available, and I was reminded by the nurses to take them daily, which I did."* One mother who experienced stock outs twice stated that, "*I wanted to take the supplements as advised, but in two visits when I went to the clinic, they told me they were out of stock. I had no choice but to go without them."* Findings were similar to those of research done in Uganda whereby pregnant mothers who did not get enough supplements to last them till the next visit were less likely to adhere (Kiwanuka et al., 2017). Key informants reported some of the reasons for stock outs to be, KEMSA not supplying enough drugs due to an increase in number of upcoming dispensaries. Some mothers reported to have experienced challenges like inadequate counselling on IFAS and anemia, negative staff attitude and waiting for long at the clinics when they had gone for the supplements.

According to qualitative results, use of IFAS guidelines during counselling sessions, sensitization on importance of IFAS, health promotion and creating community awareness on importance of IFAS had a positive impact on IFAS adherence. It was clear that mothers who got counselling on IFAS importance and how to manage side effects were more likely to adhere than those who did not. Findings were relatable to those of a study conducted in Ethiopia where advice provided during ANC on IFAS was strongly implicated with compliance (Gebreamlak *et al*., 2017). The study found that healthcare providers needed continuous job training to improve their counselling skills. This will help strengthen worker capacity. These findings were consistent with

findings of a study conducted in seven African and Asian countries on barriers and enablers of IFAS intake during pregnancy whereby, inadequate skills and training of health care providers was found to be a barrier to IFAS adherence (Siekmans *et al*., 2019).

Qualitative findings showed that the approach of community health volunteers to help in IFAS distribution and counselling was effective. Some mothers reported to have been approached by CHVs who were inquiring if they were attending ANC during their pregnancy period. Some reported to have been given IFAS by the CHVs which contributed to their consumption increase. One mother stated "*I remember a community health volunteer came to my home and asked me if I was going for clinic visits during my pregnancy. They encouraged me to continue attending ANC so that I could get the iron and folic tablets*." Findings were consistent with those of a systematic review of studies in low- and middle-income countries done by Kavle & Landry (2018), who reviewed the best practices in the community distribution of IFA supplements and recommended interventions that use of community health workers to counsel pregnant women on IFA supplementation benefits and dosage and manage supply systems to be effective. In another study in Bangladesh, such practices were associated with increased maternal supplement consumption (Nguyen *et al*., 2017).

Mothers whose haemoglobin levels improved reported that sufficient IFAS intake prevented anemia. Furthermore, mothers who had been diagnosed with anemia, had previous or current pregnancy complications or had experienced birth deformity cases in their families, were cautious about having healthy pregnancies. They reported that having a healthy pregnancy was linked to someone having normal hemoglobin levels besides other factors. A mother stated, "*In my last pregnancy of this child, I was told*

that my hemoglobin levels were okay which explains why I felt strong and did not have complications during pregnancy. I know of friends who were always tired during pregnancy because their hemoglobin levels were low. Myself, I did not experience any tiredness."

5.2 Conclusions

Anemia in pregnancy in Kilifi South subcounty was found to be high. However, there seemed to be a reduction in prevalence when comparing the findings with those of results from a previous study in the same region. Most mothers reported positive changes in their hemoglobin levels.

Adherence to IFAS intake in Kilifi South subcounty was low below the required 65%. However, when comparing with findings from previous studies in the same county, there was an improvement in IFAS adherence rate among pregnant women.

Individual factors positively associated with adherence to IFAS were, education level, age, monthly income, number of ANC visits, having knowledge on IFAS and its importance during pregnancy, knowledge on anemia and its causes, knowledge on the effects of anemia during pregnancy and being anemic. The greatest impediments of IFAs adherence were iron-folic acid related side effects, forgetfulness, ignorance, bad smell/taste of the iron-folic acid tablets and late first ANC visits.

Health system factors positively associated with IFAS adherence were, availability of IFAS and experience of challenges during antenatal clinic visits. Routine education on the importance of iron-folic acid during ANC visits has a positive influence on iron-folic acid uptake. Findings from the study showed likeliness for intake of the required dose of iron and folic acid supplements or more, to improve hemoglobin levels, hence

preventing anemia.

5.3 Recommendations

5.3.1 Recommendations from the study

1. The Kilifi County government health department, non-governmental organizations and the private health sector policy makers need to address the knowledge gap in anemia and its effects during pregnancy. Interventions may include creating awareness on the disease, routine health education and sensitizations at both health facility and community levels.

2. The Kilifi County government health department, non-governmental organizations and the private health sector policy makers and implementers of micronutrient deficiency and disease control programmes need to address the knowledge gap on IFAS, its importance during pregnancy, side effects, their management and dosage. Interventions may include creating awareness on IFAS, frequent counselling, routine health education, sensitizations at both health facility and community levels and developing follow-up -systems to monitor and encourage consistent IFAS use.

3. The Kilifi County government health department, non-governmental organizations and the private sector policy makers need to ensure effective ways to emphasize early ANC registration of pregnant mothers by creating public awareness on ANC attendance. Early and frequent ANC visits should be encouraged through community sensitizations.

4. The Kilifi County Government Health Department and Ministry of Health should ensure enough and consistent supply of IFA supplements through improved

logistics and stock monitoring, employ more qualified health workers, incorporate regular IFAS health talks and ensure strengthening of patient referral systems by CHVs.

5.3.2 Suggestions for further research

A randomized controlled trial should be done to determine the effectiveness of mobile phone reminders and community health volunteer follow-up on early ANC registration and IFAS adherence among pregnant women in Kilifi South Sub County.

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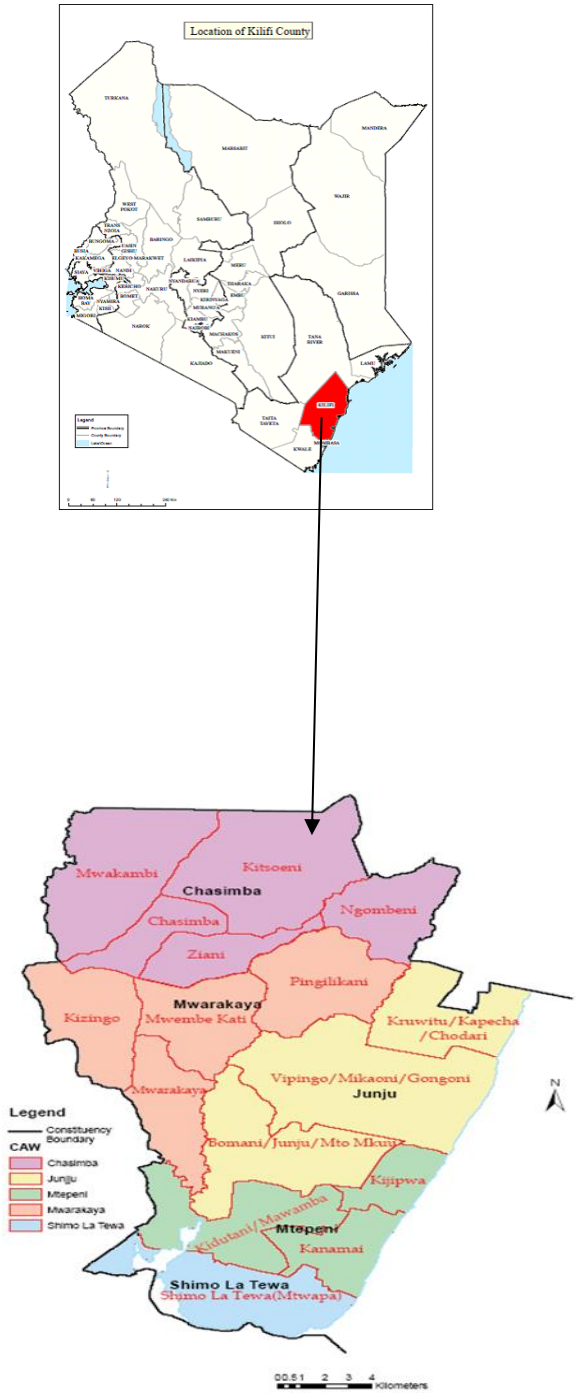
APPENDICES

Appendix I: Kilifi County Map



Source: Kenya google satellite maps

Appendix II: Consent form

Informed consent

My name is Machini Bochaberi Marion. I am a Master student from Kenyatta University. I am conducting a study titled "Determinants of Iron and Folic Acid Supplementation uptake among women of reproductive age in Kilifi South Sub County, Kilifi County". The information will be used to help identify factors that affect intake of IFAS among pregnant women.

Procedures to be followed

Participation in this study will require that I ask you some questions. I will record the information you provide in a questionnaire.

Voluntarism

You have the right to refuse participation in this study. Please remember the participation in this study is voluntarily. You may ask questions related to the study at any time.

You may refuse to respond to any questions and you may stop an interview at any time. You may also stop being in the study at any time without any consequences to the services you receive here or any other organization now or in the future.

Discomforts and Risks

Some of the questions you will be asked are on intimate subject and may be embarrassing or make you uncomfortable. If this happens, you may refuse to answer these questions if you so choose. You may also stop the interview at any time.

Benefits

If you participate in this study you will help us to learn how to provide effective services that can improve IFAS uptake among pregnant women.

Reward

If you agree to participate in this study, there are no rewards or any payment to you if you participate.

Confidentiality

The interviews will be conducted in a private setting. Your name will not be recorded on the questionnaire. The questionnaires will be kept in a locked cabinet for safe keeping at Kenyatta University. Everything will be kept private and only shared with the study team.

Contact Information

If you have questions about the study call Dr John Paul Oyore 0722335878 or Prof. Anthony Wanyoro 0722747903. However, if you have questions about your rights as a study participant: You may contact Kenyatta University Ethical Review Committee Secretariat on chairman.kuerc@ku.ac.ke, secretary.kuerc@ku.ac.ke,

Participant's statement

The above information regarding my participation in the study is clear to me. The study has been explained to me and I have been given a chance to ask questions and my questions have

been answered to my satisfaction. My participation in this study is entirely voluntary. I understand that my records will be kept private and that I can leave the study at any time.

Name of Participant.....

Signature or Thumbprint Date

_____ _____

Name of Representative..... Relationship to Subject

Investigators statement

I, the undersigned, have explained to the volunteer in a language s/he understands, the procedures to be followed in the study and the risks and benefits involved

Name of Interviewer Machini Bochaberi Marion

Signature MB Date

Appendix III: Structured questionnaire

Identification	
Cluster Number	
Household Number	
Name of village	
Name of Mother	

Date of interview	___/___/____ day/month/year
Name of Interviewer	

No.	Questions and Filters	Coding Categories	Skip
Section 1. Social-Cultural, demographic and economic factors			
101	What is your age?	……Years Do not know ……...	
102	Which religion do you belong to?	Christian.…….……...1 Muslim …….….2 Traditional Religion.….....3 Other….…….…….....4 None…….….5	
103	At the moment, what is your marital status?	Never married/ single.…...1 Divorced.……. 2 Separated …….…….3 Widow…….…….4 Married…….5	
104	What was your age when you got married?	……Years Do not know……	
105	How old is your partner?	……. Years don't know ……	
106	Who do you live with in your house?	Father…….....1 Mother …….2 Husband …….…....3 Children……...4 Brother/s …. ……...5 Sister/s…….….6 Mother-in-law….....7 Father-in-law…….....8 Other relatives ...….9 Friends……...….10	
107	Have you ever attended school?	Yes……1 No…….……2	

No.	Questions and Filters	Coding Categories	Skip
108	Which is your highest level of education that you have completed successfully?	Did not attend……. ….1 Primary……....2 Secondary…..……...….3 University/college……4 Other……....5	
109	What is your Occupation?	Unemployed …….…….1 Farmer…….....….2 Trader/Business…….…3 Government employee.…...4 Private sector employee.….5 Other (specify)……6	
110	How much money do you earn monthly? (In Ksh)	50-100 ……..….1 100-300 ……2 300- 500 ……3 500-1000 ……...4 above 1000 ……5 None……...……...…….6	
111	Who is the head of your household?	Myself.……...…1 My husband …….….2 Father-in-law …….....3 Mother-in-law ……4 Other (Please specify.....5	
112	What is the level of education of the head of your family?	No formal education ……...1 Primary ……...2 Secondary ……3 Undergraduate…….4 None …….5	
113	How much does the head of your household earn monthly?	50 or less ……..….1 50-100 …….2 100-300 ……3 300- 500 …….4 500-1000 …….5 above 1000 ...……6 Not applicable ……...7	
	Section 2: Health-seeking behaviors individual factors		

No.	Questions and Filters	Coding Categories	Skip
201	Did you attend ANC in your latest pregnancy?	Yes ……1 No …….2	
202	How old was your pregnancy when you first attended ANC?	……. Months Do not know…….	
203	During your pregnancy with this child, how many times did you attend the ANC?	Times…….….1 Don't know…….2	
204	In the last pregnancy, how many times did you attend ANC?	1 ……1 2…….2 3 …….3 4 or more……4	
205	For what reasons did you attend ANC?	To be advised on my pregnancy……1 To check on the health of my unborn child……2 To be immunization ….….3 The nurse/doctor told me to....4 To check my health ……5 Other (specify)…….….6	
	Section 3: Supplement-related individual factors		
301	Did you take IFAS when you were pregnant?	YES…….….1 NO……2	
302	What iron supplements were you given?	Folic acid …….1 Ferrous sulfate……2 Multivitamin …….3 Iron 3……..4	
303	For how long did you take the IFAS tablets that you were given?	Less than 90 days…….1 Above 90 days…….2	
304	During your last pregnancy, were you able to access any iron/folate tablets?	Yes ……..…1 No……...2 Do not remember……3	

No.	Questions and Filters	Coding Categories	Skip
305	From where do you get the IFAS?	Public hospital pharmacy….1 Private hospital pharmacy….2 Privately owned pharmacy...3 N/A……..……....4	
306	When acquiring the tablets, were there any challenges faced?	Yes……1 NO…….2	
307	What challenges did you face in getting the IFAS?	The facility was far…… ….1 Did not attend all ANC visits…….…2 Did not have money to go facility……...3 IFAS was not available in the facility……...4 Discouraged by long ques in facility……...5	
308	Did you experience any side effects when taking the tablets?	YES……1 NO…….2	
309	What side effects did you experience?	Nausea……1 Vomiting……....2 Headaches……3 Bad taste in mouth…...4 Loss of appetite…….5 Stomach pain……6 Feeling sleepy…….…7 Other…….8	
310	Did the healthcare provider inform you of any possible side effects of the supplements and how to manage them?	YES…….1 NO……2	
311	Do you take the supplements without being reminded?	YES…….1 NO……...2	

No.	Questions and Filters	Coding Categories	Skip
312	If NO, who reminds you?	Husband/partner …. …...1 Other Family member….2 Health care provider, through phone ……..….3 Other (Specify)…….4	
313	For what reasons did you not take the IFAS tablets as required?	Forgetfulness……1 Travel…….2 Side effects ……3 Many tablets to take ….4 Got tired of them ……5 Lack of food to eat ……..6 Other (specify)…….7	
314	What motivated you to take the supplement?	To get better health during pregnancy…….……1 Getting a healthy baby……2 To avoid anemia…….3 Fear of getting sick…….....4 Other (specify)……5	
315	Were you informed reasons for which you were to take the supplements?	YES……1 NO…..……...2	
316	Have you heard any information from other women before that may have changed your perception about the tablets?	YES…….1 NO……...2	
317	If yes, what is it that you heard?	IFAS brings a bad taste to the mouth……1 IFAS is meant only for anemic women…….….2 IFAS causes the fetus to grow bigger than normal……3 IFAS has complications..….4	

No.	Questions and Filters	Coding Categories	Skip
	Section 4: Food and Nutrition		
401	Before taking the supplements, did you always eat first?	YES…….1 NO ……. ….2 Sometimes……3	
402	If not, did you still take the IFAS without eating?	YES…….1 NO ……. ….2 Sometimes……3	
403	Are there foods that you avoided taking throughout your pregnancy?	YES……...1 NO…….2	
404	If yes, which foods do you avoid?	Meat …….1 Fish ……2 Eggs …….3 Milk …….4 Fruits ……5 Vegetables…….6 Legumes, grains, nuts, and seeds…7 Others (specify)……..8	
405	In your last pregnancy, did you practice any form of pica?	Yes …….1 No…….…..2	
406	If yes, what nonfood substances did you eat?	Clay ……..……1 Soil…….…….2 Chalk …….…….3 Cola nuts…….……4 Uncooked maize dough/starch ….5 Chewing stick/wooden sponge …6 Others(specify) ……..…7.	
407	Did you consume milk and its products together with other foods?	YES……1 NO…….…….2	

No.	Questions and Filters	Coding Categories	Skip
408	Did you consume tea and coffee together with other foods?	YE…….1 NO…….2	
	Section 5: Knowledge of anemia causes and their consequences.		
501	Do you know what anaemia disease is?	Yes……..….1 No…….…….2	
502	Do you know what the causes of this disease are?	Yes…….1 No…….2	
503	If yes, what causes the disease?	Deficiency of iron and folate……...1 Malabsorption…… ….….2 Inherited disorders…..……3 Not eating enough food. …4 Anemia…… …….5 Don't know…… …. ….6	
504	Are you aware of any effects of having the disease?	YES…….……1 NO……...2	
505	If yes what are the consequences?	Preterm delivery…….1 Low birth weight…….2 Neural tube defects…….3 Stillbirths…….4 Affects growth and development of fetus……5 Mortality…….6	
506	Where did you learn about this disease ad from whom?	Community health worker…1 Health professional ……..…2 Friend…….3 Relative …….4 Media……..5 Other (specify)……6	

No.	Questions and Filters	Coding Categories	Skip
507	When you were pregnant, were you diagnosed with anaemia?	YES……1 NO…….2	
508	In your opinion, do you think there is a relation between low IFAS intake and anemia occurrence?	YES…….1 NO…….……2 Do not know……3	
	Healthy facility-related factors/knowledge on IFAS		
601	During your ANC visits, were there long queues when you were receiving IFAS?	YES…….…1 NO…….……...2	
602	Is there any time you were informed that IFAS was out of stock and you could not receive some that day?	YES……...1 NO…….2	
603	During your ANC visits, were the health workers treating you well?	Fair……...1 Good…….2 Bad……3	
604	Were you educated on IFAS and its importance?	YES……...1 NO…….2 Do not know…….3	
605	Were you educated on the right dose of the supplement to take?	YES……...1 NO…….2	

Appendix IV: Key Informant Interview Guide

Name of respondent _____ Date _____

Job title _____ Gender_____

1. In this hospital, do you have guidelines and policies on providing expectant mothers will IFAS?

_____
_____
_____

2. Do you think there is any importance to providing Iron and Folate supplements to expectant mothers regardless of the levels of hemoglobin (Hb)?

_____
_____
_____

3. Do women receive tablets as prescribed supplements or medicines to the diet regardless of the levels of Hb?

_____
_____
_____

4. Are expectant mothers sensitized about the benefits of IFAS when pregnant?

_____
_____
_____

5. Who supplies IFAS to this facility?

_____
_____
_____

6. How reliable is the flow of supply? If it is not reliable, what are the contributing factors?

_____
_____
_____
_____

7. Which kind of iron/folate tablets are provided to expectant mothers?

_____
_____
_____

8. How can you describe the rate at which expectant mothers who come to this hospital consume IFAS? What are the contributing factors that affect the intake and how it is accepted? (Probe on, Side effects, taste, size and other factors.)

_____

9. What has been the trend in pregnant women's adherence to IFAS tablets?

10. Do you think all mothers who receive IFAS tablets take them as expected?

11. If not, what do you think are the contributing factors?

12. What suggestions do you have that will help improve iron/folate tablets supplementation among expectant mothers?

13. Are expectant women who have been registered to attend ANC clinics able to attend the clinic as required?

14. If not, what do you think are the contributing reasons?

15. How will you describe the quality of services offered to expectant mothers during the ANC visits?

16. Are there long queues during ANC visits when mothers are collecting their IFAS?

17. If yes, what do you do to ensure pregnant mothers are served on time?

18. During the past and current encounters, how were you able to describe the

IFAS rate of intake among expectant mothers who came to the facility for ANC?_____
_____
_____
_____

19. Do you experience IFAS stockouts in this facility?
_____
_____

20. If yes, what are the reasons for the stockouts?
_____
_____
_____
_____

21. Are pregnant women educated on IFAS use, importance and side effects during ANC visits?
_____
_____
_____

Appendix V: Focus Group Discussions Guide

Questionnaire No: …… **Name of participant……**

Name of community…… **Date ……/……/20……**

1. How many of you were able to access these iron/folate tablets during their pregnancy? (The researcher will show them a picture sample of the IFAS supplement)

_____
_____
_____
_____

2. How many of you took the tablets throughout your last pregnancy?

_____
_____
_____

3. How many were able to take the supplement for more than 90 days during the last pregnancy?

_____
_____

4. How many of you did not take the supplement tablet at all and what were the reasons for not taking them?

_____
_____
_____
_____

5. Were the tablets given as medication or a diet supplement?

_____
_____
_____

6. For those who took the tablets, what were the reasons for taking them?

_____
_____
_____
_____

7. If you started and stopped consumption, why is it so?

_____
_____
_____
_____
_____

8. Were the IFAS tablets available at the facility when you were going for ANC?

_____
_____

9. If they were not available, what were the reasons for non-availability?

10. Were you later called to the facility to pick up the tablets when they were available?

11. Were you educated on the importance of IFAS during ANC visits and by whom?

12. In your opinion, were your health care providers encouraging you to take the IFAS?

13. In your opinion, is there anything about your healthcare provider that made you not go for the IFAS or get the IFAS?

14. How could you describe the service you were given by your healthcare provider during ANC visits?

15. Was the facility you were attending during ANC easily accessible? If not, what were the challenges?

16. In your opinion, do women who are pregnant required to consume the tablets for iron/folate throughout pregnancy and if yes, why?

17. In your opinion, what do you think is the right number of days you are supposed to take the tablets when pregnant?

18. What do you think are the considerations that need to be modified to motivate more women who are pregnant to take the tablets as required?

19. Was the latest pregnancy your first and if yes, do you think it affected the understanding you have of the importance of IFAS?

20. If not, do you think previous pregnancies enabled you to understand better the importance of IFAS consumption?

21. According to your understanding, what is Anaemia, and can you identify someone suffering from the condition?

22. What are the effects of anemia during pregnancy?

23. For those who took the IFAS for more than 90 days, what was the level of your hemoglobin?

24. For those who did not take the IFAS at all, what was the level of your hemoglobin?

_____
_____

25. For those who took the supplement and stopped, what were the levels of your hemoglobin?

_____
_____

26. In your opinion, do you think there is any link between not taking IFAS and being at risk of getting anemia?

_____
_____
_____
_____
_____

27. How many of you were educated on the right diet rich in iron and folic acid?

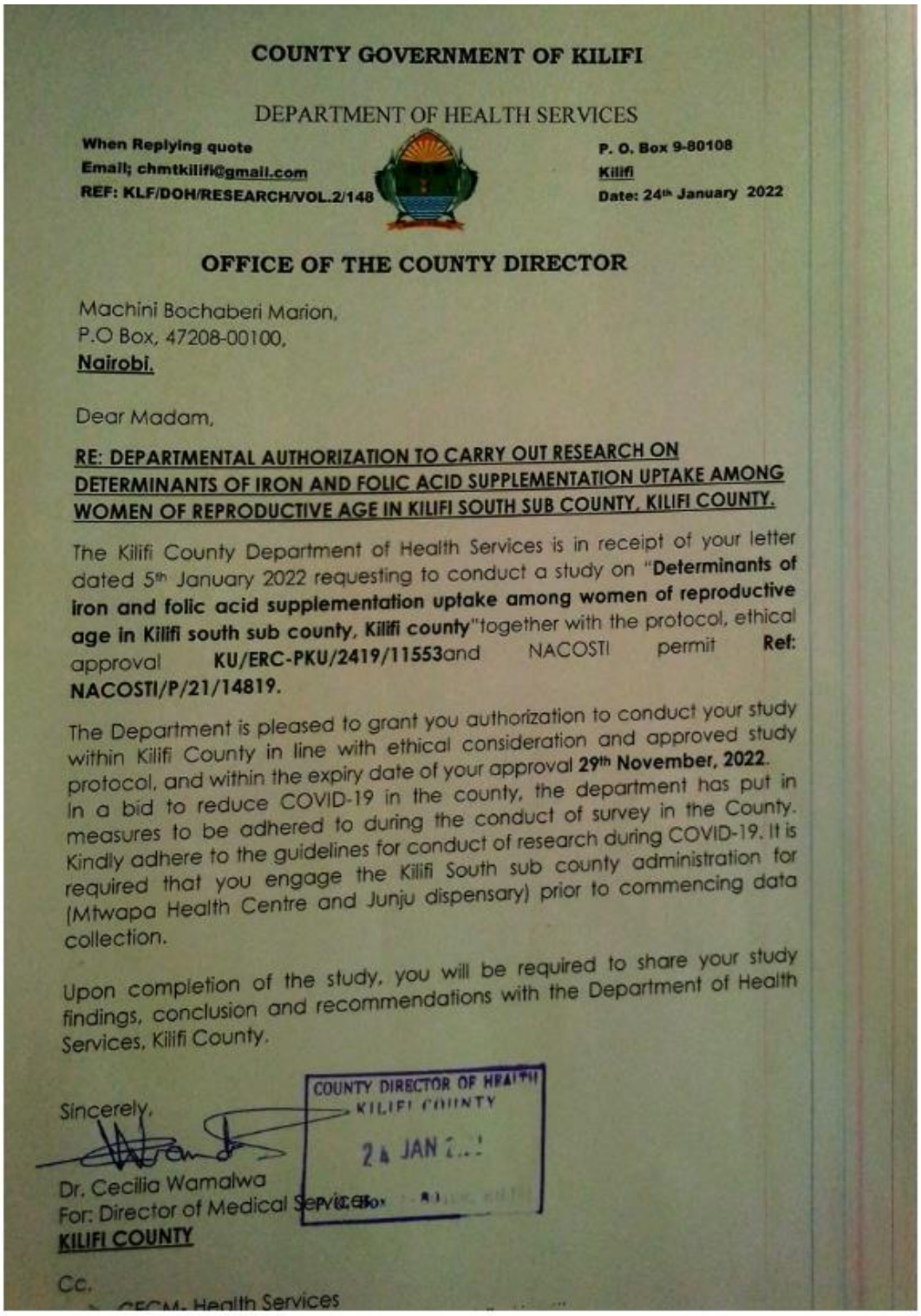
_____
_____
_____

28. In your opinion, what is the importance of taking an iron and folate-rich diet during pregnancy?

_____
_____
_____
_____
_____

29. Are there any cultural factors that affected or stopped you from taking IFAS and if yes, which ones?

Appendix VI: Kilifi County Authorization form



COUNTY GOVERNMENT OF KILIFI

DEPARTMENT OF HEALTH SERVICES

When Replying quote
Email; chmtkilifi@gmail.com
REF: KLF/DOH/RESEARCH/VOL.2/148

P. O. Box 9-80108
Kilifi
Date: 24th January 2022

OFFICE OF THE COUNTY DIRECTOR

Machini Bochaberi Marion,
P.O Box, 47208-00100,
Nairobi.

Dear Madam,

RE: DEPARTMENTAL AUTHORIZATION TO CARRY OUT RESEARCH ON DETERMINANTS OF IRON AND FOLIC ACID SUPPLEMENTATION UPTAKE AMONG WOMEN OF REPRODUCTIVE AGE IN KILIFI SOUTH SUB COUNTY, KILIFI COUNTY.

The Kilifi County Department of Health Services is in receipt of your letter dated 5th January 2022 requesting to conduct a study on "**Determinants of iron and folic acid supplementation uptake among women of reproductive age in Kilifi south sub county, Kilifi county**"together with the protocol, ethical approval **KU/ERC-PKU/2419/11553**and NACOSTI permit **Ref: NACOSTI/P/21/14819.**

The Department is pleased to grant you authorization to conduct your study within Kilifi County in line with ethical consideration and approved study protocol, and within the expiry date of your approval **29th November, 2022.** In a bid to reduce COVID-19 in the county, the department has put in measures to be adhered to during the conduct of survey in the County. Kindly adhere to the guidelines for conduct of research during COVID-19. It is required that you engage the Kilifi South sub county administration for (Mtwapa Health Centre and Junju dispensary) prior to commencing data collection.

Upon completion of the study, you will be required to share your study findings, conclusion and recommendations with the Department of Health Services, Kilifi County.

COUNTY DIRECTOR OF HEALTH
KILIFI COUNTY
24 JAN 2...

Sincerely,

Dr. Cecilia Wamalwa
For: Director of Medical Services
KILIFI COUNTY

Cc.
CECM- Health Services

Appendix VII: Kilifi south subcounty research Authorization form

COUNTY GOVERNMENT OF KILIFI

DEPARTMENT OF HEALTH SERVICES

Email: kdhsouthsub@gmail.com
When Replying/Telephoning quote
REF: DOH/KLF/MOH/VOL.3/2022/003

P. O. Box 9-80108
Kilifi
Date: 15th February 2022

OFFICE OF THE SUB COUNTY MEDICAL OFFICER OF HEALTH

MARION BOCHABERI MACHINI
P.O Box 47208-00100
NAIROBI

RE: SUPPORT TO CARRY OUT RESEARCH ON DETERMINANTS OF IRON AND FOLIC ACID SUPPLEMENTATION UPTAKE AMONG WOMEN OF REPRODUCTIVE AGE IN KILIFI SOUTH SUB-COUNTY.

Following the approval by the department of health to carry out the above-mentioned research, I would like to request for your assistance where needed to enable the bearer of this letter carry out her study for the period indicated in the letter from the department.

I would like to wish you all the best in your research

Attached is the letter from the department

SUB COUNTY HAO - KILIFI SOUTH
15 FEB 2022
P.O. BOX 9 - 80108 KILIFI

Emmanuel Makupe
Sub-County Health Administrative Officer
For: The Sub-County Medical Officer of Health
KILIFI SOUTH SUB COUNTY

Cc. Medical Superintendent-Mtwapa Health Centre
Facility Incharges-~~Kipungo~~ Mtwapa Health Centre & Junju Dispensary

COUNTY GOVERNMENT OF KILIFI
THE OFFICE OF THE MEDICAL SUPERINTENDENT
MTWAPA HEALTH CENTER
Email: mtwapahc14@...
Mob: 07...
14/2/2022

Appendix VIII: NACOSTI research authorization form

REPUBLIC OF KENYA

NATIONAL COMMISSION FOR SCIENCE,TECHNOLOGY & INNOVATION

Ref No: **269138**

Date of Issue: **09/December/2021**

RESEARCH LICENSE

This is to Certify that Miss.. Marion Bochaberi Machini of Kenyatta University, has been licensed to conduct research in Kilifi on the topic: Determinants of Iron and Folic Acid Supplementation uptake among women of Reproductive Age in Kilifi South Sub county, Kilifi County. for the period ending : 09/December/2022.

License No: **NACOSTI/P/21/14819**

269138

Applicant Identification Number

Director General
NATIONAL COMMISSION FOR SCIENCE,TECHNOLOGY & INNOVATION

Verification QR Code

NOTE: This is a computer generated License. To verify the authenticity of this document, Scan the QR Code using QR scanner application.

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 any rights thereunder are non-transferable
3. The Licensee shall inform the relevant County Director of Education, County Commissioner and County Governor before commencement of the research
4. Excavation, filming and collection of specimens are subject to further necessary clearence from relevant Government Agencies
5. The License does not give authority to tranfer 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 (thesis) 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
off Waiyaki Way, Upper Kabete,
P. O. Box 30623, 00100 Nairobi, KENYA
Land line: 020 4007000, 020 2241349, 020 3310571, 020 8001077
Mobile: 0713 788 787 / 0735 404 245
E-mail: dg@nacosti.go.ke / registry@nacosti.go.ke
Website: www.nacosti.go.ke

Appendix IX: Kenyatta University Ethical Review Authorization letter

KENYATTA UNIVERSITY
CENTRE FOR RESEARCH ETHICS AND SAFETY

Fax: 8711242/8711575
Email: chairman.kuerc@ku.ac.ke

P. O. Box 43844,
Nairobi, 00100

Website: www.ku.ac.ke

Tel: 8710901/12

Our Ref: **KU/ERC/APPROVAL/VOL.1**

Date: 29th November, 2021

Marion Machini
P.O BOX 43844-00100
Nairobi.

Dear Madam,

RE: DETERMINANTS OF IRON AND FOLIC ACID SUPPLEMENTATION UPTAKE AMONG WOMEN OF REPRODUCTIVE AGE IN KILIFI SOUTH SUB COUNTY, KILIFI COUNTY

This is to inform you that ***KENYATTA UNIVERSITY ETHICS REVIEW COMMITTEE*** has reviewed and approved your above research proposal. Your application approval number is ***PKU/2419/I1553.*** The approval period is ***29/11/2021 to 29/11/2022.***

This approval is subject to compliance with the following requirements;

i. Only approved documents including (informed consents, study instruments, MTA) will be used
ii. All changes including (amendments, deviations, and violations) are submitted for review and approval by ***KENYATTA UNIVERSITY ETHICS REVIEW COMMITTEE***
iii. Death and life threatening problems and serious adverse events or unexpected adverse events whether related or unrelated to the study must be reported to ***KENYATTA UNIVERSITY ETHICS REVIEW COMMITTEE*** within 72 hours of notification
iv. Any changes, anticipated or otherwise that may increase the risks or affected safety or welfare of study participants and others or affect the integrity of the research must be reported to ***KENYATTA UNIVERSITY ETHICS REVIEW COMMITTEE*** within 72 hours
v. Clearance for export of biological specimens must be obtained from relevant institutions.
vi. Submission of a request for renewal of approval at least 60 days prior to expiry of the approval period. Attach a comprehensive progress report to support the renewal.

vii. Submission of an executive summary report within 90 days upon completion of the study to ***KENYATTA UNIVERSITY ETHICS REVIEW COMMITTEE***

Prior to commencing your study, you will be expected to obtain a research license from National Commission for Science, Technology and Innovation (NACOSTI) https://research-portal.nacosti.go.ke and also obtain other clearances needed.

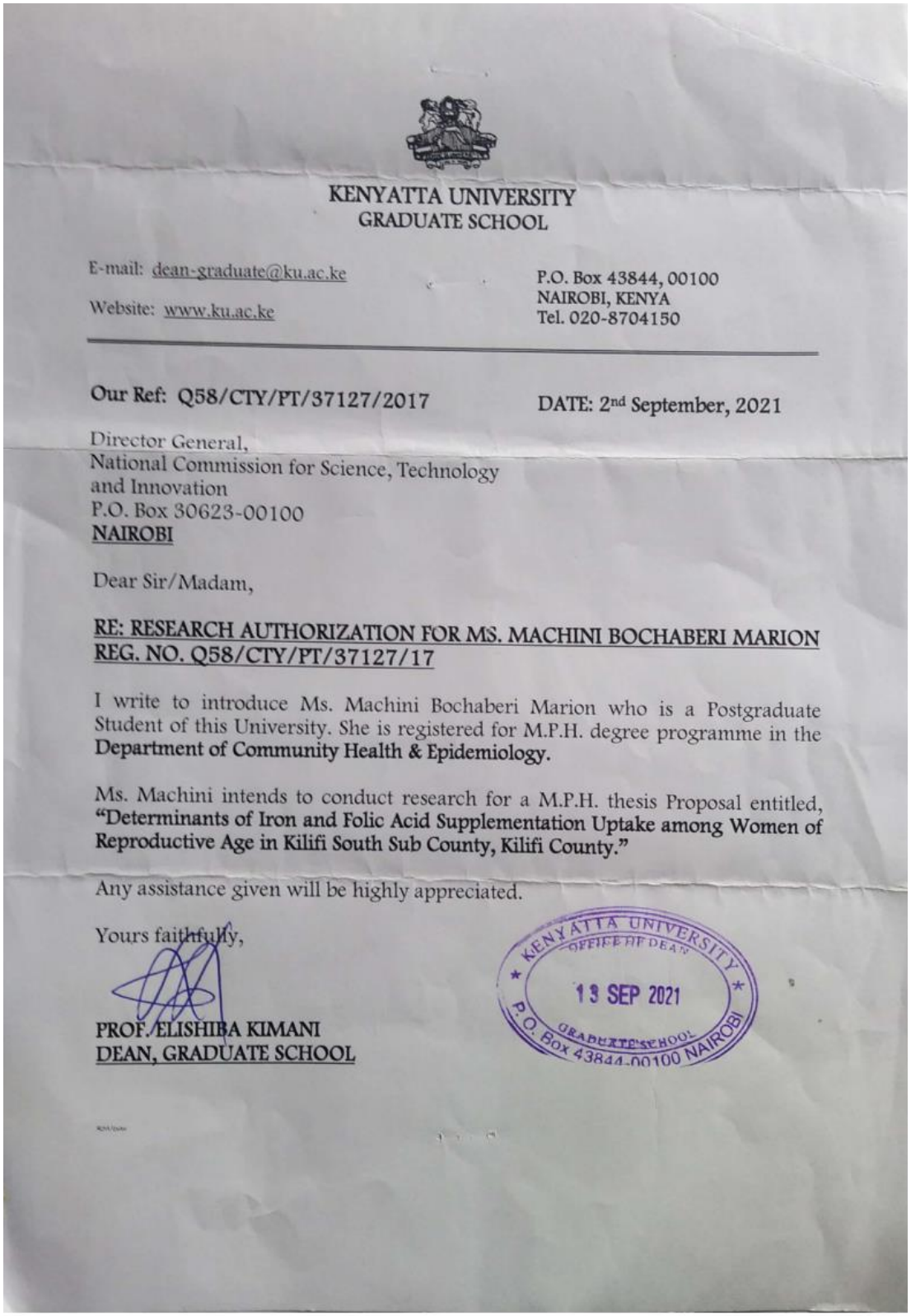
To serve you better, researchers are kindly requested to access and complete a customer feedback form and sent it back online as you continue with research and upon completion of data collection found on the following website link; ;(https://docs.google.com/forms/d/1ytWefDwvyz5h1oz_VIn0xbxg3uGdlDzMXFWNDsMrRPQ/edit?usp=sharing

Yours sincerely

Prof. Judith Kimiywe

Director: Centre for Research Ethics and Safety

Appendix X: Kenyatta University Graduate School Research Permit



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

Our Ref: Q58/CTY/PT/37127/2017

DATE: 2nd September, 2021

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

Dear Sir/Madam,

RE: RESEARCH AUTHORIZATION FOR MS. MACHINI BOCHABERI MARION
REG. NO. Q58/CTY/PT/37127/17

I write to introduce Ms. Machini Bochaberi Marion who is a Postgraduate Student of this University. She is registered for M.P.H. degree programme in the **Department of Community Health & Epidemiology.**

Ms. Machini intends to conduct research for a M.P.H. thesis Proposal entitled, **"Determinants of Iron and Folic Acid Supplementation Uptake among Women of Reproductive Age in Kilifi South Sub County, Kilifi County."**

Any assistance given will be highly appreciated.

Yours faithfully,

KENYATTA UNIVERSITY
OFFICE OF DEAN
13 SEP 2021
GRADUATE SCHOOL
P.O. BOX 43844-00100 NAIROBI

PROF. ELISHIBA KIMANI
DEAN, GRADUATE SCHOOL