

**DETERMINANTS ASSOCIATED WITH ADHERENCE TO IRON-
FOLIC ACID SUPPLEMENTATION AMONG PREGNANT WOMEN IN
KASULU COMMUNITIES, NORTH-WESTERN, TANZANIA**

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**A Dissertation Submitted in Partial Fulfillment of the Requirements for the Degree of
Master of Science in Public Health Research at Nelson Mandela African Institution of
Science and Technology**

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ABSTRACT

Pregnant women are at high risk of iron and folic acid deficiency anemia. Tanzania adopted the WHO recommendation of 2012 that, all pregnant women should consume a dose of 30-60 mg IFAS 400 µg daily for first six (6) months. Iron and Folic Acid Supplementation is the main cost-effective strategy to control anemia during pregnancy however, adherence to IFAS in Tanzania is low (21%) and more in Kigoma region (7%). Associated determinants with adherence to IFAS have not been well established and studies to assess IFAS in Kasulu district are limited. Participants were selected at the health facility through systematic random sampling. A structured questionnaire was used to collect quantitative information and binary logistic regression models were used to determine the factors associated with the adherence to IFAS with statistical significance of $p\text{-value} < 0.05$ using SPSS software (version 22). Similarly, pregnant and women with children aged 0-6 months were purposively selected from health facilities and allocated in four focus group discussions for qualitative information. In addition, an in-depth interview (IDIs) was conducted among six health care providers who were purposefully selected from two health facilities. Thematic analysis was done for qualitative data and triangulated with quantitative findings. Adherence to IFAS was found to be 20.3%. In a binary logistic regression model, factors associated with adherence to IFAS include distance to health facilities (AOR=0.338, 95% CI:131-886), counseled on the benefits of IFAS (AOR=3.864, 95% CI: 1.422-10.500), knowledge on anemia (AOR=3.840, 95% CI: 1.335-10.685), number of IFAS given at each visit (AOR=15.718, 95% CI: 5.335-46.311), Time at first ANC visit (AOR=3.724, 95% CI: 1.417-9.791), number of meals per day (AOR=3.349, 95% CI: 1.184-9.212) and number of the children (AOR=3.462, 95% CI: 1.035-12.070). From the qualitative findings, low knowledge of anemia and benefits of IFAS among women and health care providers, late first ANC, economic factors, less reminded to the uptake of IFAS, negligence and forgetfulness were the main reasons for low adherence. Overall, adherence to IFAS was low. Therefore, strengthening systems to create community awareness, health promotion, education program among health care providers and pregnant women, strengthen supply chain and reminder mechanisms is potential to improve the adherence to IFAS.

Key words: Adherence, Iron and Folic Acid Supplementation, pregnant women, women with children 0-6months, health care providers and antenatal clinic.

DECLARATION

I, Winfrida Benedicto, do hereby declare to the Senate of Nelson Mandela African Institution of Science and Technology that this dissertation is my own original work and that it has neither been submitted nor being concurrently submitted for degree award in any other institution.



Winfrida Benedicto

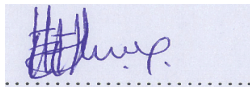
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CERTIFICATION

I hereby confirm that the dissertation entitled “Determinants Associated with Adherence to Iron-Folic Acid Supplementation among Pregnant Women in Kasulu Communities, North-Western Tanzania” submitted by Winfrida Benedicto to Nelson Mandela African Institution of Science and Technology, Tanzania in partial fulfillment of the requirements for the award of Master of Science in Public Health Research is an authentic work and has been done under my supervision.



Ester Elisaria, PhD

Supervisor

Date

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DEDICATION

This academic research is dedicated to my beloved parents, the late Adrophina Lunazi and Benedicto Lyoba for their directives and guidance on acceptable standards of living. Though your physical presence is no more your fresh memory still lingers. Furthermore, research is dedicated to my beloved daughter Abigail J. Mwinyi, my young sister Odavia Bondo and my husband Jalala Mwinyi for his tolerance during the entire period of my studies.

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LIST OF ABBREVIATIONS AND SYMBOLS

ANC	Antenatal Clinic
AOR	Adjusted Odds Ratio
CHMT	Council Health Management Team
DHS	Demographic and Health Survey
FMoH	Federal Ministry of Health
FGD	Focused Group Discussion
GMT	Greenwich Mean Time
HIV	Human Immunodeficiency Virus
HSSP	Health Sector Strategic Plan
IDI	In-Depth Interview
IRB	Institutional Ethical Review Board
IRR	Incidence Rate Ratio
PR	Principal Ratio
IFAS	Iron and Folic Acid Supplementation
KH	Kasulu Hospital
KHC	Kiganamo Health Center
MSD	Medical Store Department
NBS	National Bureau of Statistics
PMTCT	Prevention of Mother-to-Child Transmission of HIV
OR	Odds Ratio
TDHS	Tanzania Demographic and Health Survey
URT	United Republic of Tanzania
UTI	Urinary Tract Infection
VIF	Variable Interaction Factor
WFP	World Food Program
WHO	World Health Organization

CHAPTER ONE

INTRODUCTION

1.1 Background of the problem

Iron and Folic Acid Supplementation (IFAS) is one of the aspirant interventions to control anemia among pregnant women. Understanding the burden of anemia, challenges of IFAS intervention and situation of adherence to intervention among pregnant women is paramount toward improving maternal and child health.

1.1.1 Global burden of anemia among women

Anemia is still a challenging and global public health problem that affects more than two billion people. Almost 30% of the global population were affected with iron deficiency and developing countries are highly at risk (Harding *et al.*, 2017; Peña-Rosas & Viteri, 2009). Anemia being a challenge, women are more susceptible as experienced various challenges, including biological changes (menstrual period). Similarly, aspects of under-nutrition increase the risks including poor health care, lack of energy, food insecurity, gender inequalities, low knowledge of proper dietary practices and iron and folic acid deficiency (Yakoob, Khan & Bhutta, 2010). Globally, prevalence of anemia among non-pregnant women and pregnant women estimated to be 29% and 38% respectively (Kavle & Landry, 2017; WHO, 2015). Considering several causes of anemia, iron deficiency anemia alone contributes 75% of all anemia in pregnancy (Horowitz, Ingardia & Borgida, 2013). Since anemia is highly affecting the developing countries evidence revealed the similar challenge in developed countries. Anemia among pregnant women in America and Europe reported to be 24.1% and 25.1 % respectively (Boy, 2008; Niguse & Murugan, 2018; WHO, 2005).

1.1.2 Burden of anemia in Sub-Saharan Africa among women

The problem of iron deficiency anemia among pregnant women is still high predominantly in sub-Saharan Africa including Tanzania. The challenge of anemia were attributed to infectious diseases and inflammatory diseases (malaria), parasitic infections (worms), nutrients deficiencies including Vitamin A, Riboflavin (B6), Vitamin B12, Folic acid (B9), low dietary intake and poor absorption of food (Soofi *et al.*, 2017; Stephen *et al.*, 2018; Wright *et al.*, 2017). In Africa prevalence of anemia among non-pregnant women and

pregnant women is estimated to be 37.8% and 46.3% respectively (WHO, 2015). In Ethiopia 17% of the women with reproductive age were affected with anemia and more in pregnant women 22% (Gebre, 2015).

1.1.3 Burden of anemia in Tanzania among women

Tanzania Demographic and Health Survey conducted in 2015 recounted the prevalence of anemia among women and 45% of anemia reported among women of reproductive age (15-49 years). Irrespective of the several efforts to address the challenge of anemia slightly changes was observed for the past 17 years from 55.5% in 1998 to 45% in 2015 (WHO, 2015b). In Kigoma, prevalence of anemia among women of reproductive age was 55.1% which is much higher than the national estimates (TDHS, 2015).

1.1.4 Interventions strategies to control anemia

In order to improve health status of pregnant women, several strategies have been proposed as aspirant to control iron-deficiency anemia and negative outcomes among pregnant women and new born. Examples of the negative outcomes include, premature delivery, low birth weight, neural tube defects, neonatal and maternal mortality. The strategies comprise the supplementation of iron and folic acid, food fortification, dietary and access to food, nutritional education, deworming, malaria intermittent prevention tablets, distribution of insecticide-treated bed nets and blood transfusion (Etheredge *et al.*, 2015; Nguyen *et al.*, 2017; Soofi *et al.*, 2017; Stephen *et al.*, 2018; Wright *et al.*, 2017). With all interventions, pregnant women are still experiencing iron deficiency anemia attributed to poverty, food insecurity, gender inequalities, inadequate knowledge of proper dietary practices and increased iron and folic acid deficiency (Yakoob, Khan & Bhutta, 2010). Increased micronutrients demand particularly iron for the growth of foetus and metabolism cannot be easily met by diet alone due to the poverty, poor intake of food and low absorption of iron (Alphonse, 2016; Naithani *et al.*, 2016). Then, Iron and Folic Acid Supplementation intervention is the best and effective strategy with promising result in replenishes iron and improving the iron status although adherence to IFAS dose among pregnant women is observed gap of the IFAS intervention.

1.1.5 Iron and folic acid supplementation intervention

To date, Iron and Folic Acid Supplementation is well-reported to be effective and potential to pregnant women and new-born. Tanzania adopted the WHO recommendation of IFAS and anticipated that all pregnant women should receive and consume a dose of 30- 60 mg of iron and folic acid of 400 µg for the first six months (6) to control iron deficiency anemia. Iron supplementation was said to rapidly replenish the iron and contributes to improving the iron status of an individual up to 95% (Balarajan, Subramanian & Fawzi, 2013; Friedrisch & Friedrisch, 2017; Pasricha *et al.*, 2013; Sengpiel *et al.*, 2014; WHO, 2015a; WHO, 2012). Despite the effectiveness of IFAS very few countries have reported to achieve high Iron-Folic Acid Supplementation adherence. Surprisingly, the IFAS remains as major program implemented at many antenatal care clinics to address iron and folic acid deficiency anemia during pregnancy (Ibrahim *et al.*, 2011; Sengpiel *et al.*, 2014; FMOH, 2015; Gathigi, 2013; Peña-Rosas & Viteri, 2009; Sengpiel *et al.*, 2014). As a result, IFAS require interventions to achieve the Sustainable Development Goals 2030 a global targets number 3 focusing on improving good health and well-being by 2030.

1.1.6 Adherence to iron and folic acid supplementation in Tanzania

Concerning the IFAS intervention, pregnant women do not adhere to the recommendations properly and the reasons are not well understood. Generally, women who took Iron and Folic Acid Supplementation tablets during pregnant for at least 90+ days as recommended were 21% in Tanzania and lowest in Kigoma region (7%) (TDHS, 2015). A retrospective cross-sectional study conducted in Tanzania looking adherence to IFAS was also reported the low adherence. Adherence to Iron Supplementation was 17.2%, Folic Acid Supplementation was 22.3%, and only 16% reported taking a combination of Iron and Folic Acid Supplementation (Ogundipe *et al.*, 2012). Other countries that have reported adherence to IFAS including Kenya and Ambra, Ethiopia as 32.7% and 20.4% respectively (Kamau, Mirie & Kimani, 2018; Taye, Abeje & Mekonen, 2015). Studies conducted in Eastern Kenya (18.3%) and Uganda (12%) (Juma, Oiye & Konyole, 2015; Kiwanuka *et al.*, 2017) were more low compared to previous studies in Ethiopia and Kiambu, Kenya. In other countries adherence to IFAS was reported to be high and these include Senegal (51%) and Kathmandu, Nepal (73.2%) (Niang *et al.*, 2016; Rai *et al.*, 2016).

On the other hand, several studies have been conducted in Tanzania focusing on anemia but few studies have been aiming to assess determinants associated to IFAS adherence. Similarly, limited studies have been observed in Kasulu district in North-Western Tanzania which is not enough to justify the problem. Other identified gap is that, the efforts to address the low adherence to IFAS were prepared and executed based on data prompted from the Demographic and Health Survey (DHS) that normally conducted in an interval of five years. Predominantly, most of the DHS gives a snapshot of the burden or use but, do not give details on determinants as were not designed for such purpose. Understanding of adherence to IFAS and associated determinants with new interventions that can be effective in such area, could be used to address the current challenges related to low adherence to IFAS. Therefore, to assess adherence to IFAS and associated determinants associated is an essential step to improve maternal and child health.

1.2 Statement of the problem

Supplementation with iron and folic acid among pregnant women is a cost-effective method focusing to overcome the challenge of iron-folic acid deficiency anemia. Despite its effectiveness in restoring iron and reducing neural tube defects, low birth weight, premature births, neonate and maternal mortality, adherence to IFAS is very low among pregnant women in Tanzania. Similarly, there are limited studies conducted in Kigoma about IFAS which is not enough to justify the problem of low adherence to IFAS. Therefore, this study was conducted to assess the adherence to IFAS and its determinants among pregnant women attending ANC in Kasulu district.

1.3 Rationale of the study

Women experience a high demand for iron and folic acid during pregnancy which cannot be easily met by diet alone. Poverty, low dietary intake and poor absorption of iron (Alphonse, 2016; Naithani *et al.*, 2016) are the main identified reasons to exacerbate iron deficiency. Subsequently Iron-Folic Acid Supplementation is considered as an effective and efficient way to replenish rapidly the iron and improving the iron status of an individual up to 95% (Friedrich & Friedrich, 2017). Similarly, IFAS helps in reducing maternal associated risks including maternal morbidity and mortality as well.

Although the importance of IFAS is well established, adherence to IFAS is low among pregnant women. The low adherence might be related to a lack of understanding on associated determinants since most interventions rely heavily on Demographic Health Survey (DHS) that are conducted in interval of five years. In fact, DHS is not designed to assess determinants but rather to give a snapshot of the burden of prevalence or use of services to support the budgeting process. Therefore, the need to utilize a more robust method (mixed method) to assess the adherence to IFAS and its associated determinants for the improvement of adherence to IFAS is very imperative.

1.4 Objective

1.4.1 General objective

To assess the determinants associated with adherence to the Iron-Folic Acid Supplementation among pregnant women in Kasulu district.

1.4.2 Specific objectives

- (i) To assess adherence level of Iron-Folic Acid Supplementation among pregnant women in Kasulu district.
- (ii) To identify the determinants associated with adherence to the Iron-Folic Acid Supplementation among pregnant women in Kasulu district.

1.5 Hypothesis

- (i) There is low adherence to Iron and Folic Acid Supplementation among pregnant women in Kasulu-Kigoma.
- (ii) There is high adherence to Iron and Folic Acid Supplementation among pregnant women in Kasulu-Kigoma.
- (iii) There is no association between socio-demographic, health facility, maternal, household, and medication factors on adherence to Iron and Folic Acid Supplementation among pregnant women in Kasulu-Kigoma.
- (iv) There is an association between socio-demographic, health facility, maternal, household, and medication factors on adherence to Iron and Folic Acid Supplementation among pregnant women in Kasulu-Kigoma.

1.6 Research questions

- (i) What is the proportion of pregnant women who adhere to Iron and Folic Acid Supplementation in the Kasulu district?
- (ii) What are the determinants associated with the adherence to the Iron and Folic Acid Supplementation among pregnant women in the Kasulu district?

1.7 Significance of the study

This research aims to assess determinants associated with adherence to IFAS to improve maternal and child health. In fact IFAS were provided at antenatal clinic to pregnant women during their visit to increase level of haemoglobin and reduce the negative impact associated with insufficiency of iron and folate to women and new born. It is also provided to the ANC for free and once is not available can be accessed in pharmacies around residential for a certain costs. With all reported of the potential benefits to pregnant women, very few countries reported archiving high adherence to IFAS. Therefore understanding the determinants associated with adherence to IFAS is paramount. Adherence to IFAS is also reported to be low in Tanzania (21%) and more in Kigoma as study area (7%) (TDHS, 2015). Further, conducting this study to address the gap of low adherence to IFAS is essential.

1.8 Delineation of the study

Iron and Folic Acid Supplementation is one of the cost-effective intervention designed to control iron and folic acid deficiency among pregnant women. Unfortunately few studies reported about the high adherence the recommended dose of at least 90 days. The reasons for low adherence particularly in a study area are not well known. Therefore, generated data from this study will help to inform the ministry of health, community development, gender, elderly and children, council health management teams and other developmental stakeholders to evaluate the performance of the existing interventions and planning alternative interventions to address the gap of low adherence to IFAS.

CHAPTER TWO

LITERATURE REVIEW

2.1 Introduction

To control anemia among pregnant women iron and folic acid is a vital micronutrient used to carry haemoglobin in human beings for the better health. During pregnancy, iron necessity increases need to facilitate oxygen-carrying due to both fetus and placenta necessities and prevent auxiliary complicity caused by loss of blood at delivery stage (Bothwell, 2000; Lamina & Sorunmu, 2003; Ogunidipe *et al.*, 2012; Rasmussen, 2001). Increased physiological demand particularly in the second trimester which is suitable for expansion of red blood cell mass and transfer of the increased amount of iron for both growing foetus and placenta structure need to be considered (Bothwell, 2000). Similarly, folic acid that obtained only from diet or through supplementation is compulsory for metabolism, growth of foetus and development of pregnancy in generally (Naithani *et al.*, 2016).

2.2 Risks associated with deficiency of iron and folic acid among pregnant women and new-born

Despite of the necessity of iron and folic acid during pregnancy, women are more prone to anemia particularly in developing countries and highly among women of reproductive age (15-49 years). In Tanzania anemia among women of reproductive aged estimated to be 45% (TDHS, 2015). Iron deficiency anemia being a public health challenge, it poses several risks in both women, foetus and new born. In fact is associated with haemorrhage, premature delivery or rupture membrane, pre-term delivery, cardiovascular disease, decreased work capacity of mothers and maternal deaths. During neonates and childhood, anemia causes several risks including, prematurity, low birth weight, small for gestational age, poor cognitive development, morbidity and mortality (Begum, 2012; Ibrahim *et al.*, 2011). On the other hand, folic acid deficiency during the conception or early pregnancy is associated with risks of neural tube defects in the first year of life, preeclampsia, low birth weight, fetal malformation, type 2 diabetes and obesity (Berry *et al.*, 1999; Copp & Greene, 2010; Czeizel & Dudás, 1992; Ogunidipe *et al.*, 2012; Schlotz & Phillips, 2009; Sengpiel *et al.*, 2014; Tosh *et al.*, 2010).

Globally anemia contributes to decreased health and energy of approximately 500 million women and leads to approximately 50 000 deaths during childbirth each year (Alemu & Umeta, 2015; WHO, 2012; Yakoob, Khan & Bhutta, 2014) and contributes to 38% overall maternal death globally (Nguyen *et al.*, 2017; Onyeneho *et al.*, 2016). Iron deficiency alone contributes to 22% (115 000) of all anemia deaths globally (Sengpiel *et al.*, 2014).

In sub-Saharan Africa, anemia contributes to 28.65% of maternal deaths (Alemu & Umeta, 2015; Say *et al.*, 2014). Essentially most of deaths among maternal are associated with nutritional anemia (Khan *et al.*, 2006). Meanwhile in Tanzania anemia contributes to 10% of maternal deaths (Hanson, Mbaruku & Manzi, 2014) while severe anemia is linked to deaths from complications including postpartum haemorrhage (Middleton *et al.*, 2013).

2.3 Interventions strategies to control anemia among pregnant women

Several strategies have been proposed as aspirant to control iron deficiency anemia including supplementation with iron and folic acid, food fortification, dietary and access to food nutritional education, deworming, malaria intermittent prevention tablets, distribution of insecticide-treated bed nets and blood transfusion (Etheredge *et al.*, 2015; Nguyen *et al.*, 2017; Soofi *et al.*, 2017; Stephen *et al.*, 2018; Wright *et al.*, 2017).

To achieve the reduction of the risks associated with iron and folic acid deficiency anemia among pregnant women, Tanzania adopted the WHO recommendation guideline that all pregnant women should receive and consume a dose of 30- 60 mg of Iron and Folic Acid of 400 µg for at least the early six (6) months of pregnancy (WHO, 2015a; WHO, 2012). This strategy is thought to be effective in reducing the risk of neonatal mortality by 34% when taking for optimum of at least 90+tablets (Kavle & Landry, 2017; Titaley *et al.*, 2010). Other studies including one conducted in Nepal found that IFAS can decrease neonatal mortality by 45% in the first week and by 42% in first 28 days and later by taking 150 tablets during pregnancy (Kavle & Landry, 2017; Nisar *et al.*, 2014).

2.4 Challenges with iron and folic acid supplementation intervention

Iron and Folic Acid Supplementation intervention is still facing challenges despite the well-reported of potential benefits to pregnant women. Very few countries have reported to achieve high adherence to IFAS. Surprisingly, the IFAS remains a major program

implemented at many antenatal care clinics to address anemia during pregnancy (Ibrahim *et al.*, 2011; FMOH, 2015; Gathigi, 2013; Peña-Rosas & Viteri, 2009; Sengpiel *et al.*, 2014). Insufficiency information of the reasons associated to low adherence to IFAS is not well described. Similarly, there are still gaps regarding appropriate interventions to address the challenge of low adherence to IFAS. Therefore need for conducting this study to understand adherence to IFAS and associated determinants is important in addressing the gap and planning to reduce maternal anemia.

2.5 Adherence to iron and folic acid supplementation during pregnancy

Adherence to IFAS recommendation is still challenging among pregnant women. Considering that IFAS is the cost-effective intervention to control IFAS but few countries reported to achieve high adherence to IFAS.

Following adherence to IFAS, a descriptive cross-sectional study involving 352 mothers with under-five years' old children attending 7 health facilities in Kenya within Machakos county to assess factors that predict 90+ days (Optimum) IFAS among pregnant women, have reported the low adherence to IFAS (18.3%) (Juma, Oiyee & Konyole, 2015). Other studies revealed the low adherence to IFAS in various locations include Uganda (12%), Norway (16%) and Northern Tanzania (16.1%) (Kiwanuka *et al.*, 2017; Mortensen *et al.*, 2018; Ogundipe *et al.*, 2012). Additionally, studies conducted in Kiambu Kenya and Amhara Western Ethiopia was also reported the low adherence to IFAS 32.7% and 20.4% respectively (Kamau, Mirie & Kimani, 2018; Taye, Abeje & Mekonen, 2015). In contrary, adherence to IFAS was high in other countries include Senegal (51%), Kathmandu-Nepal (73.2%), Tamil-Nadu India (60.6%) and Mizan-Aman Ethiopia (70.6%) (Niang *et al.*, 2016; Rai *et al.*, 2016; Selvaraj, Arumugasamy & Sarkar, 2017; Shewasinad & Negash, 2017). These studies clearly indicated that adherence to IFAS is very low, particularly in East Africa.

2.6 Determinants associated with adherence to iron and folic acid supplementation

In fact Iron and Folic Acid Supplementation was designed to control anemia among pregnant women, unfortunately, adherence is low, particularly in Tanzania. It is also important to understand various factors, including socio-demographic, health facility, maternal, household, and medication factors when designing maternal health interventions to improve

IFAS. In addition, an overview of the study would be described along with a conceptual framework in Fig. 1.

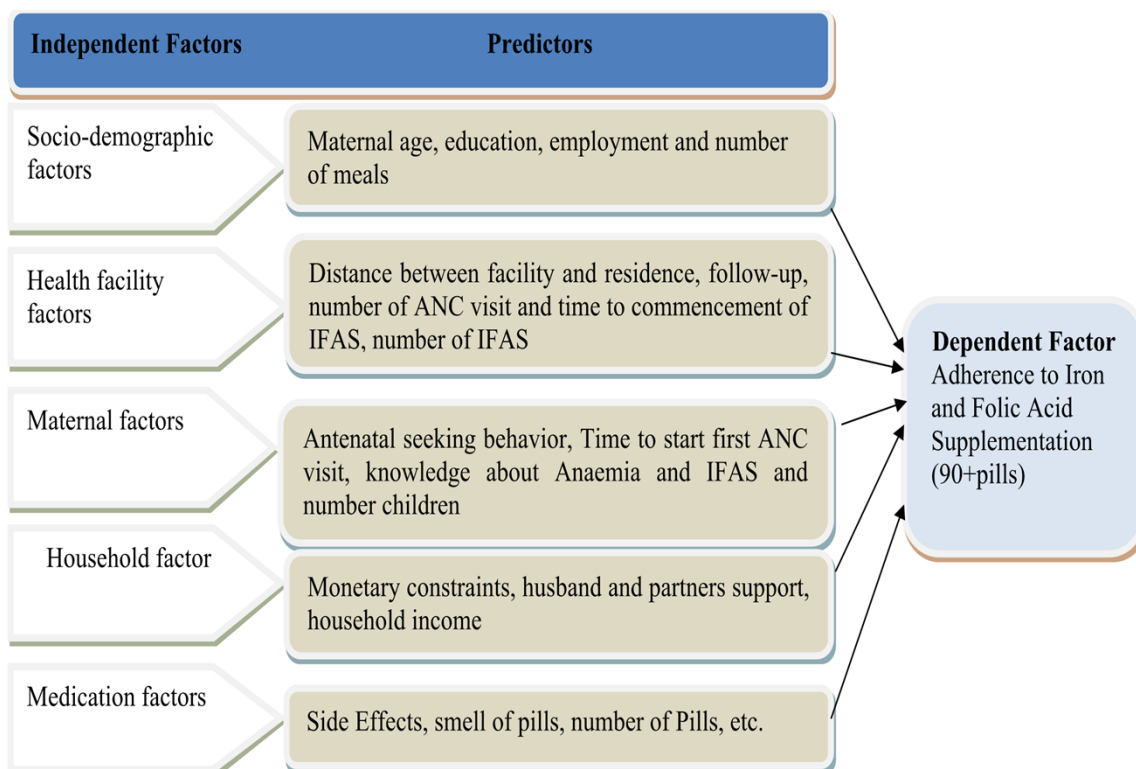


Figure 1: Conceptual framework on determinants of IFAS during pregnancy

2.6.1 Socio-demographic factors associated with adherence to IFAS

(i) Maternal and partners age

In a cross-sectional study conducted in Ismailia government among pregnant women, maternal age at first visit was a factor reported to be positive prediction of pill count adherence (Ibrahim *et al.*, 2011). Additionally, adolescents mothers have been reported to have low uptake of IFAS probably due to delayed ANC visits (Selvaraj, Arumugasamy & Sarkar, 2017). On the other hand, a study conducted among 683 785 births registered in the medical registry of Norway with the aim of assessing paternal characteristics and maternal use IFAS from 1999 to 2010 have reported that adherence to IFAS was lower if the husband was aged less 20 and above 40 years (OR=0.35, 95%, CI: 0.28-0.43 and OR=0.72, 95% CI: 0.71-0.74). In fact, the age of husband was an independent factor regardless of the other factors contributed to the uptake of folic acid (Mortensen *et al.*, 2018).

(ii) Education level

Several studies have been reported that education level has association with the IFAS program. A retrospective study of micro-data involved 19 764 observations for two models of maternal iron supplement and sufficient maternal iron supplementation was conducted in India using IDHS 2005-6. Both the first and second models revealed that women with high education had a high probability of Iron uses compared to women with low education (Ejaz *et al.*, 2013). Another study in Akaki Kality Sub-city Ethiopia found that women who completed secondary school had a lower chance to use IFAS by 34% and 28% respectively but much lower among women who could not read and write and housewife (Gebreamlak, Dadi & Atnafu, 2017). Similarly, low adherence to IFAS was presented in women with low education levels (Gupta *et al.*, 2010). In other study pregnant women were less likely to adhere the recommendation when husband/partners had low education level (Mortensen *et al.*, 2018).

(iii) Employment

Mortensen *et al.* (2018) reported that employment have positive association with adherence of IFAS. Women who had self-employment and manual work had a low chance to adhere the IFAS recommendation probably due to limited time to attend ANC compared to the women who had no job or work in public sectors (Mortensen *et al.*, 2018). This was different in a study conducted in Ethiopia 2015 which reported that women who were employed in the private sector had 1.3 higher likelihood to adhere to Iron and Folic Acid Supplementation compared to the women who were not employed in the private sector (IRR=1.28, 95%, CI: 1.11-1.49) (Gebreamlak, Dadi & Atnafu, 2017).

(iv) Place of residence

In a study conducted in Northern-western of Tigray, Ethiopia from March to April 2014 to determine the factors associated with IFAS revealed that women who were living in small cities had a low chance to adhere the IFAS program compared to the women living in town and urban areas (Gebre, 2015). The similar finding was reported in study conducted in Nigeria and India (Ejaz *et al.*, 2013; Onyeneho *et al.*, 2016). It also reported that living in rural areas and in low-middle income countries have an association with low uptake of the recommended Iron and Folic Acid Supplementation (Mortensen *et al.*, 2018). On the other

hand, women who were living in small cities reported to have a low chance of adhering to IFAS at peri-conception and during pregnancy and vice versa to urban.

2.6.2 Health facility factors associated with adherence to IFAS

There is several health facility factors associated with adherence to Iron and Folic Acid Supplementation among pregnant women. Those factors include a time at the first prenatal visit, a total number of prenatal visits, provision for free of IFAS, screening of Hb and infections, community-based distribution, distance to the health facility, presence of IFAS posters, insufficiency of service delivery, inadequate program support, perceived service, availability of IFAS, knowledge of health care providers and presence of husband at ANC.

(i) Antenatal registration

Several studies had shown that earlier antenatal attendance has been associated with adherence to Iron and Folic Acid Supplementation during pregnancy. A study conducted at Northern-western of Tigray, Ethiopia from March to April 2014 among women attending ANC found that women who attend ANC earlier from the urban side had a 1.8 higher likelihood of adherence to IFAS compared to women who attended ANC late (AOR=1.78, 95% CI:1.076-2.94) (Gebre, 2015). Similar findings were revealed in a study conducted in Burji District, South Ethiopia, that women who appeared earlier at antenatal had a high chance of adhering to IFAS more times compared to the women who attended ANC late (AOR=2.49, 95% CI:1.49-4.27) (Boti *et al.*, 2018). A study conducted in Eastern Kenya reported to be contrary that women who registered earlier at ANC had less chance to adhere to the IFAS program compared to women who were attending ANC late (Juma, Oiye & Konyole, 2015).

(ii) Number of ANC visits

Certainly the numbers of ANC visits were reported to have an association with the adherence to the IFAS regimen. This was revealed in a study conducted in Kenya within Machakos County whereas mothers who visited ANC more than 4 times were likely to adhere to the Iron and Folic Acid Supplementation for 90+ days compared to the mothers who attend less than 4 times (OR=2.76, 95% CI:1.40-5.45) (Juma, Oiye & Konyole, 2015). Similar finding

was reported in others studies (Gebre, 2015; Niang *et al.*, 2016; Onyeneho *et al.*, 2016; Warvadekar *et al.*, 2018).

(iii) Availability of the IFAS at ANC

The availability of the IFAS reported to have association with adherence to IFAS among pregnant. Actually studies conducted in Mizan-Aman Ethiopia, Pakistan and South Africa reported that high adherence to the IFAS program was supported by the availability of IFAS (Nisar *et al.*, 2014; Shewasinad & Negash, 2017; Mbhenyane & Cherane, 2017). Studies conducted in Ethiopia, Pakistan, South Africa, Uganda, and Kenya have reported that less availability and supplies were the reason of low adherence (Kamau, Marie & Kimani, 2018b; Kiwanuka *et al.*, 2017; Nisar *et al.*, 2014; Shewasinad & Negash, 2017).

(iv) Distance between health facility and residence

Definitely distance to health facility is a crucial factor to consider when addressing adherence to IFAS. In a cross-sectional study conducted in Southern Nigeria involving 1500 women with babies of 6 months reported that women who were living close to the health facility had two times more chance of adhering to the IFAS program compared to women who were living far from the health facilities (Onyeneho *et al.*, 2016). A similar finding was revealed in another study conducted in Kolda Senegal, that 53.2% (p=0.001) of women who were living less than 10km's to the ANC had likely to adhere the IFAS program compared to women who were living more than 10km from the ANC (Niang *et al.*, 2016). A qualitative study conducted in Pemba Island Tanzania revealed that the costs of transport to look for IFAS in private pharmacies were cheaper and increased the uptake of IFAS compared to the costs of transport to look for IFAS at ANC although they were provided for free because of a long distance. Private pharmacies and ANC seem to be closer, socially less distant, less waiting time and more accommodating than the government ANCs that was slightly far (Young *et al.*, 2010).

(v) Screening of diseases and haemoglobin level

A wide range of studies were conducted to assess the uptake of IFAS and revealed that the concentration of hemoglobin and malaria infection have association with adherence to IFAS program among pregnant women. This has been observed in a study conducted in Tanzania

among pregnant women from hospital based data of 1999-2008 that women who were not experiencing malaria episodes had low chance to use IFAS 0.6 less times compared to the women who were experiencing malaria episodes (OR=0.57, 95% CI: 0.56-0.62) (Ogundipe *et al.*, 2012). Screening for hemoglobin level (Hb) and testing for malaria have association with the high uptake of IFAS particularly when a mother is informed of the results (Hinderaker, 2002; Ibrahim *et al.*, 2011; Tomashek *et al.*, 2001). Correspondingly, high hemoglobin levels were reported to have an association with the uptake of the IFAS for so long (Abioye *et al.*, 2016; Juma, Oiye & Konyole, 2015).

(vi) Patterns of the day and uptake of IFAS

In a study conducted from February to March 2013 in one primary health center in Tamil Nadu among 145 pregnant women and 182 adolescent girls revealed that 90% of the women were consuming IFAS during night time or immediately after food in rice-based. Women who were consuming IFAS at night were more likely to adhere to IFAS program compared to the women who were not taking IFAS at night after meal (Selvaraj, Arumugasamy & Sarkar, 2017). This was consistency with a mixed study done in Mizan-Aman Ethiopia and reported that, taking the IFAS at night after dinner was associated with high adherence to the IFAS program (Shewasinad & Negash, 2017).

2.6.3 Maternal factors associated with adherence to IFAS

Maternal factors include the age of pregnant mothers at first ANC visit, marital status and age of pregnant women, knowledge, awareness and perceptions, beliefs to follow the practices, gravidity, sick condition, susceptibility and severity.

(i) Antenatal seeking behavior

Antenatal seeking behavior has reported to associate with adherence to IFAS during pregnancy. A cross -country analysis of global demographic and health surveys conducted among eight countries of Afghanistan, Cambodia, India, Indonesia, Myanmar, Nepal, Pakistan and Phillips to assess adherence to at least 90 iron tablets. Antenatal seeking behavior were reported to have association with adherence to IFA in five countries out of eight (Warvadekar *et al.*, 2018). Similar findings have been revealed in study conducted in Nigeria (Onyeneho *et al.*, 2016). Contrary, a study conducted in India reported that

utilization of antenatal clinic (ANC) have a poor association with the adherence to IFAS probably due to perceived services provided at ANC (Gupta *et al.*, 2010). The antenatal seeking behavior was also related to traditional beliefs and cultures of certain communities. Choudhury and Ahmed (2011) found that mothers restricted to health-seeking behavior from communities were less likely to adhere the IFAS program once only husband and in-laws had a control and final say about the access to the health facility. Being restricted was reported to associate with low education level (Choudhury & Ahmed, 2011).

(ii) Time at first ANC visit

Based on the reviewed studies, gestation age at first visit have an association with adherence to the IFAS program. In the analytical study involved 1442 pregnant women in the Kolda area in Senegal reported that women who had a low gestation age at first visit were 2 more times more to adhere IFAS program compared to the women with great gestational age at first visit (AOR=2, 95% CI: 1.47-2.7) (Niang *et al.*, 2017). Similar finding revealed in a cross-section study conducted in South Nigeria that attending earlier in the second trimester adhered to IFAS (OR=1.38, 95% CI: 1.06-1.81) compared to the women who attending ANC in the third trimester (OR=0.67, 95% CI: 0.56-0.82) (Ikeanyi & Ibrahim, 2015). Actually, related findings have reported that women in the third trimester had low adherence to the IFAS program compared to the women in the second trimester (OR= 0.27, 95% CI: 0.10-0.69) (Selvaraj, Arumugasamy & Sarkar, 2017). This study varies with findings reported by Ogundipe *et al.* (2012) whereas being in the third trimester of pregnancy increases the use of IFAS 12 times more compared to the second trimester probably due to fearing of being anemic close to birth or prolonged exposure to ANC services (OR=12.03, 95% CI: 9.66-14.98) (Ogundipe *et al.*, 2012).

(iii) Knowledge of anemia

In study conducted in Mecha District among pregnant women reported that women who have high knowledge of anemia had 4 more times to adhere to the IFAS program compared to those who had low knowledge of anemia (AOR=3.64, 95% CI: 1.78-7.39) (Taye, Abeje & Mekonen, 2015). Similar finding revealed in study conducted in Ethiopia and revealed that women who had knowledge of anemia were more likely to adhere to the IFAS program (AOR=2.083, 95% CI: 1.275-3.404) and (AOR=4.451, 95% CI: 2.027-9.777) compared to

the women who had low knowledge of anemia (Sadore *et al.*, 2015; Shewasinad & Negash, 2017). Similar finding was reported in a study conducted in Eritrea refugee camp Ethiopia and Kathmandu Nepal that women with low knowledge of anemia had less chance to adhere the supplementation program (Getachew *et al.*, 2018; Rai *et al.*, 2016).

(iv) Knowledge of IFAS

Furthermore, women who had knowledge about IFAS were likely to adhere to IFAS during pregnancy. This was reported in Ethiopia that mothers who had high knowledge of (IFAS) were likely to adhere the IFAS 3.5 times more (AOR=3.509, 95% CI: 1.442-8.537) compared to the women who had low knowledge of IFAS. From the similar study above, women who were counseling on IFA supplements were 4 times more (AOR=4.093, 95% CI: 2.002-8.368) to adhere the IFAS program (Sadore *et al.*, 2015). The other study conducted Kiambu County Kenya shown that 48.3% of women who had a high knowledge of IFAS) were likely to adhere to IFAS compared to women with low knowledge of IFAS program (Kamau *et al.*, 2018). Similar results were reported in other studies (Choudhury & Ahmed, 2011; Gebreamlak, Dadi & Atnafu, 2017; Nguyen *et al.*, 2017; Niang *et al.*, 2016; Shewasinad & Negash, 2017).

(v) Women perception's about the benefits of IFAS

In fact a history of negative maternal outcomes including small for gestational age, stunting, miscarriage, stillbirth, and xerophthalmic eye lesion have association with uptake of IFAS for at least 90 tablets and above. A qualitative study involved 39 preconception women (18-40 years) and 24 Village health workers were conducted in 20 communities of Thai Nguyen Vietnam from October 2011 to April 2012. The study found that women who had a good perception of the health benefits of the IFAS and experienced negative maternal outcomes had a high chance to adhere the IFAS program (Nechitilo *et al.*, 2016). Additionally, experience of the negative maternal outcomes and benefits of using IFAS were found to have a positive influence on the uptake of IFAS (Niang *et al.*, 2016; Rai *et al.*, 2016).

(vi) Sick condition

According to Gebreamlak, Dadi and Atnafu (2017) being sick during pregnancy have associated with low uptake of the recommended dose for at least 90+ tablets. A study conducted March to May 2015 among 557 women attending ante-natal and postnatal at Akaki Kality Sub-city found that the incidence rate ratio of IFAS was 55% lower among women who reported that they were taking IFAS when sick (IRR=0.55, 95% CI: 0.37-0.87) compared to healthy women who were not waiting to be sick for them to consume IFAS (Gebreamlak, Dadi & Atnafu, 2017). Another study involved 462 pregnant women who attended from 40 ANC in Mizan-Aman Town Ethiopia from May 2015 to June 2015 found that 53 (18%) were adhered to IFAS because of fearing of being ill (Shewasinad & Negash, 2017). Although this may be true, fearing of being sick during pregnancy has reported to have a positive association with high uptake of IFAS (Boti *et al.*, 2018; Ogundipe *et al.*, 2012; Rai *et al.*, 2016).

(vii) Gravidity

Gravidity has reported to associate with adherence of IFAS. In a study conducted among 364 pregnant women (15-49 years) who attended at Kiambu Country Kenya in October 2016 found that women who were primigravida had 37.2% likely to adhere to the IFAS regimen compared to multigravida women (Kamau *et al.*, 2018). Ibrahim *et al.* (2011) revealed that women who were primigravida had a better chance to adhere the IFAS program compared to the women who were multigravida. In another retrospective study conducted in Tanzania multigravida women had less chance to adhere the IFAS during pregnancy (Ogundipe *et al.*, 2012).

(viii) Women perceptions' on the quality of the health services provided at the facilities

Qualities of health services provided at facilities were highly perceived to associate with adherence to IFAS. A qualitative study conducted in Pakistan found that the trust of health care providers increased the uptake of IFAS (Nisar *et al.*, 2014). On the other hand, insufficient support of the program including financial support, lack of motivation from health care professionals and lack of supplies, access to IFAS and insufficient training and insufficiency services delivery, such as poor provider-user dynamics reported to associated

with low adherence to IFAS. In other studies, unavailability was the common reason for women not to comply with IFAS (Galloway & McGuire, 1994; Kavle & Landry, 2017).

2.6.4 Household factors associated with adherence to IFAS

Household factors, particularly economic status, husband support, and family member's support have impacts on adherence to Iron and Folic Acid Supplementation among pregnant women.

(i) Monetary constraints

Monetary constraints to cover transport costs during ANC visits and purchase of IFAS if they are not provided for free or they are unavailable at ANC were associated with the adherence of IFAS. A study conducted in 2008 at Ismailia using self-reported, pills count and Hb measure that monetary have association with adherence to IFAS. A method of pill count found that women with high incomes were reported to adhere to IFAS (Ibrahim *et al.*, 2011). This was contrary in other studies that, women with high socioeconomic status were less likely to adhere the IFAS program compared to women with low socioeconomic status (Ogundipe *et al.*, 2012; Selvaraj, Arumugasamy & Sarkar, 2017). However in a study conducted in Mizan-Aman town, Ethiopia reported that costs of IFAS were affecting the access and adherence to IFAS regardless of the closeness to health facilities (Shewasinad & Negash, 2017).

(ii) Husband and partners support

Actually motivation through husband and partners support during pregnancy to ensure women are taking IFAS as per recommended dose is paramount. Husbands and partners can motivate women through ensuring availability, accessibility and encouraging them to take IFAS as well as being present at antenatal clinic. A study revealed that women who were receiving support from their husbands or partners were more likely to adhere the IFAS program compared to the women who were not get support and less motivated from husbands or partners (Ejaz *et al.*, 2013). Another study was conducted in 2015, involved 600 households and 2000 recently delivered women in the context of the MNCH program in Bangladesh found that women who had support from their husbands were largely improved maternal nutritional practices and use of IFAS 25 more times compared to the women who

had no support from their husbands ($\beta=25.0$: 95%CI :18.0-32.10) (Nguyen *et al.*, 2017). Similar findings were also revealed in Tanzania whereas a high chance of adhering to IFAS program was reported in women who had support from their husbands and partners (Ogundipe *et al.*, 2012).

(iii) Social support received from family members

Notably, social and family members' support reported to have association with adherence to IFAS program among pregnant women. In some community family members had a final say over women's health. A descriptive study involves 406 women who were attending at hospital Nepal Kathmandu in 2013 found that, women who received social support from family members were more likely to adhere to the Iron and Folic Acid supplementation ($\beta = 0.172$; $P < 0.05$) compared to the women on whom had no support from family members (Rai *et al.*, 2016). Similar finding was obtained from other studies conducted in Ismailia and Norway (Mortensen *et al.*, 2018; Ibrahim *et al.*, 2011). On the other hand, some culture developed in the family or community level of restrict women to attend at antenatal clinic to access health services reported to increase the low adherence to IFAS among pregnant women (Choudhury & Ahmed, 2011).

(iv) Household income

A cross-sectional study conducted in Ibadan Nigeria in 2012 among mothers attending immunization clinics in two hospitals reported that women from household with a high socioeconomic status were likely to adhere to folic acid recommendation 4 times more compared to the women from household with low socioeconomic status (OR=4.29, 95%, CI: 1.59-11.31) (Lawal & Adeleye, 2014). This was contrary a study done in India reported that women from household with high wealth quintile were less likely to adhere to the IFAS program due to good health and accessibility when needed (Selvaraj, Arumugasamy & Sarkar, 2017). In other study women with low socioeconomic status were more likely to use Iron and Folic Acid Supplementation (Ogundipe *et al.*, 2012).

2.6.5 Medication factors associated with adherence to IFAS

Medication factors associated with adherence to Iron and Folic Acid Supplementation among pregnant women include crowding, the number of pills and side effects such as nausea, black stool and bad smell.

(i) Side effects

The side effects have reported to have association with low adherence to the IFAS program. The side effects include nausea, vomiting, dizziness, black stool and heartburn. This being a reason the study was supported by a study conducted in Tanzania (Ekström *et al.*, 1996). Other study conducted in 2015 Ethiopia found that 50.6% of women were not taking IFAS fearing of the side effects (Sadore *et al.*, 2015). Similar finding reported from other studies (Gebreamlak, Dadi & Atnafu, 2017; Ibrahim *et al.*, 2011; Nguyen *et al.*, 2017). In other study change in stool appearance reported to have association with the low uptake of IFAS during pregnancy (Choudhury & Ahmed, 2011). On the other hand counseling on the management of side effects increases the uptake of Iron and Folic Acid Supplementation Kamau *et al.*, 2018). From qualitative findings, side effects were also reported as barrier of consuming IFAS properly (Boti *et al.*, 2018; Getachew *et al.*, 2018; Kiwanuka *et al.*, 2017; Nechitilo *et al.*, 2016; Niguse & Murugan, 2018; Nisar *et al.*, 2014; Siabani *et al.*, 2018).

(ii) Number of pills

The number of pills provided at ANC reported to have association with adherence to the IFAS regimen. Several studies reported that being given enough pills had a higher chance of adhering to the IFAS regimen compared to the women who received few tablets. A literature review study focusing on nutrient supplementation for maternal health in developing countries found that insufficiency services delivery, including a lack of supplies and access to meet the required number of IFAS was associated with low adherence (Galloway & McGuire, 1994). In fact this is true however in other studies, conducted in Ismailia government and Ethiopia revealed that crowding of pills was associated with low uptake of IFAS (Ibrahim *et al.*, 2011; Niguse & Murugan, 2018; Shewasinad & Negash, 2017).

2.7 Other determinants associated with adherence to IFAS

Additionally, mass media (TV and print) and IFAS posters play a greater role in influencing the uptake of IFAS. In global demographic and health surveys conducted among eight countries of Afghanistan, Cambodia, India, Indonesia, Myanmar, Nepal, Pakistan and Phillips found that, high adherence to the IFAS among pregnant women was associated with mass media (Warvadekar *et al.*, 2018). Another study found that lack of IFAS information to support uptake at the ANC was related to low uptake of IFAS (Kamau, Kimani & Mirie, 2018). Also the availability of the follow-up system has been reported to associate with adherence to IFAS among pregnant women. The proper way to make follow up while at home either using a reminding mechanism is crucial. This was also reported in a mixed study conducted in Mizan-Aman Ethiopia (Shewasinad & Negash, 2017). Similarly, understanding the time of commencement to IFAS is a potential factor to ensure adherence to IFAS. In other study women with knowledge on the time to start IFAS had high adherence to the IFAS program (Nechitilo *et al.*, 2016). Fear of using IFAS was also associated with giving birth to big babies. This has been reported to affect the program and compromises the maternal health in the developing countries (Galloway & McGuire, 1994). Another study found that 58% of 628 women who gave birth 12 months before the survey had feared that too many tablets would impair mothers or babies (Taye, Abeje & Mekonen, 2015).

2.8 Knowledge gaps

Adherence to IFAS in Tanzania is low and studies conducted to assess adherence to IFAS and associated factors is limited. Low adherence is still challenging even to neighbors Kenya and Uganda. Also proportion of adherence to IFAS in Kigoma is lower compared to other region in Tanzania .On the other hand training need of anemia and benefits of IFAS at ANC and home visits was identified as a challenge. Late registry to ANC was also noted as another challenge to intervention of IFAS. In many countries supply chain of IFAS was reported to be controversial and need to be strengthened. Improving the livelihood of the women is most essential and in conclusion need for studies about adherence to IFAS using both quantitative and qualitative is imperative in addressing the gap of the low adherence to IFAS.

CHAPTER THREE

MATERIALS AND METHODS

3.1 Study design

This was a health facility-based cross-sectional study design utilizing a mixed-method approach. The study was conducted in Kasulu District in the Kigoma region, Tanzania mainland. Data collection was conducted from March to April 2019.

3.2 Study area

Kasulu District is one of the six districts of the Kigoma Region in Tanzania mainland. It is located in the central North-West in the Kigoma Region and bordered by Burundi in northern and Kibondo district in the East. In the south is bordered by Uvinza District. On the west are Kigoma district and Buhigwe district in the Northwest. According to the census of 2012, Kasulu District has a population of 634 038 with two administrative areas which are Kasulu town (208 244 with 99 368 males and 108 876 females) and Kasulu rural (425 794 with 207 421 males and 218 373 females) (National Bureau of Statistics, 2013). Its coordinates are 4°25'0" and 30° 19' 0" E in degree minutes, seconds or -4.41 67 and 30.33 33 (In decimal degrees). Kasulu is hosting refugees from Burundi (122 626) and 65 500 from Congo in two camps both Nduta and Nyarugusu camp. The number of refugees influx from Burundi in April 2015 increases the population caused by the Nduta Camp in Kibondo to be opened to assist Nyarugusu camp after reached overcapacity Nyarugusu (WFP, 2015). Kasulu District is predominately occupied by the "Waha" ethnic group and the main activities are substance and small farming and medium scale business. The Wasukuma ethnic group was also found in Kasulu district whereby their concentration into Kasulu for animal husbandry purpose (National Bureau of Statistics, 2013). To obtain a reasonable number of participant's two health facilities with ANC services were selected from Kasulu District targeting the pregnant women and women with children aged 0-6 months. Map of Kasulu District indicating the key health facilities attached (Fig. 2).

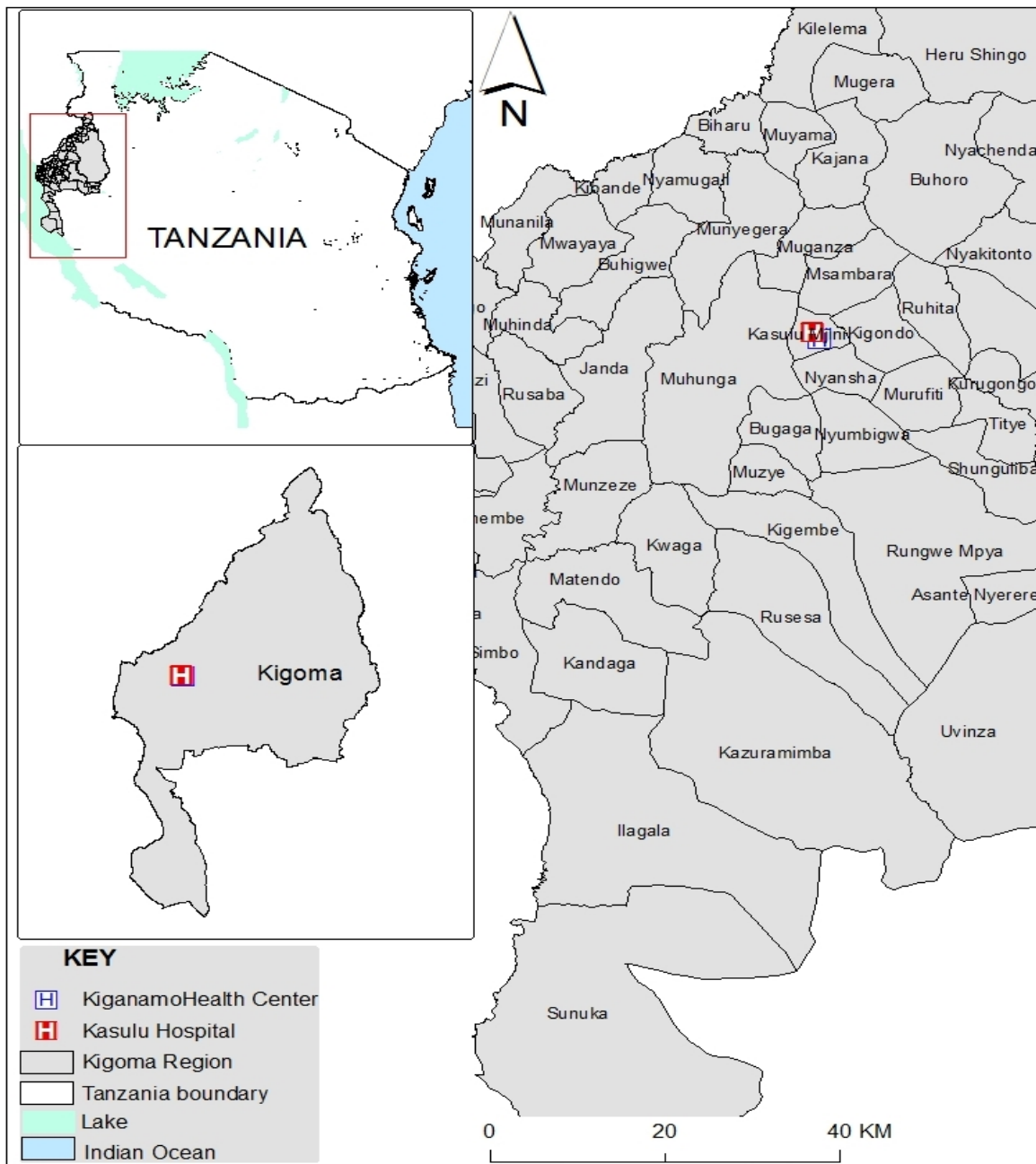


Figure: 2 Map of Kasulu district indicating the key health facilities

3.3 Study population

The quantitative component targeted women of reproductive age (15-49 years) who had children aged 0-6 months attending ANC from two health facilities in Kasulu District during the study period. For the qualitative study, in-depth interviews were conducted with health care providers from maternal and child health care departments including nursing and nutritional officers. Pregnant and women with children aged 0-6 months who not involved in quantitative study were involved in a focus group discussion.

3.4 Inclusion and exclusion criteria

All women of reproductive age (15-49 years) who had children aged 0-6 months and attended to the selected health facilities during their last pregnancies were included in quantitative study as potential participants. Additionally, health care providers who were purposely selected and available at the time of data collection were also included. Generally, participants with children above 6 months, who cannot consent and unable to speak/hear or with mental disorders were excluded.

3.5 Sample size

3.5.1 Sample size for quantitative study

A sample size of 320 women with children aged 0-6 months attending at ANC were enrolled to measure the determinants associated with adherence to IFAS at 95% confidence level ($Z_{\alpha/2}=1.96$) by considering the national adherence to IFAS ($P= 21\%$) (TDHS, 2015), 80% desired power (B_{α}) and 10% of the estimated non-response rate. The population proportion formula was used to calculate sample size, whereas about 10% of non-respondents were considered to maximize the sample size to account for the categorical data analysis.

The sample size was calculated by using mathematical formulae of Cochran Equation (1963:75) (Glenn, 2003).

$$N_0 = \frac{Z^2 P(1-P)}{(e)^2}$$

Where:

N_0 = Minimum sample size.

Z = Abscissa of the normal curve that cuts off an area α at the tails; $(1 -\alpha)$ = Equal to the desired confidence level, e.g., 95%).

e = Desired level of precision or margin error (i.e., 5%).

P = Proportion of an attribute that is present in the population (National adherence level= 21%).

$1-P$ = Estimated proportion of an attribute that is absent in the population.

The value of Z is found in statistical tables that contain the area under the normal.e.g. Z =1.96 for 95% level of confidence.

Therefore, the sample size no= $\frac{1.96^2 \times 0.21 (1-0.21)}{(0.05)^2} = 255$

Add 10% of non-respondents = $255/0.90 = 284$

Therefore, approximately 320 participants were recruited to account for the categorical data analysis.

3.5.2 Sample size for qualitative Study

In qualitative study a total of 40 participants were recruited purposefully to participate in Focus Group Discussion (FGD) and In-Depth Interviews (IDI) from March to April 2019. Thirty four participants were involved in the study to conduct the focus group discussion. A total of 19 pregnant women involved in 2 FGD and 15 women who had children aged 0-6 months were involved in the study for other 2 FGD. On average, each FGD had 7-11 participants. Similarly, a total of 6 health care providers were recruited for in-depth interviews.

3.6 Study sampling

3.6.1 Quantitative study sampling

Purposefully, two health facilities with ANC services which provide services to a large population of women with children aged 0-6 months were selected. The health facilities were selected for a better presentation of the study subject to represent the entire population in the Kasulu district. The Kiganamo health center was included because of the large population that normally attending at the center. Also Kasulu hospital was also included because it provides services as a district hospital with two councils including Kasulu rural and Kasulu town. All women of reproductive age (15-49 years) who had children with 0-6 months and attending antenatal and postnatal services at selected facilities were registered for the study. The generated list of women with children aged 0-6 months was used as a sampling frame for recruiting the intended participants from the population who were attending the ANC on the day of study with the help of ANC health providers by systematic random sampling. Every

3rd of the targeted mothers were selected and in case there was a refusal, the next mother was interviewed until 320 participants were reached (Fig. 3).

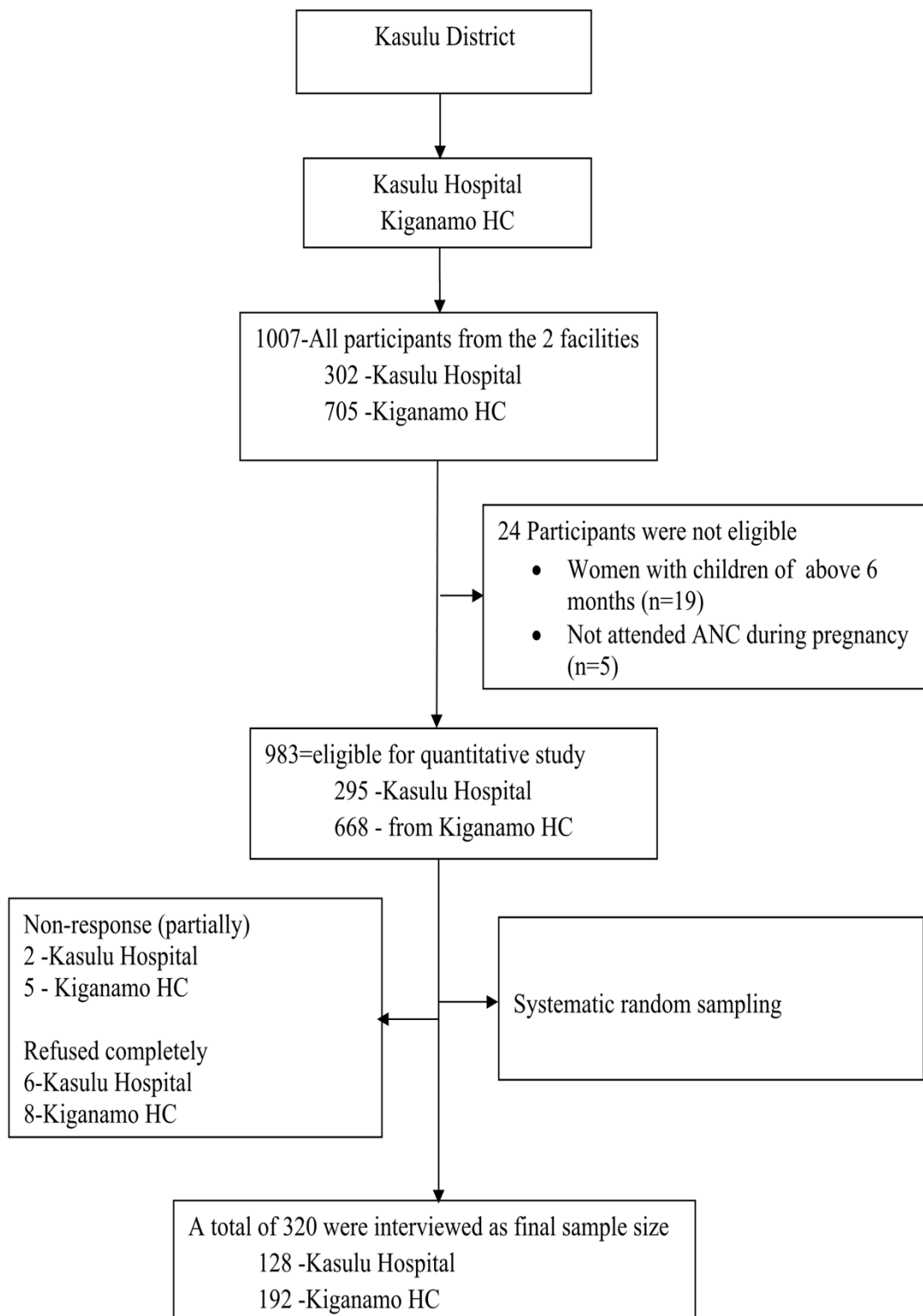


Figure 3: Participants flow diagram

3.6.2 Qualitative study sampling

Similarly, participants were selected through a purposive sampling method from health facilities and directed them in a special room for the focus group discussion. The health care providers were also selected for in-depth interviews. The study was conducted with facilitation from leaders and health care providers at ANC. Saturation point were achieved during focus group discussion particularly in third group and on fifth participant for in-depth interview.

3.7 Data collection procedure

3.7.1 Quantitative part

A quantitative method of data collection method was employed using a structured questionnaire and some questions were adopted and modified from Tanzania Demographic Health Survey (TDHS) and published articles to increase validity and reliability of data (Gebremariam *et al.*, 2019; Nguyen *et al.*, 2017; TDHS, 2015; WHO, 2012). The questionnaire was reviewed by an expert and pre-tested by enumerators to ensure all reliable information was included to capture the intended information. All modifications recorded during pre-testing were made after pre-testing of the questionnaire. A questionnaire was developed in English and translated into Kiswahili and back-translated to English to maintain the meaning and ensuring accuracy and consistency. Enumerators with experience of conducting interviews were recruited and trained to conduct data collection with high integrity.

3.7.2 Qualitative part

During the data collection of qualitative information, Focused Group Discussion and In-Depth Interviews guide was employed to support the quantitative method. Some questions were adopted from published articles (Kamau, Mirie & Kimani, 2018; Kimiywe *et al.*, 2017). Tools were translated into Kiswahili to facilitate data collection and later were back-translated to English to ensure accuracy and consistency. Before data collection, social scientist specialized in agricultural extension and nutrition with high experience in collecting qualitative data trained the team on how to moderate discussions and take notes to capture reactions during interviews.

3.8 Data analysis

3.8.1 Quantitative data analysis

Overall, the data were checked, coded and entered into SPSS software version 22 with statistical significance of p-value <0.05. Descriptive analysis, including frequency, percentages and chi-square test was used during data quality checks and analysis of demographic information. Binary logistic regression model was employed after multicollinearity diagnosis to establish the determinants associated with adherence to IFAS. The findings were presented using the Adjusted Odds ratio (AOR) to estimate the number of 90 days that IFAS was consumed under different scenarios.

3.8.2 Qualitative data analysis

All interviews were audio-recorded, transcribed, coded and translated before the analysis to ensure qualitative information is meaningful. Transcription of each discussion was done precisely and carefully checked if each resulting transcript was accuracy by simultaneously listening to the audio recording and reading transcript. Thematic analysis was done using NVIVO software. The themes that arose in both FGD and IDI were triangulated with quantitative findings.

3.9 Ethical consideration

This study was approved by the Ifakara Health Institute Review Board and provided on 9th February 2019 (IHI/IRB/No: 9-2019). District administrations were visited with an introduction letter supported by the Department of Research and Training of Ifakara Health Institute prior to data collection. This study was conducted according to the Ifakara Health Institute Review Board guideline. Further, the purpose of the study was explained and the written consent was provided to participants while confidentiality was considered during data collection by picking a number in the box and the introduction was made using numbers and not names. Names were recorded during the discussion to facilitate interviews, but not for the analysis. For women with age below 18 years, assent and permission of their guardians (parents, relatives or husband) to participate in the study were considered.

3.10 Dissemination of the results

Research findings would be shared to stakeholder and government through respective meeting and committees including Council Health Management Team CHMT. The part of this study was published in the International Journal of Reproductive Medicine.

CHAPTER FOUR

RESULTS AND DISCUSSIONS

4.1 Socio-economic and demographic characteristics of women with children aged 0-6 months

Generally, a total of 320 participants were recruited from Kiganamo Health Center and Kasulu Hospital and involved in the analysis (Table 1). Of the recruited participants, the majority were attending at Kiganamo Health Center 192 (60%). Less than 50% of women involved in the study were aged 15-24 years while 142 (44.9%) husbands were between 25-34 years. Over fifty percent mothers completed primary education 172 (53.8%) and 72.5% were not employed informal sector and small farming activities. Other socioeconomic and demographic characteristics were detailed in Table 1.

Table 1: Socioeconomic and Demographic Characteristics of Women with Children age 0-6 Months

Variable	Characteristics	n	%
Name of Health Facilities	Kasulu District Hospital	128	40.0
	Kiganamo Health Center	192	60.0
Mothers Age (Years)	15-24 Years	140	43.8
	25-34Years	121	37.8
	35-49 Years	59	18.4
Mothers Education Level	No formal education	69	21.5
	Completed Primary	172	53.8
	Completed Secondary +	79	24.7
Mothers Occupation	Not Employed	232	72.5
	Employed	88	27.5
Marital Status	Single	35	10.9
	Married	285	89.1
Family Size	1-3	89	27.8
	4-6	136	42.5
	6+	95	29.7
Mothers Religion	Catholic	90	28.1
	Protestant	167	52.2

Variable	Characteristics	n	%
Husband Age (Years)	Muslim	63	19.7
	15-24 Years	58	18.4
	25-34Years	142	44.9
	35- Above Years	116	36.7
Husband Education Level	No formal Education	32	10.0
	Completed Primary	169	52.8
	Completed Secondary+	119	37.2
Husband Occupation	Not Employed	140	43.8
	Employed	180	56.2
Household income	Below 200 000 (Poor)	237	74.0
	210 000-400 000 (Moderate)	44	13.8
	410 000 and Above	39	12.2
Number of Meals	Twice and Below	174	54.4
	Thrice +	146	45.6

4.2 Characteristics related to maternal and health facilities during pregnancy

4.2.1 Knowledge of anemia

Knowledge of anemia was assessed using prepared questions. Answers were categories into two groups and mark was put when the answer was correct. In fact finding revealed that a total of 222 participants (69.4%) of women had knowledge of anemia (Table 2). From the qualitative findings, the meaning of anemia was also clarified based on the symptoms of anemia. The symptoms raised during discussion include dizziness, fatigue, feeling sick and edema. Knowledge about the meaning of anemia was contrary to one another among health care providers as quoted below:

“Having Hb below 7.5 during pregnancy is considered as anemia and IFAS will be provided as soon as possible” (IDI: A health care provider).

And another said:

“Anemia in pregnancy is when a woman has a blood level below 12mg/l” (IDI: A health care provider).

Focusing on the causes of anemia both pregnant women and health care providers explained that sitting under the sun, inadequate consumption of vegetables and fruits, diseases (malaria, UTI, HIV, worms) and poor diet were reported as a common cause of anemia. On the other hand, bleeding during childbirth was reported by the majority of women as a leading cause of maternal deaths. In this study miscarriage and stillbirths were mentioned with few women as negative impacts of anemia.

Additionally, control strategies of anemia were also assessed to measure knowledge of anemia. The IFAS program was also known to control anemia, however the majority were enlightened anemia control strategy based on nutritional context, including the access to food and consumption of fruits and vegetables. During the interview with health care providers, a nutrition officer, in particular, added that consumption of meat and cereals would facilitate to control nutritional anemia due to its iron content.

4.2.2 Knowledge of iron and folic acid supplementation

Almost 110 (34.4%) of women were educated on IFAS benefits and over eighty percent had a knowledge that IFAS increases blood during pregnancy as stated in Fig. 4. The belief of IFAS to increase blood was also revealed from qualitative findings; however, other benefits of IFAS were less known though few were mentioned. These include reducing pre-term delivery, small for gestation age and control of neural tube defects.

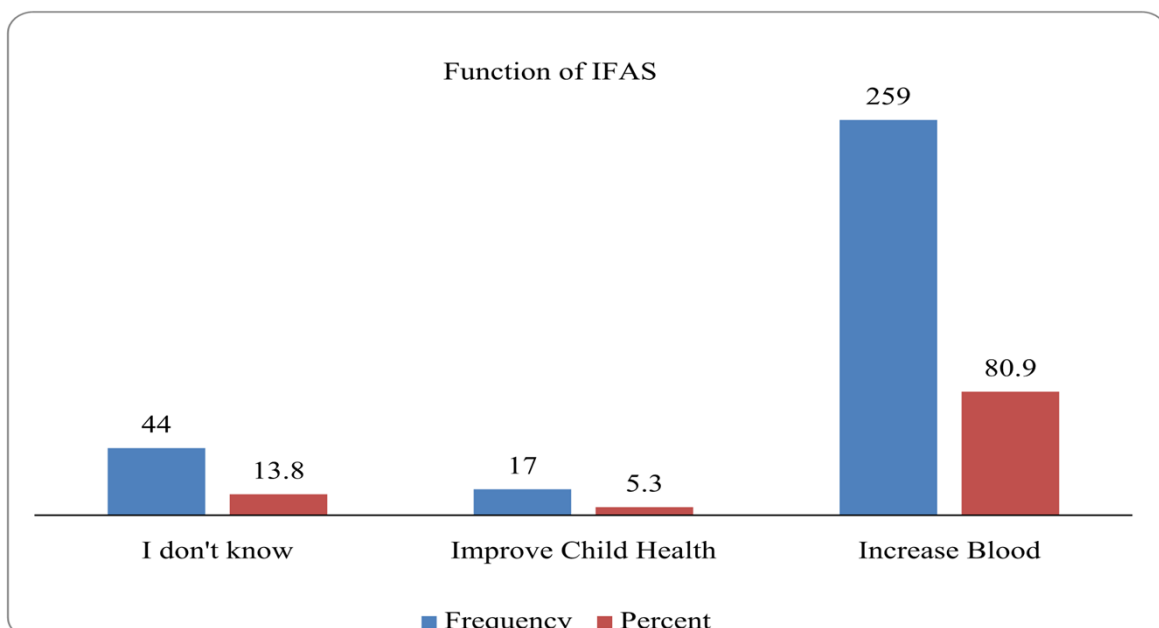


Figure 4: Knowledge of the benefits of IFAS during pregnancy

Similarly, low knowledge about the negative outcomes linked with low use IFAS during pregnancy was revealed. Maternal deaths during delivery were mentioned with few women as negative outcome when IFAS not consumed properly during pregnancy. Another negative impact was deaths of neonates and newborns; however, a great number of women appeared to have a low knowledge on the other negative outcomes related to low use of IFAS as stated:

“If the IFAS tablets would not be used during pregnancy, there is a possibility of a newborn to get albinism” (FGD: Pregnant women).

During discussion another woman who appears to have knowledge of the negative outcomes informed that:

It is better to consume IFAS properly to avoid the negative maternal outcomes, most of us experienced such outcomes without knowing the source until we experience stillbirths or other outcomes and that is a time we get know that, the low use of IFAS was the associated cause (FGD: Women with children aged 0-6 months).

To emphasize the IFAS guideline some questions were posed and the majority found to have low knowledge about the number of pills or days for at least need to be consumed during pregnancy. Mostly were silent and when questioned about the recommended number of the IFAS tablets others were responding using body language. In fact these indicate that, women were not aware of the recommended dose. This was supported by the one participant who raised hand requesting to be told the recommended number of IFAS tables as quotes:

“I don’t know the exact number of IFAS tablets recommended during pregnancy, however, if provided I use it.... “Tell us, please” ... (FGD: Pregnant women).

Further, women were not clear about the proper time to start using the IFAS tablets. Majority start IFAS any time after the ANC registry. A great number of women reported that a proper time to start IFAS is when a woman has two or three month’s pregnancy. Although few of them disclosed that women should start IFAS as soon after becoming pregnant and probably before being pregnant. Considering the low knowledge of timing to IFAS one said:

“I came at first visits when I was two months pregnant, however, I was informed that time to start IFAS was not yet” (FGD: Pregnant women).

4.2.3 Time to start ANC services and reasons for late visit

Starting first ANC visits early is important and increases the chance of adherence to IFAS. However, the study revealed that over sixty percent attending first ANC during the second or third trimester as reported in Table 2. During the interview with the health care providers, similar finding was revealed and one said:

“Few women who came earlier with few month pregnancies; the majority came with six- month pregnancy. However, another came with eight or nine months to find a way of being provided a maternity ward entry card (IDI: A health care provider).

The possible reasons for late visits at first time include less motivation from the husband to accompany their wives at ANC; however, women themselves had a negative perception about early visits as quoted:

We want to be sure of what is inside the womb through fetal movement first, before you starting clinic for the first visit, because if you attend to the clinic early many will laugh at you and say that you are making an advertisement that you are pregnant, it is a show up (FGD: Women with children aged 0-6 months).

Other reasons for late ANC visit include the notion of HIV testing to both partners through the program of Prevention of Mothers to Child Transmission (PMTCT). Testing of HIV during pregnancy was thought to stress the couples. Also a system created to allow women from a few streets to attend ANC visits on a weekly basis particularly at Kiganamo health center to avoid overcrowding in a single day was another reason for the late start of ANC visit. This was a good idea, but its implementation was claimed to mismatch with such an arrangement of having one specific day in a week.

On the other hand, attending ANC visit particularly at first time requires male appearance at ANC as detailed above. Opening the file for registry during pregnancy in the absence of husbands/partners requires arranging with street executive officers to get a letter of introduction which inform that husband was not around or woman had no partner at the moment. The request of appearing with partners/husbands during first ANC reported to

stigmatize the women with unknown partners or had a relationship with a married man. This is because those who attended with partners were prioritized during the provision of services and women attended ANC without partners were late considered to be provided services. Although the intention of men engagement was good, its implementation approach imposed negatively impact time spent at ANC particularly at first visit as quoted:

When I came at clinic for the first time, I found a case of pregnant women who came with a motorcycle driver acting to be her husband. After testing for HIV, the motorcycle driver was infected. During counseling of a pregnant woman, she then disclosed that a man was not her husband, therefore, this strategy puts pressure on women and leading them to tell lies (FGD: Pregnant women).

4.2.4 Distance from living resident to the health facility

In this study distance was estimated by using the time spent from residents to health facilities. In fact over fifty percent of women spent 30 minutes or less to reach health facilities and 46% spent 60 minutes and above (Table 2). Among 320 women participants, 65% were used to walk when attending to ANC visits, and when transport useful, it cost between 1000 to 2000Tshs per each ANC visit. Basically attending to the ANC during pregnancy has an association with distance and IFAS program as quoted:

“Please help us to have a clinic close to our resident, it’s hard for a pregnant woman to walk more than one hour to reach ANC services” (FGD: Pregnant women).

4.2.5 Number of IFAS provided to pregnant women

WHO recommended IFAS to be free provided to all pregnant women at each ANC visit. Despite of the informed information the study revealed that, not all women were given IFAS during their last pregnancy, provided of attending to ANC each visit. Reason for not providing women with IFAS was unknown however others revealed that unavailability of IFAS at ANC was the reason. Almost 128 (40%) were received IFAS at each ANC visit as presented in Table 2 but much fewer (30%) reported receiving more than 90 tablets, prerequisite adherence to IFAS. From the qualitative findings, shortage of IFAS was reported in both health facilities and where necessary shortage was managed through the purchasing

the IFAS from private pharmacies while waiting for IFAS to be supplied by the medical store department (MSD) as quoted:

“It depends on the stock available, if obtainable, we give them 30 or 60 IFAS tablets per month depends on the weight of a single tablet” (IDI: A health care provider).

4.2.6 Knowledge and experience of the side effects

Women experienced the side effects including nausea, vomiting, dizziness, heartburn and black stool however majorities were not experienced any side effects as presented in Fig. 5. Over half of women attended to ANC during pregnancy were also counseled on side effects and its management. Half of the participants reported to receive advice of consuming IFAS at night after a meal. They also informed that proper counseling of side effect management increased adherence to IFAS.

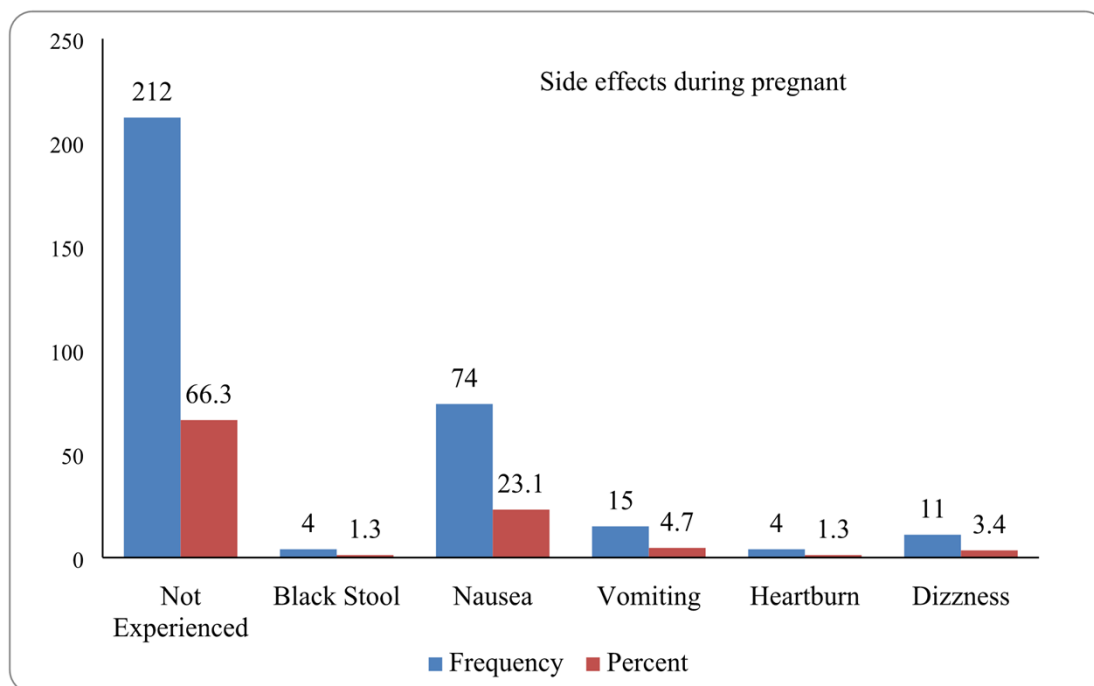


Figure 5: The side effects of IFAS during pregnancy

4.2.7 Women believes, perception and practices at ANC

Women have more trust in health care providers and services provided at ANC during visits. About two hundred and thirty women had a positive perception of the health services provided at facilities during ANC visits (Table 2). From the qualitative findings, the quality of the services provided at both health facilities was promising. However, few challenges

were informed including spending more time at ANC during the first visits and also created environment for waiting services at ANC was poor and not impress to visit ANC. About believes one said that:

“We trust health care providers that they would not provide us with things that will affect my health and my baby” (FGD: Pregnant woman).

The time spent to provide education to mothers on the importance of IFAS was not sufficient to impart understanding and behavior change. The health care providers spent only 30 minutes to provide a group education in an open space or special space at the ANC during visits for both mothers and partners. Despite the less time spent on educating the importance of IFAS, the material and tools to support understanding of the importance of IFAS were missing. Concerning the time spent to give education on IFAS; one woman raised hand and said that:

“Time is limited, without repetition, only educated will understand” (FGD: Women with children aged 0-6 months).

To make clear about limited time, questions were also posed to health care providers and one said:

We are very few and we have a lot of tasks to do including screening malaria, Hb, syphilis, level of sugar, check on progress of pregnancy, HIV testing, counseling and provision of services including IFAS and filling of the books for records. So if you find me alone at the center, I just do simple education, however, I wish to continue with education (IDI: A health care provider).

4.2.8 Health care provider’s knowledge about IFAS

Inadequate knowledge about the benefits of IFAS health care providers was revealed. Lack of confidence to provide the right information about IFAS to women particularly on the benefits of IFAS was also reported during the interview. On the other hand health care providers reported to have good understanding about execution of the IFAS in relation to other programs located to improve maternal and child health some constraints were also reported. About the knowledge of IFAS one said:

We lack a good explanation to pregnant women; we often tell them that, IFAS helps to prevent women from giving birth to a child with a big head, but if a mother asked about how it happens, I believe it will become hard for many of us to explain because we have no further information”. She emphasized, “We need updates (IDI: A health care provider).

About the challenge of IFAS program another health care provider said:

“IFAS does not belong to anybody, because other services like malaria, family planning, and HIV have special people working closely with the ANC and community to ensure the community understands better. Fewer efforts are put to advocate on the importance of IFAS in and out of clinics” (IDI: A Health care provider).

4.2.9 Understanding of IFAS guidelines among health care providers

Iron and Folic Acid Supplementation guide was formulated to provide health care providers with proper understanding relating to IFAS and pregnant women. Unfortunately, low understanding of IFAS recommendation was revealed. In this study, health care providers had less knowledge about the best time to start using the pills, duration of using IFAS and the number of tablets needed to control and prevent the negative effects of iron and folic acid deficiency anemia as quoted:

“Recommendation informed that a pregnant woman should take a pill daily (IDI: A health care provider).

When asked if guideline for IFAS document was in place at health facility level to facilitate knowledge one says:

“Mmh, I am not sure if the guideline document is available probably is outdated”. During discussion about special trainings focusing on IFAS one said I attended maternal training four times, but not IFA specifically” (IDI: A health care provider).

4.2.10 Availability of the follow- up system

In fact no any follow-up system was put in place to allow health care providers to track and remind pregnant women who were provided with IFAS during ANC visits. Health care providers were just keeping a record of all women who were provided with pills and ask

them at the next visit if they still have some pills have or not as the current follow-up systems. During discussion about how do they make a follow-up to ensure adherence one said:

“If they won’t take it, they know themselves with their God, sometimes they lie, especially when you ask them, it is so difficult to monitor the progress, even medical personnel were not consuming pills” (IDI: A health care provider).

4.2.11 Contribution of husband/partners to remind women on consumption of IFAS

Over ninety percent of the women were not reminded to consume IFAS by their husbands or partners (Table 2). The similar situation was revealed from the qualitative findings, whereas the husband reported to have low contribution toward IFAS as reported by one woman during discussion:

“How do they remind us when they do not understand its benefits....They even did not bother...They did not care.... They are less concerned” (FGD: Pregnant women).

Another woman said:

“I always remind myself, if my husband had heard and understood the benefits well during the first visit I wouldn’t forget to use it” (FGD: Pregnant women).

4.2.12 Contribution of private pharmacies to accessibility and availability of IFAS

The contribution of pharmacies towards the accessibility of IFAS was lower compared to ANC. More than ninety percent of women were accessing IFAS from ANC (Table 2). Focusing on the contribution of pharmacies to support access to IFAS, health care providers had a negative perception about IFAS accessed from pharmacies and resulted to poor advises to women access IFAS in pharmacies. Instead health care providers encouraged women to attend ANC properly and access from health centers and hospitals. Additionally, women themselves were less motivated to buy IFAS from pharmacies due to either low knowledge about its benefits or the costs as quoted below:

“Some time It is difficult to advise them to go and buy pills from pharmacies as we fear of quality in terms of expiring date and prescription” (IDI: A health care provider).

Another health care provider said:

Always pregnant women and their husband asking how the government is running out of stock while the private pharmacies have sufficient of IFAS. Such question has association with political issues so we just stick to what is available to health facilities as recommended to be given freely rather than creating complaints with some political figures when advised to buy them in private pharmacies (IDI: Health care provider).

Table 2: Characteristics related to iron and folic acid supplementation during Pregnancy

Variables	Characteristics	n	%
Distance to the Health Facility (minutes)	0-30 minutes	172	53.8
	60 +minutes	148	46.2
Number of Children	1-3Children	221	69.1
	4+Children	99	30.9
Time to Start First ANC visit	0-3 Months	103	32.2
	4-6 Months	197	61.6
	7-9 Months	20	6.2
Number of ANC Visit	Below four visits	121	37.8
	Four and above visits	199	62.2
IFA Given Each Visit	Given Each Visit	128	40
	Not Given Each Visit	192	60
Side Effect	Side Effects	108	33.8
	No Side Effects	212	66.2
Knowledge of Anemia	Knowledgeable	222	69.4
	Unknowledgeable	98	30.6
Educated on IFAs Benefits	Educated	110	34.4
	Not Educated	210	65.6
Reminded by a husband to take IFAS	Reminded	28	8.8
	Not Reminded	292	91.3
Time spend to educate IFAS	Enough	92	28.8
	Not Enough	228	71.2
Perception of health services	High	230	71.9
	Low	90	28.1
Access to IFAS	ANC	296	92.5
	Not ANC	24	7.5
Adherence to IFAS	Adherence	65	20.4
	Not Adherence	255	79.6

4.2.13 Other reasons for not taking iron and folic acid supplementation properly

The other reasons for not taking IFAS includes good health, women's experiences from multiple births, misinformation about pregnancy and pills, side effects such as nausea, dizziness, bleeding during delivery and vomiting, lack of knowledge about the benefits if IFAS, negligence and forgetfulness. Women with experience of having multiple births and with no history of complications did not take IFAS as quoted:

"I am not sick, why I should take it" (FGD: Women with a child aged 0-6 months).

Again the same woman said:

"We were told by our fellow women in our communities that if we use pills we will experience more bleeding during delivery and also we will give birth to blaze skinny babies" (FGD: Women with a child aged 0-6 months).

About the other reasons for not taking IFAS, one of the health care providers informed that in one of the health facility a woman who attended ANC visit and quoted while telling the other women her experience as quoted:

"I have five children; I never used those pills and did not experience any complication, so I did not see the importance" (IDI: A health care provider).

4.3 Adherence and associated determinants with iron and folic acid supplementation

Adherence to Iron and Folic Acid was found to be 20.3%. Reasons for low adherence includes the time to start ANC services, distance from living resident to the health facility, number of IFAS pills provided to pregnant women, etc.

4.4 Determinants associated with adherence to IFAS among pregnant women

The model used to assess associated determinants was significant at $p < 0.05$ with an adjusted R of 0.691 (69.1%) from Nagelkerke R Square. Similarly, the model was the best fit to predict determinants by 91.8%. In a binary logistic regression model, seven determinants were reported to be significant associated with adherence to IFAS. Number of meals per day (AOR=3.349, 95% CI: 1.184-9.212), number of children (AOR=3.462, 95% CI:1.035-12.070), counseled on the benefits of IFAS (AOR=3.864, 95% CI: 1.422-10.500), knowledge

of anemia (AOR=3.840, 95% CI: 1.335-10.685), IFAS given in each visits (AOR=15.718, 95% CI: 5.335-46.311) and gestation age at first visits (AOR=3.724, 95% CI:1.417-9.791) were positive determinants associated with adherence to IFAS supplementation among pregnant women. Living 60 + minutes to the Health Facility (AOR=0.338, 95% CI: 0.131-0.886) was less associated with adherence to IFAS.

Table 3: Determinants associated with the adherence of iron and folic acid supplementation

Variables	Adherence Level		COR (CI at 95%)	AOR (CI at 95%)
	Adhered n (%)	Not Adhered n (%)		
Facilities Name				
Kiganamo Health Center	21 (10.94)	171 (89.06)	0.234 (0.131-0.419)	0.196 (0.073-0.522)
Kasulu District Hospital	44 (35.48)	84 (64.52)		1
Time to the Health Facility (minutes)				
60 +minutes	27 (16.77)	134 (83.23)	1.271 (0.732-2.205)	0.338 (0.131-0.886) *
0-30 minutes	38 (23.90)	121 (76.1)		1
Number of ANC Visits				
4+	49 (24.62)	150 (75.38)	0.466 (0.256-0.865)	0.6106 (0.220-1.692)
Less than 4	16 (13.22)	105 (86.78)		1
Educated on its Benefits				
Educated	35 (31.82)	75 (68.18)	2.800 (1.604-4.890)	3.864 (1.422-10.500)*
Not Educated	30 (14.29)	180 (85.71)		1
Knowledge of Anemia				
Knowledgeable	56 (38.62)	89 (61.38)	3.336 (1.577-7.059)	3.840 (1.335,10.685)*
Unknowledgeable	09 (5.14)	166 (94.86)		1
IFA Given Each Visit				
Given Each Visits	52 (40.62)	76 (59.38)	9.421 (4.848-18.307)	15.718 (5.335-46.311)*

Variables	Adherence Level		COR (CI at 95%)	AOR (CI at 95%)
	Adhered n (%)	Not Adhered n (%)		
Not Given Each Visit	13 (6.77)	179 (93.23)		1
Number of Meals				
Twice and Below	49 (28.32)	124 (71.68)	3.385 (1.721-5.894)	3.439 (1.284-9.212) *
Three times or more	16 (10.88)	131 (89.12)		1
Time at First Visit				
1 st Trimester	33 (32.04)	70 (67.96)	2.725 (1.559- 4.765)	3.724(1.417-9.791) *
2 nd + Trimester	32 (14.75)	185 (85.25)		1
Side Effect				
Side Effects	12 (11.11)	96 (88.89)	0.375 (0.191-0.757)	0.132(0.043-0.406)
No Side Effects	53 (25)	159 (75)		1
Reminded by Husband				
Yes	55 (18.84)	237 (81.16)	2.394 (1.047-5.473)	1.157(0.454-2.946)
No	10 (35.71)	18 (64.29)		1
Number of Children				
Less than 4 Children	57 (25.79)	164 (74.21)	3.185 (1.807- 8.651)	3.462(1.035-11.582) *
4+Chidren	8 (8.08)	91 (91.92)		1

*Determinants associated with adherence to IFAS

4.5 Discussion

To improve the health and wellbeing of pregnant women and newborns united republic of Tanzania adopted the WHO recommendation for IFAS that, all pregnant women must receive and consume one tablet daily of IFAS. The current study reported that adherence to IFAS program for 90 days and above among pregnant women was low and accounts to be 20.3%. This study was consistent with a Tanzania national adherence (21%) (TDHS, 2015) and other studies that have been conducted in Tigray Ethiopia, Kiambu Kenya and Amhara Western Ethiopia (Gebre, 2015; Kamau, Mirie & Kimani, 2018; Taye, Abeje & Mekonen, 2015). On the other hand, adherence was slightly higher compared to the studies conducted in Eastern Kenya, Uganda, Norway and Northern Tanzania (Juma, Oiye & Konyole, 2015; Kiwanuka *et al.*, 2017; Mortensen *et al.*, 2018; Ogundipe *et al.*, 2012). Similarly, adherence to IFAS was lower compared to studies conducted in Northern Ethiopia, Senegal, Kathmandu Nepal, Tamil Nadu India and Mizan-Aman Ethiopia where adherence to IFAS was high (Getachew *et al.*, 2018; Niang *et al.*, 2016; Rai *et al.*, 2016; Selvaraj, Arumugasamy & Sarkar, 2017). The possible reasons for inconsistency of adherence to IFAS might be the study subjects, socio-demographic characteristics, locality, knowledge, follow-up, reminding mechanism and qualities of health services that were offered in the health facilities.

Focusing on the distance from residential to the health facilities several studies reported that distance had a contribution on adherence to IFAS program. In these study women who were spent sixty minutes or more were likely to adhere the IFAS program 0.34 less times compared to the women who were living close to health facilities. Findings from this study was different with other studies reported that women who were living close to health facilities or private pharmacies had more chance to adhere the IFAS program more times compared to women who were living far from health facilities (Onyeneho *et al.*, 2016; Young *et al.*, 2010).

Knowledge on the benefits of IFAS yielded statistically significant results on the adherence to the supplementation program. In this study women who were educated on the benefits of IFAS were likely to adhere to the IFAS 3.9 more times compared to women who were not counseled on the benefits of IFAS. This study was consistent with studies conducted in Northern Wollo Ethiopia and South Ethiopia (Demis *et al.*, 2019; Sadore, Gebretsadik & Hussen, 2015). The findings from qualitative revealed that, if women were not counseled

properly on the benefit of IFAS were less likely to adhere the program. Few women reported to have knowledge on the benefits of IFAS. These include reducing of fetus abnormalities and increasing blood whereas the other thought that, IFAS prevents albinism among newborns. Actually the knowledge of IFAS has connected to time spent on providing counseling about the benefits of IFAS and the prescription. During the discussion time revealed to be not enough for counseling of IFAS in which result to direct effects on low adherence to the IFAS program. The findings were also reliable with a study conducted in Akaki Ethiopia whereas women who believed that IFAS increased blood were more likely to adhere IFAS program compared to women who did not have such belief (Gebreamlak *et al.*, 2017).

In this study, women with good knowledge of anemia were likely to adhere the IFAS programs 3.8 more times compared to women with low knowledge of anemia. This was reliable with studies conducted in Ethiopia and Nepal (Kassa *et al.*, 2019; Rai *et al.*, 2016; Sadore *et al.*, 2015). During focus group discussion majorities of mothers defined anemia focusing on symptoms of anemia including dizziness, fatigue, getting sick and edema. The gaps of the findings in studies might be formed because of different levels of education, quality of education provided at ANC, Number of ANC visits or less availability of media used to create awareness in communities.

The number of tablets given to pregnant women was very crucial for adherence to IFAS program. In this study, women who were provided with IFAS tablets at each visit were likely to adhere the IFAS program 15.72 more times compared to those women who were not provided with IFAS each visit. The study was also reliable with various studies conducted in Mizan-Aman Ethiopia and Pakistan (Nisar *et al.*, 2014; Shewasinad & Negash, 2017) . On the other hand, studies conducted in Ismailia government and Ethiopia reported that women who perceived a crowding of the IFAS had less possibility of adherence to IFAS (Ibrahim *et al.*, 2011; Niguse & Murugan, 2018). In studies conducted in Ethiopia, Pakistan, South Africa, Uganda, and Kenya reported that less availability and supplies were the reason of low adherence (Kamau, Mirie & Kimani, 2018; Kiwanuka *et al.*, 2017; Nisar *et al.*, 2014; Shewasinad & Negash, 2017). The reasons for variation might be the availability of tablets at ANC, knowledge of health care providers about time to start IFAS and number of IFAS essential for adhering to IFAS regime. Being provided IFAS each visit or not might affects

directly the number of tablets provided to women and subsequently lead to low or high adherence to the IFAS program.

Basically, the number of meals per day was informed to have an association with adherence to IFAS. Women from families eating twice or less time per day were found to have high adherence to IFAS 3.4 more times compared to those who were eating three times or more meals per day. This implies that women from low wealth quintiles were likely to adhere to the IFAS program since the number of meals is related to wealthy status. These findings were reliable with studies conducted in India (Selvaraj, Arumugasamy & Sarkar, 2017). This was not the case in India and Nigeria where women from high wealth quintile were likely to adhere to IFAS compare to women from low wealth quintile (Ejaz *et al.*, 2013; Onyeneho *et al.*, 2016). The result might be confounded by education level, occupation of women and their partners, location, health status and fear of being sick.

Several studies reported that, time to start ANC visits was associated with adherence to IFAS program. In this study women who attended ANC visit in the first trimester were likely to adhere to the IFAS program 3.7 more times compared to those who started ANC visit in the second trimester and third trimester. This was aligned with studies conducted in North Wollo Zone, Ibadan Nigeria, Bangladesh and Tamil Nadu, India that early registration in first and second trimester has positive effect to adherence of IFAS program than in the third trimester (Demis *et al.*, 2019; Lawal & Adeleye, 2014; Nguyen *et al.*, 2017; Selvaraj, Arumugasamy & Sarkar, 2017). Low knowledge of the time to start ANC, believes, perception and distance to the health facility were revealed in qualitative study as reasons for early or late ANC visits and hence low adherence to IFAS. Then, late start of ANC visit might affect directly the endorsed duration and number of tablets consumed and later the low adherence to program.

In this study, women who had 1-3 children were likely to adhere the IFAS program compared to the women who have more children. The study was consistent with studies conducted in India and Tanzania that, women with 2 children and below were likely to adhere to the IFAS program 3.5 more times compared to women with more children (Chourasia *et al.*, 2017; Ogundipe *et al.*, 2012). In contrary, a study conducted in Assela town Ethiopia reported that women having fewer children had less likely to adhere the IFAS program compared to women with more children (Niguse & Murugan, 2018). The reasons might be the less experience of having children with complications and vice versa. From the

qualitative findings less economic index, less availability of pharmacies used to sell IFAS and negligence among mothers were the reasons for low adherence to IFAS program.

In respect to medication factors, the study found that pregnant women who were experiencing side effects had less chance to adhere the IFAS program 0.13 less times compared to pregnant women who were not experiencing side effects. This study findings were aligned with studies conducted in Ismailia and Hawassa Ethiopia (Ibrahim *et al.*, 2011; Kassa *et al.*, 2019). During discussion in the qualitative study participants have informed the side effects they experienced during pregnant and these included nausea, vomiting, dizziness, black stool, and heartburn. Other studies done in South Ethiopia, Uganda, Vietnam, Pakistan and Iran have reported that fear of the side effects and less knowledge on the side effect management were reasons of not using IFAS properly (Boti *et al.*, 2018; Kiwanuka *et al.*, 2017; Nechitilo *et al.*, 2016; Nisar *et al.*, 2014; Siabani *et al.*, 2018).

4.5.1 Reason for not taking IFAS as recommended

In this study, the various reasons for women not consuming IFAS during pregnancy were identified. These include wellbeing, women's experiences on the previous births, misinformation about pregnancy and pills, lack of knowledge about the benefits of IFAS, negligence, forgetfulness and side effects, including nausea, dizziness, and vomiting. The majority of women did not use IFAS if they were not feeling sick and become less motivated. This study was reliable with a studies conducted in Ethiopia (Gebre, 2015; Gebreamlak *et al.*, 2017). On the other hand, studies have reported that fear of being sick was associated with adherence to the IFAS program (Boti *et al.*, 2018; Ogundipe *et al.*, 2012; Rai *et al.*, 2016; Shewasinad & Negash, 2017). In addition, women with multiple birth experiences and with no history of complication, they believe that IFAS was not worth. They also felt like to understood all about the importance of IFAS (Nechitilo *et al.*, 2016).

Findings from the qualitative study emphasized that misinformation was another reason for not taking IFAS properly. These includes giving birth to child with heavyweight or skinny with blaze, more bleeding during delivery and having no history of children with complications which was similar to other studies (Galloway & McGuire, 1994; Mbhenyane & Cherane, 2017; Niguse & Murugan, 2018; Rofail *et al.*, 2011; Taye, Abeje & Mekonen, 2015). In regard with forgetful the study was reliable with various studies conducted in various regions including Kenya, Vietnam, Pakistan, Ethiopia, and Iran (Kamau, Mirie &

Kimani, 2018; Nechitilo *et al.*, 2016; Nisar *et al.*, 2014; Sadore *et al.*, 2015; Siabani *et al.*, 2018). In fact condition of being health, being sick or fear of being sick, fear of giving birth to a big babies, difficult delivery, unsafe to babies , spot-on teeth of children and faces were also reported to be the reasons. On the hand, mothers informed that using IFAS have association with more bleeding during delivery and resulted to less motivated of taking IFAS (Boti *et al.*, 2018; Niguse & Murugan, 2018; Ogundipe *et al.*, 2012; Rai *et al.*, 2016; Rofail *et al.*, 2012).

4.5.2 Strength and limitation of the study

The use of mixed-method design was the strength of this study because of triangulation. The bias was managed through, the selection of individuals who accessed health services in a short time interval to reduce recall bias. None payment to participants, structuring and review of questions by a team of experts and proper training of interviewers were other strength of the study. Community based study design, pill counts and measuring of hemoglobin concentration and other biomarkers may predict better the adherence in future studies. The study has its own limitations, including assessing of adherence to IFAS among pregnant women using the self-report method. This might affects the actual adherence to IFAS due to the possibility of over or under-reporting of ingested tablets. Furthermore, not all determinants associated with the adherence of IFAS were investigated and somehow the study was subjective. The study has done into two health facilities which could limit the generalization of the study.

CHAPTER FIVE

CONCLUSIONS AND RECOMMENDATIONS

5.1 Conclusion

This study was focused to understanding adherence to Iron and Folic Acid Supplementation among pregnant women. The study utilized a mixed-method (quantitative and qualitative) whereas women with children aged 0-6months, pregnant women and health care providers were involved. From quantitative findings, adherence to IFAS through self-reporting was low (20.3%). Determinants associated with adherence of IFAS from both quantitative and qualitative were identified, including the time to start ANC, knowledge about anemia among pregnant women, being counseled about the importance of IFAS, number of IFAS provided to pregnant women, number of meals and a number of children women have. The side effects, distance to the health facility, the pattern of a day IFAS was taken and type of health facility a woman attended during pregnancy were found to have less effect on adherence to IFAS. From qualitative findings, low knowledge of a proper time to start ANC visit, low use of private pharmacies, knowledge about side effects management, lack of support from their husbands and forgetfulness were also revealed. Other reasons include women and health care provider's perception, woman's perception, attitude about the use of IFAS, challenges of supply chain to reach ANC, notion of HIV/AIDS testing and lack of priority to IFAS regime were identified as determinants and reasons for low adherence to IFAS.

5.2 Recommendations

To improve adherence to IFAS program, potential strategies should be employed including strengthening the system to create community awareness, home visits, health promotion, education programs among health care providers and pregnant women in and out of ANC, proper counseling among partners, behavior change interventions and reminding mechanism. All stakeholders, Ministry of Health, Community Development, Gender Elderly and Children and Council Health Management Team (CHMT) as well should utilize the finding during evaluation and planning intervention to improve maternal and child health. Strengthening capacity of supply chain of IFAS and knowledge of the health providers through refresher courses and staffs in department of reproductive and child health is potential.

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APPENDIX

Institutional clearance certificate for conducting health research in Kasulu District

 **IFAKARA HEALTH INSTITUTE**
research | training | services

INSTITUTIONAL REVIEW BOARD
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9th February, 2019

National Institute for Medical Research
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Winfrida Benedicto Lyoba,
Ifakara Health Institute,
P O Box 74,
Bagamoyo.

IHI/IRB/No: 09 - 2019

INSTITUTIONAL CLEARANCE CERTIFICATE FOR CONDUCTING HEALTH RESEARCH

On 1st February 2019, the Ifakara Health Institute Review Board (IHI-IRB) reviewed the study titled: ***“Determinants associated with the adherence of iron-folic acid supplementation among pregnant women in Kasulu-communities north-western Tanzania”*** Submitted by Principal Investigator: Winfrida Benedicto Lyoba.

The study has been approved for implementation after IRB consensus. This certificate thus indicates that; the above-mentioned study has been granted an Institutional Ethics Clearance to be conducted in (Kasulu District) Tanzania.

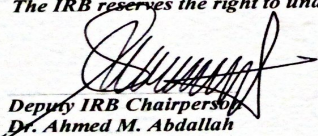
The following documents were reviewed and approved:

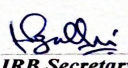
1. Study Protocol
2. Informed Consent Forms English and Kiswahili versions
3. Data collection tools in English and Swahili
4. Budget and budget justification
5. Investigators' CVs

The Principal Investigator of the study must ensure that, the following conditions are fulfilled during or after the implementation of the study:


1. PI should submit a six month progress report and the final report at the end of the project
2. Any amendment, which will be done after the approval of the protocol, must be communicated as soon as possible to the IRB for another approval
3. All research must stop after the project expiration date, unless there is prior information and justification to the IRB
4. There should be plans to give feedback to the community on the findings
5. Any publication needs to pass through the IRB
6. The approval is valid until 1st February 2020.

The IRB reserves the right to undertake field inspections to check on the protocol compliance


Deputy IRB Chairperson
Dr. Ahmed M. Abdallah


IRB Secretary
Dr. Mwifadhi Mrisho

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