FACTORS ASSOCIATED WITH ANAEMIA AMONG PREGNANT WOMEN: A CASE STUDY OF MANDERA COUNTY REFERRAL HOSPITAL

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DECLARATION

I hereby declare that this research is my original work and has not been presented for any other academic award in any other university.

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DEDICATION

I dedicate my thesis to my family whose inspiration especially my brother Abdiwahab Mohamed who helped me financially and encouragements has made me reach this level of my life.

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ABSTRACT

Anaemia is the most common medical related disorder during pregnancy, and has become a major health related problem in a large number of developing nations, mainly where deficiency in nutrition, worm infestation and malaria are common. Both pregnant and non-pregnant women are affected by this disorder. Even so, most women lack adequate knowledge regarding causes of anaemia in pregnancy as the most commonly cited cause is inadequate iron. This study sought to determine factors associated with anaemia among pregnant women in Mandera referral Hospital. The study adopted a descriptive cross sectional research design. The study targeted a population constituting of pregnant women aged 15-49 years in Mandera Referral Hospital. At the time of the study, the hospital had an estimated number of 3651 pregnant women, and these formed the target population for the study. The study adopted simple random sampling and convenience sampling techniques. The study used a questionnaire to collect primary data. Data analysis was carried out using SPSS Version 22.0. The analyzed data was then presented in frequencies, cross tabulations and tables, which were accompanied by appropriate descriptions in line with the objectives. The study findings showed that most of the respondent were in their second or other pregnancies as they had been pregnant before [205, 65.7%] compared to those in their first pregnancy [107, 34.3%] ($p = 0.000$). While on the stage of their pregnancies, slightly more than half [161, 51.6%] were in their second trimester compared to 25.3% in their first trimester ($p > 0.05$). Half of the respondents indicated that they had two pregnancies, 80(25.6%) had three pregnancies. That majority (68.9%) of the respondents were not aware of iron (p value <0.05) and further that 44.2% of the respondents knew the sources of iron compared to 55.8 who neither knew or not sure on the sources (P value >0.05). Majority (199, 63.8%) faced challenges to access and availability of iron rich foods. Most women (249, 20.2%) were aware of Vitamin A, further 96.2% were not aware of the various sources of Vitamin A, and these responses were significant at 5%. Majority 46.2% and 42.3% took foods rich in Vitamin A on weekly and daily basis. The study recommends that there should be interventional measures to educate mothers and initiate importance of iron folic acid supplements as this would be vital in prevention of Anaemia during pregnancy.

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LIST OF ABBREVIATIONS AND ACRONYMS

ASAL	Arid and Semi-Arid Lands
CDC	Centre for Disease Control
HIV	Human Immunodeficiency Virus
IDA	Iron Deficiency Anaemia
IFAS	Iron Folic Acid Supplementation
KAP	Knowledge, Attitudes and Practices
KDHS	Kenya Demographic and Health survey
KEMU	Kenya Methodist University
MOH	Minister of Health
WHO	The World Health Organization

CHAPTER ONE

INTRODUCTION

1.1 Background to the Study

Anaemia is amongst the world's most prevalent problems in health (Findley, 2020). Research has shown that the problem has affected approximately two billion people in the world, which translates to a third of the population in the world, hence; it has become an important problem in public health. In almost every developing nation, between a third and a half of children and female population has been referred as anaemic. Anaemia has as well been regarded as the most common medical related disorder during pregnancy, particularly in developing nations, where nutritional deficiency conditions like malaria and worm infestation are common. The condition mostly affects both pregnant and non-pregnant women (Ferreira et al., 2017).

Chronic anaemia, particularly when concomitant with chronic deficiencies of micronutrients can have major effects on children and women, and can as well affect the attendance of children to school, performance as well as physical work (Ikunaiye et al., 2018). Iron deficiency has become a rampant nutritional health deficiency condition, which has become a burden among people and governments in the global context. Nutritional related anaemia is the most rampant type of anaemia globally. It is caused by iron; folate and vitamin B12 insufficiencies (Khadija, 2016). Causes of anaemia are inclusive of nutritional deficiencies, genetic factors, and infectious agents. Therefore; deficiency of iron is perhaps the greatest and significant due to physiological changes related to pregnancy, that lead to a demand for extra iron that is required for foetus transfer (James et al., 2019).

The World Health Organization (WHO) projected that in countries that are developing; the rates of prevalence in expectant women usually range from 40% to 60%. Most people with anaemia suffer from deficiency of iron. Deficiencies in folate and other reasons usually account for a large percentage of other types of anaemia (Bekele et al, 2016). Maternal anaemia during pregnancy is normally taken to be a risk factor relating to pregnancy outcomes that are poor and could lead to problems threatening the lives of foetus and mother. Present knowledge shows deficiency in iron during the pregnancy period as a risk factor for miscarriage succeeding low birth weights and probable sub-standard neonatal health. The importance of this is to have information to adopt a positive attitude and practices in nutrition; most causes of anaemia are nutrition related (Ferreira et al., 2017).

A previous study done in India found that lower knowledge and attitude about anaemia during pregnancy increases risk in about five times (Thakur et al., 2020). This accelerates and worsens during pregnancy increasing the anaemia risk to about six times. Some of the possible risk aspects that were shown to increase anaemia were knowledge and attitudes regarding the anaemic condition in pregnant women (Schieve et al., 2014). Infections that include hookworm, malaria and other helminths also take part in anaemia pathogenesis during pregnancy. Expectant women are more susceptible to Malaria infections in endemic populations and this places them at a higher risk of anaemia. Anaemia may increase the prevalence of postpartum haemorrhage and predispose to puerperal infection. In developing countries, the two conditions are the leading factors of death in pregnant women. Lack of a balanced diet, especially insufficient intake of fruits, vegetables and animal sourced foods are the major causes of iron deficiency and poor birth outcomes (Semba et al., 2008).

Diets among low-income societies majorly comprise of legumes and cereals, which are slightly lower in iron. These foods are a source of non-heme iron. This type of iron is slightly complex and difficult to be absorbed in the human body (Bekele et al, 2016). The heme iron is absorbed two to three times better than the non heme iron. In addition, little amounts of heme iron necessitate the absorption of non-heme iron. These diets are common among pregnant women and a major determinant of the iron capacity that is absorbed in their bodies. The legumes and the whole grains contain phytic acid, which form insoluble compounds that prevent iron absorption hence deficiency in iron, which results into anaemia (Ferreira et al., 2017).

Majority of women have inadequate knowledge on causes of anaemia during pregnancy and most mothers are aware of the fact that inadequate iron containing diet as the cause of anaemia (Thakur et al., 2020). Regarding the knowledge on sources of rich iron containing foods, most of the women in ASAL regions and in slum regions are characterized with low socioeconomic status are not aware of the that green leafy vegetables, meat, fish, egg are good sources of iron (Weldekidan et al., 2018). Most women in the ASAL regions have no access to fresh supply of green vegetables and heavily rely on meat for iron. Coupled by their inadequate knowledge of proper and adequate nutrition, this has increased their risk of developing anaemia. However, early detection and effective management of anaemia can contribute substantially to reduction in maternal mortality. The rolling out of nutrition education on consumption of healthy foods during pregnancy and strengthening supplementation of iron and folate in pregnant women will ultimately reduce mortality of anaemia and other micronutrient, low birth weight among women (Renzi et al., 2016).

Inadequate knowledge concerning causes of anaemia in pregnancy is a common phenomenon among women. Additionally, they have little or no knowledge regarding iron rich diet; this remains the main cause of anaemia (Bekele et al, 2016). Most of the women living in ASAL and slum regions are characterized with low socioeconomic status and are not aware of iron rich sources of food such as eggs, meat, fish and green leafy vegetables. Most women in the ASAL regions have no access to fresh supply of green vegetables and heavily rely on meat for iron (Renzi et al., 2016). Coupled by their inadequate knowledge of proper and adequate nutrition have increased their risk of developing anaemia. However, early diagnosis and effective management of anaemia can contribute significantly to reduction in maternal mortality. Nutrition education and sensitization of balanced healthy diet before and during pregnancy as well as supplementing pregnant women with iron and folate help reduce mortality related anaemia, micronutrient and low birth weight in women (Semba et al., 2008).

A number of demographic, social economic factors have been closely associated with nutritional diet practice and diversity that many pregnant women adopt. They include occupation, age, level of education, income generated and their marital status (Price et al., 2020). Measuring the impact of national guidelines: what methods can be used to uncover time-varying. Level of education has closely been linked to the choice of diet and eating habits of the pregnant women. Patterns in dietary intake are closely determined by occupation, parity, level of education and age. An increased maternal age and high maternal education are often associated with a healthy and a diversified diet in pregnant women. Women with less education and are not working record a higher parity and are likely to indulge in unhealthy and less diversified diets (Ganapathy & Nieves, 2020).

1.2 Statement of the Problem

Globally, deficiency of iron is the leading cause of anaemia in women during pregnancy. Anaemia prevalence in Kenya is moderately high and pregnant women have a poor nutritional status and anaemic (Abdo et al., 2019). On attendance of antenatal clinics, pregnant women are administered with iron supplements. However, the struggle to fully eradicate anaemia continues to be really high as well as foetal morbidity and maternal mortality in Kenya due to low knowledge of anaemia and type of foods they consume (World Health Organization [WHO] & Centre for Disease Control [CDC], 2015). Many households in Mandera County are vulnerable to food and nutrition insufficiency, poverty, illiteracy and drought have led to minimal access to essential services to the majority of the inhabitants of the County. The anaemia related problems are accelerated by factors such as difficulties in the access of quality maternal health services, which include antenatal services, delivery services and post-natal services. Moreover, marginalization, poor health care, lack of transparency and accountability, negative cultural and religious practices are other factors affecting efforts put in place to curb anaemia (Renzi et al., 2016).

A pregnant woman suffering from anaemia is likely to experience problems during pregnancy and can result to serious complications to the mother and the foetus. Deficiency in iron leads to preterm deliveries, inferior neonatal health and low birth weights (Findley, 2020). In Kenya, the prevalence of anaemia is about 54% whereas 70% of pregnant women in the country suffer from anaemia. This creates the need to evaluate the factor associated causes of anaemia in pregnant women and their knowledge about good diet intake (Khadija, 2016). Most of the studies done in Kenya have sought to evaluate the extent of anaemia and none has been done to and did not ascertain the KAP on anaemia among

women. A study by Khadija (2016) carried out in Kakamega established prevalence of anaemia in pregnancy at 25.7%. Sawe et al. (2015) conducted a study in Kericho District and established a prevalence of anaemia during pregnancy at 24.5%. Currently, there is no study, which has been done to evaluate the knowledge and practices of nutritional causes of anaemia among women in northern part of Kenya. Therefore, this study will seek to determine the factors associated with anaemia among pregnant women attending Mandera Referral Hospital in Mandera County.

1.3 The Purpose of Study

The study was aimed at identifying factors associated causes of anaemia in pregnant women in Mandera County. The study seeks to help the health workers to improve on service delivery to prevent the cause anaemia in pregnant women and to provide awareness towards anaemia and look for ways of intervention.

1.4 Objectives of the Study

1.4.1 Main Objective

To examine the factors associated with anaemia among pregnant women, a case of Mandera County Referral Hospital.

1.4.2 Specific Objectives

i. To determine the socio demographic characteristics of pregnant women attending Mandera County Referral Hospital.
ii. To determine the intake of dietary iron among pregnant women attending Mandera County Referral Hospital.
iii. To examine the intake of dietary folate among pregnant women attending Mandera County Referral Hospital.

iv. To examine the intake of dietary vitamin A among pregnant women attending Mandera County Referral Hospital.

1.5 Research Questions

i. What are the socio demographic characteristics of pregnant women attending Mandera County Referral Hospital.?

ii. What is the intake iron among pregnant women attending Mandera County Referral Hospital?

iii. What is the intake folate among pregnant women attending Mandera County Referral Hospital.?

iv. What is of intake of Vitamin A among pregnant women attending Mandera County Referral Hospital?

1.6 Justification of the Study

In developing countries, prevalence to anaemia is about 15%. However, in Africa, anaemia prevalence especially to pregnant women ranges from (35-75%) (WHO, 2015). In Sub Saharan Africa, the burden of anaemia disease continues to increase due to the additional iron requirements from puberty to menopause. A report by (WHO, 2015) indicates that during pregnancy, 58.27 million women in the world are anaemic. Insufficient knowledge on the causes and prevention measures of anaemia may lead to high morbidity and maternal mortality among pregnant women, and pregnant women have a poor nutritional status that lead to anaemia. The Ministry of Health has laid out policy on Iron supplementation to all women attending antenatal clinic and this can be effectively done if proper knowledge and strategies set out towards nutritional anaemia among pregnant women are well documented.

The micronutrient deficiencies and anaemia remain as major concern for pregnant women; this will lead to reduced mental capacity, poor physical performance and fatigue during pregnancy (Findley, 2020). This study will go a long way into obtaining information relating to anaemia in knowledge level and its application among pregnant women in the Mandera Referral Hospital. In such places, micronutrient deficiency is very high due to insufficient knowledge and poor practices among the pregnant women at Mandera Referral County Hospital, hence; it will help in paving the way forward towards objective intervention measures among women in Mandera County. There is a need to carry out the study to identify key challenges and gaps in giving knowledge and positive attitude, thus the study will be aimed at determining the Nutritional causes of anaemia among pregnant women attending Mandera Referral Hospital.

1.7 Limitation of the study

The study was majorly focusing on pregnant women attending Mandera Referral Hospital. The study foresaw challenges during data collection due to the security reasons that have affected the region. The region is also characterized by high illiteracy rates among women and this posed challenges in data collection.

1.8 Delimitation of the study

To overcome the challenges, the researcher used research assistants who administered the questionnaire using the local dialect to overcome the language and illiteracy barrier. The data collected was collected at the healthcare facility where security was provided.

1.9 Significance of the Study

The study findings will be important to various stakeholders. It will provide the common causes of anaemia such as parasitic infestations such as malaria and hookworm, the

predisposing factors, age, low socioeconomic status and illiteracy, which were critical in anaemia preventions, the knowledge level in nutritional causes of anaemia in pregnant women. Alternatively, the study will avail key information to other researchers and academicians by providing the KAP on the nutritional causes of anaemia in Kenya. This is because few studies have been carried out in Mandera Referral County Hospital and this will improve the information to the researchers and the government, which has been advocating and providing free iron supplementation to the pregnant women in Kenya.

The study may provide key information to the mothers on the need of iron supplementation before and during their pregnancy period as well as the sources of folate and iron. This would contribute to their overall wellbeing through intake of adequate iron and folic nutrients. This may help the residents to observe healthy living to reduce the disease burden among pregnant women through their knowledge.

1.10 Assumptions of the Study

This study assumed that the targeted respondents were well versed with the information required for the study. The study as well assumed that the targeted pregnant women in Mandera hospital provided true information to the best of their knowledge, and that the generated findings are a reflection of a reality in relation to nutritional factors associated with anaemia. The study further assumed that the targeted respondents and the analysis methods utilized were adequate to address the objectives of the study until further studies are carried out that could propose new methods.

1.11 Definition of Key Operational Terms

Anaemia: Refers to the concentration of haemoglobin in the body, below two standard deviations, and the median of a healthy population of the same age, and with a specific reference mean (Abdo et al., 2019).

Attitude: Refers to the perceptive, emotional, motivational as well as cognitive beliefs, which have either positive or negative influence on an individual's practice or behaviour. The feeding habits of individuals are influenced their motivations, emotions, perceptions or thoughts. The attitude influences the future behaviour regardless of individuals' knowledge, and helps in explaining why individuals adopt a certain practice with no other substitutes. The term belief, attitude and perceptions can be interchanged (Ferreira et al., 2017).

Knowledge: It is the individual's ability to understand the causes, signs and symptoms and the prevention measures of anaemia. It is the ability to remember nutrition and food related terminologies, facts and information (Bekele et al, 2016).

Practices: Refers to an observable action of individuals, which can affect their nutrition, for instance, washing of hands, feeding, food selection and cooking. Behaviour and practice are terms that can be interchanged, even though practice is connoted as long-standing practice (Weldekidan et al., 2018).

Public hospitals: refers to a hospital that is under the ownership of the government and receives funds from the government (Ferreira et al, 2017).

CHAPTER TWO

LITERATURE REVIEW

2.1 Introduction

This section reviews literature associated with factors contributing to prevalence of anaemia among pregnant women. The literature review was collected from different sources books, document analysed from hospitals, journals and internet. In the world, anaemia prevalence amongst pregnant women is at 55.9%, anaemia as particularly prominent in South Asia. In India, anaemia is one of most problematic nutrition health related challenges (Sohail et al., 2015). The prevalence of anaemia is between (33- 89%) in pregnant women. There are a number of factors that lead to the increase of anaemia in sub-Saharan Africa. An iron and folate deficient diet is amongst the leading causes of anaemia as well as malaria and hookworm's infections. The rapidly increasing human immunodeficiency virus (HIV) has significantly led the rising cases of anaemia (Gebremedhin et al., 2014).

2.2 Global and National Prevalence of Anaemia

Anaemia, as the state of disease, is manifested through decreased red blood cells presence, which is coined with in decrease concentration of haemoglobin (Ferreira et al., 2017). The complexity of Anaemia is related to various probable pathophysiological causes that range from genetic and environmental, in addition to shifting epidemiological surveillance levels (Gebremedhin et al., 2014). Anaemia currently remains a community health concern that is borderless, and that has great impacts on health, socio-economic states as well as preferential prospects for those that are impacted directly. Regardless of the possibility of intervention as well as treatment, the disease remains to be a great source of morbidity and

mortality at regional and global levels. In the global context, anaemia has affected between a quarter and a third of the total population in the world, even though researchers have provided estimates of risk populations, indicating about a 50%-80% incidence level, principally because of deficiency of iron (Sohail et al., 2015).

Pregnancy is normally an exceptional, exciting as well as a joyous moment in the life of a woman because it demonstrates an astounding nurturing and creative powers possessed by a woman as she also provides a connection to a better tomorrow (Ferreira et al., 2017). Lacking of nutrition, coined with other various factors leads to numerous difficulties throughout the pre-birth period. A major difficulty often noticed in mothers during the antenatal period in countries that are developing countries like India is prevalence of the anaemic condition throughout pregnancy (Gebremedhin et al., 2014). Anaemia refers to a reduction in haemoglobin levels in the body, to lower than the standard range of about 13.5 gm/dl in men, 11.5 gm/dl in women, and 11.0 gm/dl in children as well as in pregnant women). Anaemia has now become a renowned community health related problem related to proliferated risk of mortality and morbidity, particularly in women that are pregnant. Anaemia arises from multiple causes, including nutrition (for instance vitamins as well as mineral insufficiencies), in addition to non-nutritional causes sometimes frequently co-occurring (Khadija, 2016).

Generally, the commonly causal factors include; deficiency of iron, deficiency of folic acid as well as deficiency of vitamin B12. Anaemia that arises from deficiency of iron is normally taken to be a main contributor to the worldwide disease burden (Ogundipe et al., 2012). In those countries that are developed, it has been projected that about 3% suffer from anaemic. In developing countries, this value could be approximately 50%, which has

ultimately contributed to high maternal mortality rates. The inadequacy of foods that are nutritious, food related taboos, as well as cooking and eating customs usually play a major role. Anaemia can be prevented through making women to understand the existence of the problem as well its causes (Gebremedhin et al., 2014).

Globally, anaemia cases have continued to fall over the past few years. A 12% anaemia decline was experienced between the year 2005 and 2011in non-expectant women and (43-38%) decline among pregnant women (Leidy & Gwin, 2020). This indicates that there has been significant success in the efforts to prevent against anaemia. Therefore, it is necessary that countries review their national health policies, infrastructural structures and resources to implement strategies to prevent and control anaemia (Morris et al., 2019). In 2003, the World Bank conducted a study in developing countries and established anaemia to be the eighth leading cause of disease in teenage girls and women (World Bank, 2015).

A study by the World Health Organization- World Health Statistics in 2015, estimated the average prevalence of anaemia in the world to be 41.8%. Research studies have been conducted and they have revealed that Asia and sub Saharan Africa have the highest cases of anaemia (WHO, 2015). Africa has an estimated 57.1% prevalence of anaemia while South East Asia has a prevalence of 48.2%. On the other hand, anaemia prevalence in America has an estimated prevalence of 24.1% in anaemia cases while in Europe it is at 25.1%. Africa has the highest anaemia cases in the world. In Nigeria, the anaemia prevalence ranges between (30-40%). Urban areas in Ethiopia have an anaemia prevalence of 35.9% while the rural areas have a prevalence of 56.8%. Ethiopia as a whole has an anaemia prevalence of 41.9% (WHO, 2015).

In actual figures, the World Health Organization has suggested that roughly 900 million children and women have been affected by anaemia in the global context (Moshi & Mbotwa, 2020). A current approximation of about 38% global anaemia prevalence in women that are pregnant, coined with above 50% of problems relating to deficiency of iron have clearly highlighted the way children and women have extremely been affected by anaemia (Hands et al., 2019). During pregnancy, anaemia has been linked to greater possibilities of occurrence of preterm labour, post-natal contagion rates, low birth weight, infant/maternal mortality as well as low Apgar scores. Occurrence of anaemia has been termed as the utmost in the African continent, reportedly with a prevalence of approximately 58% in expectant women (which is about 17 million) and 69% in infant (84 million) (Ferreira et al., 2017).

A study conducted by Yadav et al. (2014) revealed that the prevalence of Anaemia was high in the course of the immediate post-natal stage, and also at the age of 1 to 4 years in young children, and this recognizes a probable relationship between the pre and post-natal states of anaemia. When focusing on children particularly, anaemia is termed as a life threatening condition that shortens people's lives. It as well affects expressively on the potentials that people have in life. Universally described health problems linked to anaemia in young children include; decreased cognitive ability, impaired growth as well as decreased motor development (Hands et al., 2019).

Severities in anaemia cases have been much more widespread in developing countries. Conditions such as low birth weight, foetal physical and mental disability, maternal and prenatal mortality. On the extreme ends, death of infants is experienced. Often, anaemia is worsened by postpartum haemorrhage and exposes the mother to puerperal infection,

which is a leading cause of maternal mortality in developing countries (Ferreira et al., 2007).

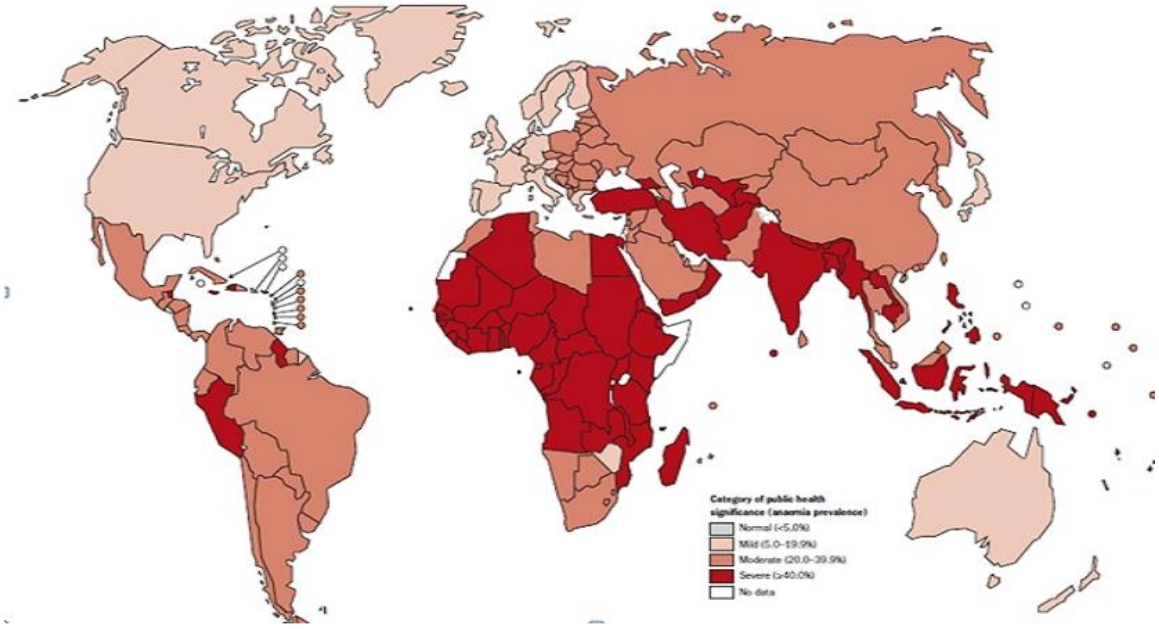
A study in Pakistan postulated that anaemia remains to be a major public health challenge in the rural areas of Pakistan. A study by WHO revealed that 30% and 53% of women and children respectively were already at risk of anaemia. From the study, women were more prevalent to anaemia than children were. The rural areas of Pakistan experienced low haemoglobin tests for earlier prevention and treatment. This has been attributed to lack of anaemia awareness among the communities, often due to low education levels. The costs involved in the testing of anaemia were established as a major challenge hindering the communities from seeking early anaemia testing (Ferreira et al., 2007). During the study, free testing was offered to the participants and the Point of Care System was adopted. Individuals were screened from their homes hence eradicating the barrier of transport and movement from their homes to the clinic. The study concluded that the Point of Care Testing improved the access to anaemia testing and diagnosis. This has also proven success in the testing of chronic, infectious and acute conditions in the rural areas (Akhtar et al., 2013).

A study by Ayenew et al. (2014) has shown that in Ethiopia, around 9.4% of the mothers were anaemic 64.3% were mildly anaemic, 32.1% were moderately anaemic and 3.6% were severely anaemic. The findings of this study were similar to those found in Nigeria 40.4%, Tanzania 47.4%, India 74.8 and Ethiopia 38.2%. The differences in the studies were attributed to the differences in social cultural, economic and demographic characteristics of the various countries. The high prevalence of anaemia in Isparta, Turkey was attributed to thalassemia. The high prevalence in India was due to the high rural population.

A study by Sohail et al. (2015) found out that malaria was a high risk factor for anaemia with a prevalence of 5.4 % at antenatal clinics and delivery units. In addition, the prevalence of anaemia at the antenatal clinics was 86% whereas in the delivery units it was at 72%. Cases of severe anaemia were at 13.6% and 7.8% at antenatal clinics and delivery units respectively. Much higher anaemia prevalence was observed in patients who also had malaria. The study recommends prompt diagnosis and administration of drugs to pregnant women who report cases of parasitemia and asymptomatic infection of plasmodium vivax either in pregnancy or during delivery. Early diagnosis of these diseases results to reduced risk of anaemia (Ogundipe et al., 2012).

Figure 2.1:

Worldwide Prevalence of anaemia 1993-2005



Source: WHO Global Database on Anaemia (2008)

A research was undertaken in South Eastern Africa in the year 2006 and revealed that Tanzania had an anaemia prevalence of 74.4%, Mozambique-58%, Coastal Kenya-75.6% and Rural Zaire -76% (Jane et al., 2017).

In Malawi, between July 2007 and June 2008, a study done on the urban population of women who sought antenatal services at St. Elizabeth Hospital in Blantyre, 57.1% were found to be anaemic. A study by (James et al., 2019), in Kenya, indicated that Kakamega had an anaemia prevalence during pregnancy of about 25.7%. A study in Kericho District showed that the area had an anaemia prevalence of about 24.5% (Sohail et al., 2015).

According to The Global Micronutrient survey done in May to October 2009, Kenya, prevalence of moderate anaemia in pregnancy was 54%, while almost 70% of pregnant women were moderately anaemic. This is despite routine supplementation with iron for all pregnant women who attend antenatal clinics (James et al., 2019). About 17% of Ethiopian women are anaemic during their reproductive age. In addition, 22% of the anaemic women are pregnant. Regardless of the adverse effects the disease has on the population, well-documented data is unavailable on this regard (Central Statistical Agency [Ethiopia] and ICF International, 2011).

A study by Ara et al. (2019) in Bangladesh revealed that micronutrient deficiencies were the main causes of anaemia. Children and pregnant women were found to be more vulnerable. Anaemia is one of the leading public health concerns in the region. Pregnant women are the most vulnerable to anaemia. This micronutrient deficiency has escalated and has had a devastating effect on the general economic growth of Bangladesh. Following a survey in the region, the deficiency and anaemia prevalence was much higher in slum

dwelling school children, pregnant and lactating mothers. This deficiency can be attributed to low quality and less diversified diets, poverty, little knowledge on dietary choices and societal inequalities (Ogundipe et al., 2012).

According to Sari et al. (2001), a research study on the risk factors and severity of anaemia was carried out in Kisumu District and observed that the respondents who had developed obstetric complications, 22% were diagnosed with anaemia. Poor pregnancy care and ailments during the pregnancy period were cited to be the leading causes of the high anaemia prevalence. Sanitary, social and economic conditions were fundamental in the prevalence of anaemia. In Kilifi, a research study was carried out and showed that 10% of the pregnant women who had undergone the antenatal clinic suffered from severe anaemia (Hb<7g/dl) with 76% having Hb, 11g/dl. Hookworm infestation, folate deficiency and malaria were the main causal effects of anaemia. HIV infections also played a key role in the prevalence of anaemia (Sari et al., 2001).

Anaemia has significant effect on social and economic development. It is one of the major challenges facing the health sector in developing countries. It is one of the leading causes of complications during pregnancy in Africa. Death in pregnant women as well as foetal mortality is a major challenge facing developing countries because of anaemia. Anaemia causes about 115,000 maternal and 591,000 per natal deaths in a year (Ogundipe et al., 2012). Causes of anaemia during pregnancy can be as a result of teenage pregnancy, short pregnancy intervals, malnutrition, multiple pregnancies, reduced appetite and vomiting which is a characteristic of many pregnancies. In low socio-economic settings, anaemia is a major phenomenon during pregnancy. Multiparity, multigravida women are at a high risk of developing anaemia as compared to other categories of women. Consumption of tea as

a beverage has also been linked to anaemia as it inhibits iron absorption (Sohail et al., 2015).

In pregnancy, anaemia is the greatest causal factors of the worldwide disease burden, where anaemia caused by iron deficiency contributes to more than a half of all reported cases. Commonly, anaemia has effects on over 70% of pregnant women in most African Nations. In Kenya, there is a very high prevalence of anaemia during pregnancy, which ranges between 45% and 55%. About six in every ten women that are anaemic normally suffer from anaemic, resulting to about 2 in ten maternal related deaths and two in ten prenatal deaths in Kenya (Bôtto-Menezes et al., 2015).

A study in Pumwani Hospital, Kenya, to determine the relationship between anaemia and HIV/AIDS during pregnancy was carried out. The study sought to establish the socio economic characteristics as well as the dietary intakes of the pregnant women. The study found out that anaemia was more prevalent among women who were HIV positive (Bôtto-Menezes et al., 2015). The risk factor for anaemia was two times more in HIV positive patients as compared to the uninfected pregnant women. The study concludes that anaemia was more prevalent among the women from low socio economic backgrounds as they consumed low iron foods. The study therefore recommends that there should be enhanced sensitization of iron consumption and supplementation to women living with HIV/AIDS during the prenatal clinics (Okube et al., 2016). The services should be extended even to areas characterised by low economic status.

In areas where malaria is endemic, intermittent preventive treatment with effective anti-malarial drugs and the distribution of insecticide-treated bed nets need to become implemented on a large scale as per The Roll Back Malaria; a global partnership founded

in 1998 by World Health Organization (WHO), The United Nations Development Programme (UNDP), the United Nations Emergency Children's Fund (UNICEF) and World Bank with the goal of halving the malaria burden by the year 2010 (Bôtto-Menezes et al., 2015).

Other preventive measures include ensuring comprehensive obstetric and social history at the antenatal clinic, proper dietary counselling on proper sources of iron available to the community, family planning services encouraging at least three-year intervals and discouraging eating of soil during pregnancy (Cates et al., 2018). Intense IDA leads to severe outcomes to both the mother and the growing foetus; hence; needs apt interventions with the use of intravenous iron sources. This promotes safety of mothers, who maybe for a number of reasons usually stand against transfusion of blood. On every occasion possible, the causes of this pandemic need to be evaluated before anaemia is subjected to treatment. Transfusion of blood could only be applied in cases of dangerously low haemoglobin levels, in cases of risks of further hazardous falls, as in cases of rapid bleeding, or in cases lacking efficient anaemia treatment (Bôtto-Menezes et al., 2015).

2.3 Nutritional Causes of Anaemia

2.3.1 Iron Deficiency

Deficiency of iron commonly results from an imbalance of iron intake, insufficiency of iron stores as well as the body losing iron, hence; the iron available becomes inadequate to for fully supporting red blood cells production (Bôtto-Menezes et al., 2015). Anaemia arising from iron deficiency hardly leads to death, though its effect on the health of humans remains greatly significant. In developed countries, anaemia is often identified easily and treated fast; nevertheless, it is habitually disregarded by most of the physicians. Centrally,

anaemia has become a great health related problem that touches main parts of a population in the majority of the developing nations (Sohail et al., 2015).

Largely, preventing and successfully treating anaemia arising from iron deficiency has remained distressingly inadequate in the global context, particularly amongst disadvantaged children and women (Getahun et al., 2017). Iron deficiency anaemia is the most common type contributing to 50% of all anaemia, and results to almost a million deaths per year, with three-quarters of these deaths occurring in Africa and south East Asia. Close to 500,000 maternal deaths ascribed to childbirth or early post-partum, occur every year, with vast majority occurring in the developing world. Anaemia poses a 5-fold increase in overall risk of maternal death related to pregnancy and delivery (Bôtto-Menezes et al., 2015).

Iron is known an important constituent of haemoglobin within the red blood cells, and is a component of myoglobin within the muscles, containing about 60% of overall iron within the body. Iron is as well essential for the operation of numerous mechanisms within the cell that include; enzyme based procedures, synthesis of DNA, and generation of energy in the mitochondria. In grownups, the body comprises of 3–5 grams of iron, and 20 to 25 mg being needed on daily basis red blood cells production as well as cell based metabolism (Kassa et al., 2019). Since nutritional consumption is usually limited to 1–2mg per day), some additional bases are required for homoeostasis of iron, like reprocessing of aged red blood cells in the macrophages, exchange of iron in enzymes as well as stores of iron. Approximately 1–3mg iron is lost on daily basis due to menstrual cycle, desquamation of skin, urinary excretion and sweating. Since iron lacks a regulation pathway in its excretion,

intestinal absorption, dietary intake as well as recycling of iron need to be regulated finely (Kedir et al., 2013).

Nutritional iron is often present in two formulae: that is, haem as well as non-haem iron. Iron is normally presented Fe^{2+} (ferrous iron) within the haemoglobin and in the haem formula, and is available in animal foods, including poultry, meat as well as seafood (Getahun et al., 2017). Non-haem form of iron (Fe^{3+}) is available in vegetarian diets (cereals, black tea, dried fruit, cacao and so forth). Haem iron contributes approximately 10–16% of overall intake of iron in populations that eat meat, but, since it is commonly absorbed in a better way at the rate of about 15–35%, as opposed to the non-haem iron form, it accounts for greater than 42% of overall iron absorbed (Kedir et al., 2013).

Haemoglobin is a key component involved in carrying of oxygen in the blood. One of the key components of haemoglobin is iron. Iron can be acquired through the intake of an iron rich diet and when iron is recycled from old blood cells (Getahun et al., 2017). Usually, reduced iron blood amounts results to reduced carrying capacity of oxygen by the blood resulting to interferences in the physiological bodily processes (Gann et al., 2016). An estimate of an average amount of 840-1210 mg of iron is given as the required amount to be absorbed during pregnancy. When this is not achieved, maternal haemoglobin falls to 11 g/dl and below. When the haemoglobin level is 10 mg/dl or below (haematocrit under 33%), a case of iron deficiency is likely to be diagnosed (Katai et al., 2018).

Patients suffering from anaemia resulting from iron deficiency can show signs linked to all types of anaemia, while in most cases they are linked to particular symptoms because of deficiency of iron. Skin pallor, conjunctivae as well as nail beds are the most common symptoms (Getahun et al., 2017). The effectiveness of these symptoms in diagnosis is

improved when physicians have the ability of ascertaining if their availability is an alteration from normality in a patient. Other signs are normally due to hypoxic operation including: exertional dyspnoea that progresses to lack of breath in the rest period, headaches, vertigo, tachycardia, syncope as well as cardiac systolic flow murmur (Bôtto-Menezes et al., 2015).

In cases that are severe, patients may experience dyspnoea during rest, haemodynamic instability as well as angina pectoris. Clinical related characteristics of deficiency of iron in anaemia are dependent on the disease severity, comorbidities, chronicity, age as well as the onset speed. In a number of cases, anaemia becomes asymptomatic, and can only be detected after conducting laboratory based haemoglobin concentrations measurement (Getahun et al., 2017). Deficiency of iron deficiency, particularly has major effects on epithelial cells, and accompanied by a quick turnover. It leads to skin roughness, damaged and dry hair and fingernails that are spoon-shaped). In some cases, loosing tongue papillae takes place, particularly in patients that suffering from mild-to-moderate deficiencies of iron, and remains a worthy gauge of deficiency length (Kassa et al., 2019).

Globally, over two billion people suffer from iron deficiency, with pregnant women being the largest affected category. Problems of inefficient systems, definition related difficulties and lack of accurate and reliable data are some of the challenges marring efforts aimed at combating anaemia. Anaemia that occurs during pregnancy is due to iron deficiency (Katai et al., 2018). In industrialized countries, about 14% of pregnant women ail as a result iron deficiency anaemia (IDA). The developing countries have a higher rate which ranges between (35-75%) with an average of 56% (WHO, 2015).

In the year 2010, worldwide prevalence of anaemia stood at 39·9% (that is, above22 billion had been affected), and deficiency of iron was noted to be the main cause (Getahun et al., 2017). WHO had provided estimates that; between the year 1994 and year 2005, the global anaemia occurrence stood at 24·8percentage within the overall population, ranging from approximately 12.8 percentage in men, to 48·6% in young children at the age of between 0 and 5 years (Kedir et al., 2013). Occurrence ranged from 31.3% amongst women, 42.8% in pregnant women, while it was noted that about 24.7% of people above 60 years had anaemia. In 1995-2011, global anaemia occurrence reduced by approximately 4–6% in young children at the age of 0–5 years and both pregnant and non-pregnant women at the age of15 to 49 years (Kassa et al., 2019).

Deficiency of iron is the commonly occurring dietary deficiency; however, vigorous, population-based researches have been conducted in this area. For example, in the United States, studies on iron deficiency prevalence range from 4.8% to 20%. Nevertheless, at a worldwide phenomenon, the least anaemia burden linked to deficiency of iron was identified in Canada and USA (2.7% of envelope) (Gann et al., 2016). In a number of regions, including the central Asian region (65.8%), the south Asian Region (56.4%) as well as the Andean Latin America (63.5%), a very great percentage of the burden of anaemia resulted from deficiency of iron. Data relating to iron deficiency epidemiology in relation to anaemia are quite untrustworthy, particularly because the disease is frequently credited to deficiency of iron, regardless of its cause. WHO (2016) has estimated that about 50% of anaemia cases globally result from deficiency of iron, though subgroup and regional disparities normally exist. In a number of studies that have been carried out in the

previous 5 years, anaemia due to iron deficiency anaemia has recorded a prevalence of about 20%.

Poor iron intake is increased by some dietary contents, such as phytates and phenolic compounds which reduce iron absorption which ultimately results to increased cases of anaemia. Often, iron deficiency is likely to occur in a person who is suffering from other nutrition related deficiencies. However, this is neglected hence the increased cases of anaemia. In this regard, folic acid deficiency, riboflavin, Vitamin B12, Vitamin A and copper results to an increased risk of anaemia as they play a vital role in haemopoietin (Katai et al., 2018).

During pregnancy, the bodily iron requirements usually increase, hence more constraining to a woman who is already iron deficient. Pregnancy results to increased physiological demands for iron unlike in other physiological processes. Pregnant women highly need iron to supplement their regular iron losses, to cater for the required red blood cells capacity and the demand requirements for the foetal placental unit (Gann et al., 2016). Iron supplements should be recommended to be taken together with orange juice as it increases its absorption. Various studies have shown that substantial iron supplementation during early pregnancy stages has a positive effect on foetal growth and development. Parenteral iron supplementation results to faster haematological recovery due to its variations in oral iron tolerability, absorption and compliance. It is administered through intravenous or intramuscular methods (Kassa et al., 2019).

Globally, one of the major public health challenges is deficiency of iron among the communities. Deficiency in iron is manifested through general ill health and body weakness, premature deaths and bodily foetal abnormalities (Getahun et al., 2017). Iron

deficiency has been known to lower one's capacity to perform hence leading to serious economic growth and development challenges in a region. Anaemia has affected approximately a third of the global total population; and half of reported cases are attributed to deficiency of iron. Anaemia has become a great public health difficulty globally affecting child and maternal mortality, health-care professionals' referrals as well as physical performance (Jane et al., 2017).

Children at the age of 0 to 5 years, women at the age of childbearing are mainly at risk of contracting anaemia. A number of chronic illnesses are habitually linked to anaemia resulting from deficiency of iron, particularly the chronic disease of kidney, chronic failure of heart, inflammatory bowel diseases and cancer (Obse et al., 2013). Assessment of serum ferritin, serum soluble transferrin receptors, transferrin saturation as well as transferrin receptors–ferritin indices are additionally correct compared to typical red cell indices in iron deficiency anaemia diagnosis. On top of the detection for and management of the iron deficiency causes, treatment approaches are inclusive of; prevention methods like fortification of food fortification as well as supplementation of iron (Gann et al., 2016).

2.3.2 Folate Deficiency

Deficiency of Folate is a very great problem affecting women in the global context. This deficiency results principally from insufficient nutritional intake. Characteristic intakes of folate are sub-optimal in most women's diets during their childbearing ages, and also intake of Folate is additionally affected by poor bioavailability as well as cooking losses, that are estimated to range from approximately 51% to 83% (Getahun et al., 2017). Grains fortification with folic acid has led to increased intake of Folate in various developed nations, although such food types are normally unavailable in Ethiopia. Deficiency of

Folate could as well be a result of medical circumstances that amplify the requirement of folate, or lead to improved folate excretion in situations of lactation, pregnancy, malabsorption, alcoholism, liver disease; kidney dialysis, particular anaemias as well as medications interfering with metabolism of folate (Varghese et al., 2019).

Folate is a key player in neurotransmitter synthesis and regulation of gene expression. It plays a crucial role in cell division and amino acid metabolism. The one carbon metabolism process for physiological nucleic acid synthesis is a function of the folate substance (Obse et al., 2013). In pregnant women, an increase in folate consumption is necessary for cell proliferation. Folate also aids the growth of the uterus and placenta tissue as well as the expansion of the mother's blood capacity. Bodily folate requirements are 5-10 folds higher in pregnancy than in non-pregnant women, hence expectant mothers are at an increased risk of folate deficiency (Cook, 2004).

Folate nutrients' deficiency has been associated with numerous risks to health. Serious cases of folate deficiency have often resulted in the megaloblastic anaemia condition. Sub-optimal preconceptions concerning folate nutrients intake increases spontaneous clinical risks of abortion in women, sub-optimal birth weight, neural tube deficiencies as well as preterm birth (Getahun et al., 2017). Disorders related to digestion like diarrhoea, loss of weight and appetite may possibly occur with Folate deficiency, as also can happen with body weakness, sore tongue, palpitations of the heart, headaches, forgetfulness, behavioural conditions and irritability. Furthermore, there has been emerging evidence that deficiency of folate could be associated with osteoporosis development due to increased homocysteine level. Therefore, deficiency of folate has remained a significant issue in public health, predominantly in women at the childbearing period (Varghese et al., 2019).

In addition, folate deficiency results to an increase in the homocysteine substance in the serum and is likely to cause heart related ailments (Getahun et al., 2017). Alternatively, it may result to pregnancy complications such as neural tube abnormalities during conception and pre-eclampsia in the late stages of pregnancy. Pregnant women should take around 400μg of folate in a day. Globally, deficiency in folate has been a major challenge. This deficiency is because of inadequate folate intake (Cook, 2014). The ideal intake of folate in the diet of many women in the childbearing age is very low and is further minimized during cooking and poor bioavailability at an estimated rate of (50-82%).

Deficiency of folate is at present a major micronutrient deficiency, and is also a worldwide concern of public health, particularly amongst women who are at the age of child bearing. A study carried out byVarghese et al. (2019) showed that deficiency of folate in women who are pregnant women intensifies the neural tube defects (NTDs) risk, intrauterine development hindrance, congenital heart deficiencies, premature births as well as oro-facial cleft deficiencies in newborn children. The defensive outcomes of sufficient maternal consumption of folate on the risks of having pregnancies affected with Neural Tube Defects have been proven in interventional and observational studies. Systematic reviews of 29 studies that evaluated the transformations in NTDs prevalence due to compulsory fortification of folic acid food demonstrated a decrease in the Neural Tube Defects occurrence due to compulsory strengthening, with the utmost declines observed in Costa Rica, at 59% decrease, Argentina at 52% decrease, while in Canada there was 49% decrease.

The worldwide occurrence of deficiency of Folate in populations is not known due to unavailability of information from various world parts. Most nations, particularly in

countries that are low income, do not regularly evaluate the status of Folate in the population. In nations lacking information on the status of Folate, reported information on deficiency of Folate is varied due to usage of diverse methods of testing, variable cut-off choices as well as race heterogeneity, ethnicity or geographical regions. A Canada based research through the post-obligatory period of fortification amongst women who are pregnant generated an occurrence of 2% deficiency of Folate.

Worldwide data in relation to cognizance as well as usage of folic acid has been inadequate, has mostly been reported from few studies that have been carried out in a number of countries. A number of such researches have been reporting great cognizance concerning folic acid, and some of them have been reporting low awareness levels. Great awareness levels in relation to folic acid amongst women at the age of child-bearing were established in researches done in the United States in Kansas State (85%), and also Texas state (76%). Awareness levels of Folic acid amongst women who are pregnant that were receiving prenatal care was established to be at very high levels (86%) in Australia. In Nigeria, great awareness levels (62.8%) concerning folic acid amongst women who are pregnant that were in search of prenatal care in some of the largest hospitals were established. Some studies that were carried out in Chile established low levels of awareness of folic acid at 44%. The usage of supplements of folic acid by women who are pregnant was reported at 27% and 18%, correspondingly, in studies carried out in Chile and the United States.

Developing countries have intensified efforts to fortify grains with folic acid so as to increase folate intake. Deficiencies in folate can be because of other medical conditions that result to an increased need or excretion of folate such as lactation, pregnancy, kidney dialysis and certain types of anaemia, malabsorption and other medications that interfere

with folate metabolism (Cook, 2014). Deficiency in folate often leads to a number of health related risks. An increased rate of folate deficiency often results to megaloblastic anaemia. Little folate intake before conception may lead to still births, neural tube defects, low birth weights and unforced abortions.

In South Africa, comparative studies relating to status of folate amongst childbearing women in the stage of pre-fortification versus the stage of post-fortification revealed a decrease in folate deficiency prevalence, ranging from 25.8% to 2%. Great folate deficiency prevalence amongst women at the age of child-bearing was established in researches carried out before mandatory flour fortification implementation in Ethiopia (48%), and also in Benin (33%). Nevertheless, there exists limited data relating to folate deficiency prevalence in Kenya.

In the Kenyan context, two types of intermediations iron and folate supplements for consumption by individuals as well as mandatory fortification legislation of maize that is milled as well as wheat flour have been utilized to improvement of status of folate in populations. A combination Iron-folate supplements are regularly offered to women during their initial antenatal care (ANC) visits (at below 16 weeks' of gestation) with intentions to prevent anaemia, nevertheless, they cannot reduce NTDs risk, since neural tubes normally close at the age of 21-28 days after conception has taken place, before the majority of women are aware of pregnancy. The Kenya Food, Drug and Chemical Substances Act were amended in 2012 to comprise of compulsory fortification of folic acid in maize as well as wheat flour. Media campaigns that promote the usage of flour that is fortified flour have been done in order increase awareness, and promote fortified flours' demand since 2012.

2.3.3 Vitamin B-12 Deficiency

Vitamin B12 is also referred to as Cobalamin, and is grouped amongst the eight B vitamins. It plays a major role in promotion of metabolism in the cell, and is intertwined closely with folate and another vitamin B (Anlaakuu & Anto, 2017). Since its discovery, and characterization Vitamin B12 for approximately 60 years is known to have played a fundamental role in prevention of pernicious anaemia, and its lack or the presence of this disease is normally termed as Vitamin B12 deficiency) (Ferreira et al., 2017). Pernicious anaemia first attained its suitable eponym due to the eventual deadly haematological and devastating neurological manifestations of the disease and was later shown to be caused by autoimmune destruction of gastric parietal cells and their product, intrinsic factor (also known as gastric intrinsic factor), which is required for B12 absorption (Odhiambo et al., 2016).

Previously perceived as a dietary deficiency disorder mainly resulting from the Vitamin's mal-absorption and restricted only to the old, predominantly those form the Northern European region, deficiency of B12 is currently known as a global dimensions' problem, commonly resulting from dietary insufficiency, predominantly amongst women at the childbearing age as well as children (Adanikin & Awoleke, 2016). Sources of Vitamin B12 include milk, meat and eggs. Deficiency in vitamin B12 can be caused by the inability of the small intestine to absorb the nutrient (Obse et al., 2013).

This may be due to previous stomach surgeries, bacterial growth or any other intestinal disease. It is also caused by tapeworms ingested from fish or its products. However, lack of the intrinsic factor is the main cause for vitamin B12 deficiency. Lack of intrinsic factors

normally results to low absorption of vitamin B12. Anaemia as a result of vitamin B12 deficiency is called pernicious anaemia (Anlaakuu & Anto, 2017).

Vitamin B12 deficiency is mainly manifested in the nervous system and blood. Classical expressions of deficiency Vitamin B12 were initially recognized in the pernicious anaemia condition, a cause that was unknown then. Ever since, the range has considerably shifted, beginning with the new identification of neurological expressions (like as motor and sensory instabilities (predominantly in the lower boundaries), ataxia, cognitive degeneration resulting to psychiatric disorders and dementia). It is frequently dominant and can regularly happen in the absence of haematological problems (Obse et al., 2013).

Additionally, the manifestations of subtler B12 deficiency, made complete possible through assays' introduction for metabolites methyl malonic acid (MMA) as well as homocysteine in clinical practices (Obse et al., 2013). This has made the landscape broad of what could be attributed to deficiency of Vitamin B12, though has opened a Pandora's controversy box relating to what might be taken to be actual. Clinical related deficiency of Vitamin B12 compared to metabolic inadequacy states of the vitamin. Progression from the normal rates to clinical deficiencies goes through an inadequacy stage through which biochemical indication of inadequacy of B12 in increased blood form and tissue degrees of homocysteine and MMA and deteriorating B12 levels that are bound to transcobalamin (also referred to holotranscobalamin). This precedes morbid manifestations' expression I case of deficiency. This situation has as well been referred to as 'sub-clinical' Vitamin B12 shortage, and is linked to marginal or B12 intensities (Kassa et al., 2019).

Deficiency of Vitamin B12 is greatly incidence amongst old people, largely rising above 60years at age between 21 and 23 (Ogundipe et al., 2012). Fundamental deficiency causes

are varied and well go beyond the 2–5% pernicious anaemia incidence amongst older people, about 10-15% show sub-clinical deficiency of B12 that can frequently, though not at all times, be standardized with therapy of Vitamin B12. The incidence is additionally greater in the 'oldest-old', where reports have shown that about 23–36% of individuals at the age of 80years and above suffer from deficiency of Vitamin B12. Flexible vulnerability across diverse populations as well as racial groups has frequently been established (Anlaakuu & Anto, 2017).

Both Pregnancy and lactation change the status of maternal B12 in a way that it enables B12 transfer to the infant as well as foetus (Okube et al., 2016). Intense anatomical and physiological alterations happen in almost every organ in pregnancy, with significant results on biochemical markers, therefore; confounding the micronutrient status evaluation and limiting the usage of reputable orientation choices determined in women with less than the reported limit levels that define deficiency in normal women. Certainly, this escalation is dependent on the status of maternal B12, and is less in women consuming supplements (Kedir et al., 2013). This presents a great requirement for particular ranges of reference on the basis of Vit-B12-replete (this is one which is supplemented to standard intensities) in pregnant as well as lactating women (Lebso et al., 2017). Relative to these alterations, the true occurrence of Vit-B12 shortage in pregnant women is hard to measure, though it reportedly occurs in <10% (in Brazil and Canada) to >75% (in parts of Turkey and India) of expectant women 33–35%. In one research, postpartum period, maternal circulation of Vitamin B12 level was reported to be considerably greater than in non-expectant women. This could certainly symbolize physiological adaptations to improve maternal B12

mobilization in stores so that they can be transferred to the infant through accumulative levels of breast milk (Kedir et al., 2013).

Deficiency in vitamin B12 deficiency has an incidence of 10-28% in uncomplicated pregnancies. Sources of vitamin B12 are mainly animal products. An estimated amount of over 1000μg is available to fertile women who often have a balanced diet (Kiwanuka et al., 2017). During full term, vitamin B12 in a foetus ranges between 25-50μg. About 20% of women indicate signs of a significant reduction in vitamin B12 levels in the pregnancy period and this accelerates in the third trimester. The vitamin B12 levels in the pregnant mother determine the level of vitamin B12 in the foetus. Vitamin B12 is transferred through active transport from the mother's placenta into the foetal circulatory system, which often results in double the volume of foetal serum as compared to maternal serum capacity (Okube et al., 2016).

Deficiency in vitamin B12 leads to anencephaly, a condition where the foetus is born without a brain and hence dies immediately after birth. A study by Shoran et al. (2019) identified three anencephalic mothers and found that they had very low Vitamin B12 levels. This might have been the case as vitamin B12 is a key player in the metabolic activities of the neural tissue. Other pathological conditions that take place as a result of deficiency in vitamin B12 include neuronal death, demyelination and axonal degeneration (Shoran et al., 2019).

Women who do not receive adequate dietary requirements are most likely to experience vitamin B12 deficiency (Kiwanuka et al., 2017). Vitamin B12 plays a crucial role in DNA synthesis, which is a requirement for cell multiplication in foetal development. Other conditions caused by vitamin B12 deficiency include hyperhomocysteinemia. B12

shortage has recently emerged as a great concern in public health in most low-income nations. A study carried out by Okube et al. (2016) recognized infants, infant children as well as expectant women and lactating mothers as the most susceptible groups. Approaches for preventing B12 shortage as well as its significance in public health could be deliberated in a life-course theory (Lebso et al., 2017).

The status of Maternal B12 during the prenatal period as well as cord blood concentration of B12 predict the offspring's status well and all the way into the early adulthood, and highlights an essential responsibility for vitamin status in the mother to avert deficiency of vit-B12 in the future generations (Kiwanuka et al., 2017). Outstandingly, this transgenerational sequence turns into a self-perpetuation if a foetus happens to be female. This recommends that improvement of the nutrition in young girls potentially improves the B12 status 'legacy' in a population for several generations, and reduces related morbidity levels. The status of Maternal B12 status is undesirably influenced by combinations of foods that exist poorly in foods that are animal-sourced, high fertility degrees as well as short inter-expectancy interludes, and is further intensified by socio-cultural factors like early marriages coined with adolescent expectancies, and dietary taboos during expectancy and lactation (Lebso et al., 2017).

2.3.4 Vitamin A

Night blindness and an increase in maternal mortality are some of the conditions brought about by a deficiency in vitamin A. Cases of premature births and intrauterine growth retardation have also been attributed to vitamin A deficiency. Symptoms from a person suffering from vitamin A deficiency are inclusive of night blindness, exophthalmi (dry eyes that fail to produce tears), keratomalacia (the dryness and clouding of the eye's cornea,

combined with ulceration), Bitot spots (presence of keratin fragments in the conjunctiva) as well as photophobia. Follicular hyperkeratosis (disproportionate keratin development along the hair follicles) that takes place due to malnourishment indicates existence of deficiency of Vitamin A (Milman et al., 2013).

Deficiency of Vitamin A has remained to be a major problem in public health amongst women, that affects about 20 million expectant women, and the largest burden occurs in the World Health Organization regions of South-East Asia and Africa. Throughout gravidity, vitamin A is known to be necessary as it contributes to the wellbeing of the mother, in addition to health of the developing foetus (Msemo et al., 2018). This nutrient facilitates cell division, foetal organs' development as well as maturation, maintaining the immune system in order to reinforce defence against hazardous infections, in addition to vision development in foetuses and maintaining maternal eyes' health as well as night vision (Derso et al., 2017).

During pregnancy, there is always a great need for Vitamin A, though the additional amounts needed are little, hence; the amplified requirements are only limited to third pregnancy trimester. The amount of vitamin A nutrient recommended in pregnancy period is about 800 µg of retinol equivalents (RE) per day that could be hard to acquire by the help of the diet alone in areas of vitamin A deficiency. Nutritional provitamin A sources are inclusive of vegetables like carrots, pumpkins, red palm oil and papaya. It is also present in animal foods such as dairy products (yogurt, whole milk and cheese), fish oils, liver oil as well as human milk (Witt et al., 2014).

While expectant women have great susceptibility to deficiency of vitamin A throughout their gestation period, vitamin A deficiency most commonly occurs during the third

trimester as a result of enhanced development of the foetus as well as the physiological upsurge of the volume of blood through the period (Gebreweld & Tsegaye, 2018). In an expectant woman who has a reasonable deficiency of vitamin A, the growing foetus could still acquire adequate vitamin A for appropriate development, though it is at the expenditure of the stores of maternal vitamin A. Deficiency of Vitamin A could as well result when rates of infectious diseases are great, and also during periods when sources of foods that are rich in vitamin A become scarce (Witt et al., 2014).

Night blindness's prevalence (an outcome of deficiency of vitamin A) also occurs more commonly within the third trimester of prenatal period, where populations showing a ≥5% prevalence are rated to be having a noteworthy problem of public health in relation to deficiency of vitamin A. The present estimation is that about 9.8 million expectant women globally are in one way or another affected by the night blindness menace. Some research indications have shown that low vitamin A supplementation dosage offered on daily or weekly patterns, beginning at the second or third trimester, could decrease severe declines of levels of maternal serum retinol in late gestation as well as night blindness symptoms. Gebreweld & Tsegaye (2018) revealed that supplementation in 12 weeks is often required for the prevention of decline of levels of serum retinol.

Vitamin A nutrient is often provided in the form of various vitamins' formulations to be used for prenatal care purposes in a number of countries. When offered alone, some of the compounds that are mostly utilized include retinyl palmitate and retinyl acetate, which are given in the form of tablets or solutions that are oil-based. Alternate delivery forms are inclusive of fish liver oils, β-carotene, and also an amalgamation of vitamin A and β-carotene (Derso et al., 2017). The dosage of vitamin A supplements that is recommended

is commonly well stood by expectant women; nevertheless, vitamin A can sometimes be toxic for a mother and the foetus if cases of excess intake levels, such as beyond 10 000 IU daily or 25 000 IU weekly. B-carotene, an originator of the vitamin A, could be given preference over other supplements of vitamin A in expectant women as β-carotene excesses have no known causes of defects on birth. Symptoms of vitamin A toxicity that is acute are inclusive of nausea, dizziness, vomiting, vertigo, headaches, reduced muscle coordination, blurred visions, skin exfoliation, weight loss and fatigue. Toxicity commonly comes from too much vitamin A ingestion, nonetheless, consistent intake of large amounts of liver, though may not be problematic in vitamin A-deficiency could lead to toxicity because of its high vitamin A content in the body (Msemo et al., 2018).

A study in Nepal established that vitamin a supplementation on a weekly basis played a major role in reducing mortality among pregnant mothers by 40%. The study also showed that iron deficiency anaemia was significantly reduced from 76% to 69% in pregnant women who received Vitamin A (Milman et al., 2003). In developing countries, the most prevalent group of people to anaemia are the pregnant women and women in the childbearing age bracket. Vitamin A deficiency has been characterized among the leading causal agents of anaemia. Vitamin A deficiency causes anaemia through haematopoiesis. This is the increase in the immunity of the body to diseases, hence anaemia through the modulation process of iron metabolism (Gebreweld & Tsegaye, 2018).

Following a study done in Nepal, maternal mortality reduced with about 40% prevalence. The prevalence in pregnant women reduced from 76%-69% in pregnant women who received vitamin A supplementation. Increase in dietary intake of vitamin A substance is known to increase haemoglobin concentrations hence reduce anaemia prevalence. A

similar study in Tanzania showed that intake of other multivitamins other than vitamin A increased haemoglobin concentration in HIV positive pregnant women. Women who took vitamin A and iron supplementation weekly had higher iron concentration than women who took iron supplements daily or weekly. Vitamin A is known to increase iron absorption and utilization, hence, there is reduction of anaemia levels (Derso et al., 2017).

2.4 Maternal Knowledge on Anaemia

Knowledge of anaemia is key to pregnant women during and after childbirth as it encourages them to take iron supplements that are vital during these periods as it affects the iron components in the mother and the child. A study carried out in Southern Israel illustrated that the prevalence of anaemia amongst infants and the level of knowledge in pregnant women were not closely associated. Little or no information on anaemia knowledge led to a 12% rise in anaemia cases among infants relative to women with higher knowledge levels concerning anaemia (Treister-Goltzman et al., 2015).

Throughout pregnancy, most women have high blood volumes as well as increased masses of erythrocytes, an increase of about 45%. Consequently, at pregnancy, women are usually at a greater anaemia risk, which escalates complications risk contributing to mortality and morbidity mothers and foetuses. These may include; retardation of foetal growth, stillbirth and childbirth and maternal deaths (East et al., 2018). Inadequate knowledge regarding nutrition is considered as a major factor leading to malnourishment, and could activate complication-causing practices. An evaluation that was undertaken to test the knowledge levels as well as practices that concern anaemia amongst pregnant females in Iran revealed that only 45.7% of expectant women utilized iron supplements correctly, n although 76.4% of the expectant women had awareness regarding the significance of iron intake during

gravidity. The levels of knowledge and understanding, attitudes as well as practices concerning anaemia are very closely linked, and when the levels of the aforementioned elements become low, complications normally tend to occur (Gebremedhin et al., 2014).

According to Mbule et al. (2012), in Uganda, only 80.9% of the respondents had the knowledge about anaemia. Some of the most recognized symptoms among the respondents were persistent fatigue, intermittent dizziness and general body weakness. About 45.1% were aware of three symptoms of anaemia although this knowledge was inversely related with anaemia presence. Mbule et al. (2012) postulates that most women have little knowledge concerning the predicaments of anaemia, in terms of what would happen to them as well as their children. A condition characterized by immoderate blood loss (haemorrhage) was one of the widespread causes of anaemia. Yadav et al. (2014) found out there was inadequate knowledge regarding the causes of anaemia, dietary requirements to prevent anaemia. Knowledge in relation to anaemia prevention and treatment was relatively adequate among the people. The findings illustrated that there existed a direct relation between the women's knowledge and education on proper diet, signs & symptoms, prevention, causes and treatment of anaemia (East et al., 2018).

In Africa, countries have adopted the prevention and treatment of anaemia policies by providing folic acid and ferrous sulphate to all pregnant women. The most widespread is iron supplementation in bid to reduce anaemia prevalence among pregnant women. These drugs are offered free of charge to ease access to citizens in the various socio economic classes in the society (Derso et al., 2017).

In pregnancy, most anaemia related cases are recognized in the second and third trimesters. It has often been associated with unplanned pregnancies. Family planning is yet to be

embraced in developing countries. Most of the pregnancies are experienced while the mother is still breastfeeding. This results to increased stress to the mother affecting her nutritional and diet status hence depletion of micronutrient stores in the mother. This causes the development of anaemia in the first trimester in the succeeding pregnancy (East et al., 2018). Folate and iron requirements increase in the last two trimesters of pregnancy. This requirement can only be met by both diet and from the maternal reserves. Low iron reserves results to anaemia which escalates in the second and the third trimesters. A pregnant woman who once had anaemia history is likely to become anaemic in subsequent pregnancies if not properly examined and treated. Women in the child bearing age should therefore seek treatment and strictly observe their diet as advised by any health practitioner (Ogundipe et al., 2012).

A study by Souganidis et al. (2012) revealed that maternal knowledge concerning anaemia has no effect in preventing the mother against anaemia but was found to protect and prevent children in rural and urban families from anaemia. Other factors that determined the prevalence of anaemia between mothers and children included the availability and consumption of fortified milk as well as the availability of improved latrines (Siddiqui et al., 2008). The study established that a pregnant woman's knowledge on anaemia was significant to the child's intake of iron supplementation and fortified milk during the mother's last pregnancy. However, the expectant mothers' knowledge of anaemia was not directly linked to the deworming procedures in the child. Other than in urban families, maternal knowledge of anaemia was directly related with the intake of animal proteins in rural families (Gebremedhin et al., 2014).

Malaria has been a rampant cause of anaemia during pregnancy. Areas with high prevalence of malaria often experience higher anaemia related cases as compared to areas with low malaria infection. Malaria is also a risk factor for low birth weights, foetal anaemia and stillbirths. Micronutrient deficiencies accelerate the prevalence of anaemia in both the mother and the child. Health care workers in antenatal clinics should educate pregnant women on the need to take a diversified diet inclusive of all the necessary dietary requirements (East et al., 2018).

A recent study showed that 85.7% and 84% of the mothers in urban slums and rural areas respectively, have ever used and had access to iron supplements during their last pregnancy. The expectant mothers' knowledge of anaemia was directly linked to the intake of animal source foods in the rural areas. Poverty and lack of resources resulted to a decrease in the consumption of animal source foods, which are vital sources of iron (Ogundipe et al., 2012). Some household preparation and food processing methods are important in increasing the bioavailability of micronutrients in foods obtained from plants. Such processes include soaking, germination/malting, mechanical processing and thermal processing. Hence, a mixed diet of plant source foods and small quantities of animal source foods would ultimately result to an improvement in micronutrient bioavailability and dietary diversity (Siddiqui et al., 2008). In Mandera County, micronutrient deficiency is a major contributor to pregnant women anaemia (Kenya National Bureau of Statistics [KNBS], 2015).

2.5 Practice of Intake of Iron Rich Foods amongst Pregnant Women

It is generally assumed that balanced nutrients' amounts in food are essential in all human beings to ensure effective functions of the body systems (Wanjek, 2005). This is an

indication that nutrition stands as an important pillar for all human beings, to support both health and entire life development. Nowadays, malnutrition is the great problem in both developed and developing countries. It is worth noting that obesity and chronic non-communicable diseases are major problems in developed countries. In developing countries, on the other hand, widespread under-nutrition and micronutrient deficiencies are common (Msemo et al., 2018).

It is believed that during pregnancy, it is necessary to have a proper balanced diet in order to make sure that there is adequate intake of energy for sufficient foetal growth without necessarily obtaining nutrients from the mother's tissues so that she can sustain her pregnancy (Sloan et al., 2012). Gravidity is as well a period where one experiences a significant proliferation of requirements of iron; when the demand goes higher because of physiological alterations in the red blood cell masses in the mother's body, and additionally because of the requirements for growth and development of the placenta as well as foetus. In spite of augmented requirements of iron, gravidity is as well-known as a period of augmented anaemia risk, which is greater than that occurring in non-pregnant state (Varghese et al., 2019).

An increased intake of animal proteins is beneficial in the improvement of health-associated behaviour that has a significant effect in the overall maternal knowledge of anaemia. Better maternal nutrition can be achieved by adequate consumption of animal rich foods for better health during pregnancy and lactation to both the mother and the child. Animal sourced foods have a higher level of bio available micronutrients and they present a diverse diet option (Sloan et al., 2012). According to Nyaruhucha (2009), passions and dislikes among food items is a common phenomenon during pregnancy. The most common

during this period are nausea and vomiting. These problems are a source of embarrassment and are significant in the interference of normal dietary intake which may at times lead to more critical problems during pregnancy. As a result, health workers should aid women in their choice towards foods and dietary considerations (Ullah et al., 2019).

In the sub-Saharan African context, multiple factors associated with anaemia during pregnancy have been identified including insufficient food, iron and folic acid as well as vitamin B12 insufficiencies. Other factors include impairment of micronutrient absorption system, loss of blood from hemorrhage condition as well as helminths infestation (Gebreweld & Tsegaye, 2018). Reports from Ethiopia show that approximately 28% of females are usually malnourished, most having a body mass index (BMI) of below 18.4, and only about 4% obese, with a BMI of more than 25.0 (Ullah et al., 2019). The main problems include protein-energy undernourishment and micronutrient insufficiencies like vitamin A, iodine and iron. Such values put Ethiopia amongst sub-Saharan nations having a very large number of undernourished women. Anaemia has affected about three billion people worldwide, amongst whom about 42 million are expectant women. Insufficiency is perceived as the greatest cause of the anaemic condition, and has accounted for 72%-97% of anaemia cases. Research has shown that anaemia has affected about 58% of expectant women worldwide with a high occurrence in Africa (Lebso et al., 2017).

Anaemia has been perceived as in a pointer to nutritional insufficiencies that have a significant effect on defects of birth, low birth weight and preterm labour that could result in worldwide problem of public health. Nevertheless, “iron deficiency anaemia (IDA)” is an important factor leading to mortality and morbidity, prenatal and infant losses. Physical

and cognitive losses can stall economic and social development in emerging nations (Chowdhury et al., 2015).

In Africa, the extent to which pregnancy related anaemia is somewhat alarming, whereby its prevalence has broadly led by poor nutrition, iron and deficiencies of micronutrients, chronic infections, parasite related infections, short prenatal periods and illiteracy (Kahn et al., 2012). Women experiencing IDA can asymptomatic; nevertheless, they become more vulnerable to infections, may get tired easily, could be subjected to an enhanced chances of postpartum and preeclampsia as well as haemorrhage. They may also poorly endure, even a negligible blood losses at birth. Additionally, there is an indication of enhanced risks of minimal weight of birth. Additionally, IDA has been associated with a greater occurrence of low birth weight, infants' preterm births, pre-maturity, stillbirths as well as neonatal deaths in children of women suffering from severe iron deficiencies (Turcotte et al., 2016).

The predominance of anaemia in pregnancy in Ethiopian women aged 15-49 years is 19%. It is 29.8% in the Southeast of Ethiopia, lack of responsiveness has become the major impeding factor for reaching the millennium development goals, because anaemia awareness amongst expectant females is only 70%. Anaemia is a severe problem of public health in Ethiopia. Slightly above 50% of expectant females suffer from anaemia (Kahn et al., 2012). It has been estimated deficiency of iron and supplementary nutrients have been cited as the main factors leading to anaemia world over. It has become very common amongst women at the childbearing age. These insufficiencies could result in preterm labour, low weight at birth, birth related defects, which in turn increases prenatal deaths (Lebso et al., 2017).

With regard to knowledge concerning iron rich foods, a very few number of pregnant women can identify iron rich foods. Red and organ meat are often despised irrespective of their rich iron contents (Kahn et al., 2012). ANC clinics should take up the role of educating pregnant women towards the right nutrition to reduce the anaemia prevalence. As a result, the little knowledge concerning the right nutrition during pregnancy can be attributed to low attendance of the antenatal clinics. Even on attendance of the antenatal clinics, nutritional education services are inadequate. Mwadime postulates that the health workers at the various health facilities are faced with many responsibilities and therefore they have little or no time to offer health and nutritional education (Turcotte et al., 2016).

Some pregnant women lack the knowledge as to why they should attend antenatal clinics during the first three months of pregnancy, as it is viewed as majorly curative other than preventive. As cited by Finlayson and Downe (2013), pregnant women do not seek the antenatal clinic services as they lack trust of the health system. This is a result of low-level services and medicine unavailability. This has highly contributed to the increased use (73%) of traditional herbal medicine and services in Uganda as an alternative to antenatal clinic (Sloan et al., 2012). Some of these beliefs and practices are the causes of high anaemia incidence in pregnant women. Poverty is another constraining factor as it reduces the access to timely information. Poverty leads to inadequate access to sufficient and balanced meals at the household and individual levels. In addition, iron rich foods such poultry, fish are quite expensive and individuals at the low ranks of society cannot afford them (Siddiqui et al., 2008).

Counselling before pregnancy, nutrition advice and therapy have all proven to result to successful pregnancy results (Turcotte et al., 2016). Blood count test should be carried out

on every visit to the antenatal clinic and repeated at 28 weeks of pregnancy to check for anaemia to treat it as early as possible. To mothers who are at a higher risk of anaemia such as those with multiple pregnancies should undergo haemoglobin checks as often times as possible as the delivery approaches (Chowdhury et al., 2015). Nutritional advice should be carried out to mothers so that they can improve their iron food consumption. They should also be advised on the kind of foods to avoid that are likely to inhibit the consumption of iron. Iron and folic acid supplements should be administered to all menstruating women in areas where anaemia is a major health concern. Other health practices such as deworming should be observed to prevent anaemia. These minerals play a crucial function in embryogenesis and any deficiencies mainly results in congenital abnormalities. Proper identification of the cause of anaemia is the first step in finding its cure. During delivery, slowed clamping of the umbilical cord should be an indicator of neonatal anaemia and therefore necessary precaution should be taken (Wanjek, 2005).

Maternal awareness regarding of anaemia is significant due to its effect on encouragement of women to consume supplements of iron when pregnant, and after childbirth, is it affects the status of iron in both mother and infant (Turcotte et al., 2016). High intake of animal foods from animals is a supplementary health-related conduct that is encouraged through maternal information of anaemia. Benefits that accrue from consumption of foods from animals include; comparatively higher bioavailable nutrients, dietary diversity and better nutrition that affects mothers and children in prenatal period and lactation (Sloan et al., 2012).

Strategies for reducing anaemia prevalence in children focus on fortified milk consumption by children and deworming medications' administration. Fortified milk consumption is an

efficient strategy for reducing anaemia in infants and is the basis for compulsory powdered milk fortification with vitamins, iron as well as other minerals. (Goessler et al., 2008). Usage of dewormers in areas of endemic improves status of iron in children exposed to anaemia through reduction of prolonged blood loss in intestines linked to hookworm as well as other parasites' infections (Msemo et al., 2018). Negative attitudes towards iron supplementation, derived from side effects, concerns with the tablet's bad taste, or fears of adverse outcomes, could facilitate non-compliance, even if the benefits of iron supplementation are known (Goudet et al., 2011).

Despite anaemia being recognized as a worldwide problem of public health for a number of years, there is no rapid progress that has been witnessed, in spite of the disease remaining prevalent globally (Goudet et al., 2011). Numerous interventions have been made for prevention and treatment of maternal anaemia, but there is a large number of pregnant mothers affected by the disease. The contributing factors for this kind of persistence of disease is not empirically established. It therefore, becomes imperative to formulate a strategy for reducing and controlling anaemia (Siddiqui et al., 2008). The need for an educational campaign on the importance of diversified diet is an aspect that cannot be neglected whatsoever. Promotion of food items rich in iron has proven success especially in urban areas. Educational campaigns have proven success among young adolescent girls and helped improve their nutrition and health (Chowdhury et al., 2015).

2.6 Theoretical Framework

Nutrition education programs and interventions established on theory driven models and research whose aim is to change behaviours receives the most funding. A theory mainly elaborates on the variables affecting the target behaviour and the relationships among these

variables. A theory explains how to make interventions to promote behaviour change while providing predictability for expected outcomes (Jiang et al., 2015).

Scholars and researchers in the nutritional community are yet to agree and come up with a single model as the standard measure for behavioural change. One of the main challenges has been to consolidate clear structures from the other theories into a single model that can be empirically tested and improved into a more comprehensive, tailored theory or set of theories specific to food and nutrition behaviour changes. There are four behaviour change models commonly used in nutrition and they include; The Health Belief Model (HBM), the Social Cognitive Theory (SCT), the Trans-theoretical model (TTM) and the Theory of Reasoned Action (TRA).

2.6.1 Health Belief Model

The model originated from the US Public Health Service and was developed in the 1950's (Davis & Sandman, 2010). The theory was constructed to offer an explanation on the prevention health behaviours as portrayed by various groups of people. Initially, the model was centred on the association between the health practices, behaviours and the utilization of health services. However, the model has been shaped to involve health motivation to users to differentiate between health behaviour and illness behaviour. The model illustrates that benefits and barriers associated with health practices and the perceived susceptibility and severity aid in the determination of the resultant health behaviours. The model has been used to train how to stop some behaviours such as smoking, risky behaviours and overall adolescent health practices (Odhiambo et al., 2016).

A more recent version of the Health Belief Model consists of six elements namely cues to action, perceived benefits, self-efficacy, perceived susceptibility, perceived barriers and

perceived severity. Perceived susceptibility refers to one's perceptions on the likelihood that they will encounter a circumstance that will have an adverse effect on their health. Perceived severity has been termed as an individual's belief on the extent of development of a health condition that has affected his/her livelihood (Wasse et al., 1994).

Perceived benefits are individual opinions on the extent of effectiveness of the recommended solutions and actions at preventing disease and in reducing the incidence of the negative health effects. Perceived barriers are the physical and all the psychological costs that are involved and may hinder one from taking the necessary action. For a change in behaviour to be successful, an individual must be certain that they have the masterly of behaviour (self-efficacy) and must have established that the benefits associated with change are quite more desirable than the obstacles even in the face of self-behaviour (perceived susceptibility and severity) doubt. In addition, internal or external cues are the driving forces in the way of an individual's course of action (Davis & Sandman, 2010).

The health belief model has proven to be successful in the forecast of behaviour change. However, a research review indicated that the model yielded minimal usefulness in the study concerning the nutrition education arena, specifically related to obesity. The model has been cited to consist of a number of limitations. Health behaviour is not directly influenced by belief, as people are most likely to act contrary to their personal convictions. The model neglects other factors that directly influence one's behaviour such as past experiences, economic hardships and cultural diversity. These factors have a high potential of influencing decision making among the study's target population, hence the application and use of this model will be limited (Odhiambo et al., 2016).

2.6.2 Trans-theoretical Model (TTM)

The model suggests that a change in the balance and an improvement in the confidence portrayed in the performance of certain tasks whose main aim is change must take place first before the occurrence of behavioural change. It is one of the most widespread models that have been in application in both health and nutritional educational sectors. Its emphasis has been shifted to fruit and vegetable consumption, fat reductions and dietary fibre intake (Gurley et al., 2012).

The Trans-theoretical model suggests that behaviour change is associated with five distinct stages. The stages include pre-contemplation, contemplation, preparation, action and maintenance. Every phase consists of a distinct aspect towards behavioural change. It consists of experimental and behavioural processes. The change process illustrates the progress that individuals make from one phase of behavioural change to the next. The process consists of about ten methods that aid the smooth movement through the phases. They include self-liberation, stimulus control, self-re-evaluation, social liberation, dramatic relief, helping relationships, environmental re-evaluation, counter conditioning and reinforcement management (Gurley et al., 2012).

The model eludes that the basis of individual decision making is based on the advantages and the disadvantages associated with behavioural transformation. This goes along with the ten processes involved for behaviour change to be achieved. At the pre-contemplative stage, a number of people believe that the less the positive results and the more the negative outcomes often results to a possibility of behaviour change. Those at the end stages believe that behaviour change can be achieved when there are more positive results and less negative outcomes. The theory has been used to predict behaviour changes in nutritional

fat reductions, fruit and vegetable consumption. The theory emerged from a temporary dimension, various stages of change, integration of principles and processes from various theories. The theory advanced as a leading theory in psychology and behavioural change (Gurley et al., 2012).

2.6.3 Theory of Reasoned Action/ Theory of Planned Behaviour

The theory began as the theory of reasoned action and was used to predict behaviours at a specific time and place (Ndukwu & Dienye, 2012). The theory was aimed at explaining all behaviours that have a significant effect on self-control. The theory has been used to explain and predict behaviours associated with smoking, breastfeeding and the efficiency of health services utilization. The theory states that the success behaviour change is dependent on motivation as well as behavioural control (Kiwanuka et al., 2017).

The core of TRA is that one's subjective norms as well as attitude have a notable effect on the intention behind the performance of certain behaviour. This then is a clear forecast on the likelihood and possibility for engagement in that particular behaviour. Attitude has a direct effect on one's opinion towards engagement in a particular behaviour (Kiwanuka et al., 2017). Subjective norms are as a result of societal pressure and forces to either engage or not engage in a particular behaviour. An effective explanation on the actual behaviour is directly associated with the extent to which the behaviour is under the control of the individual as well as the intention that invokes this behavioural change. The Theory of Planned Behaviour (TPB) was developed in 1986 so as to foretell behaviours over which people have incomplete volitional control (Ajzen, 2011).

Theorists suggest that the ability to control behaviour is the third predictor of the intention involved before the performance of a particular behaviour. Behaviour control has been perceived as a representation of activities and circumstances that are beyond the control of an individual hence affecting both the intention and the behaviour (Adanikin & Awoleke, 2016). The theory exudes a direct relationship between behaviour and the role it plays in behavioural intention. The behavioural control aspect illustrates the ease or the challenges associated with the engagement of a particular behaviour pattern. The TPB theory postulates that a person uses low energy in the engagement of a particular behaviour when their behaviour control perception is at the lowest, but is likely to put a bit more effort when the behaviour control is quite higher. Therefore, one's behaviour intention and control can be used in behavioural prediction (Adanikin & Awoleke, 2016).

The TPB theory has proven to be successful in various sectors such as exercise and nutrition as well as condom usage. Despite the many successes that the model has achieved so far, it has been marred by a number of challenges and this has exempted it from the major health behavioural models that most scientists identify with. Success with the TPB model is only experienced when the behavioural aspect is not affected by volitional control. In addition, the prediction of real behaviour using the behaviour intent aspect lowers with time. In conclusion, the scanty definition of behaviour control by researchers results to a myriad of challenges in its measurement (Fisher et al., 2015).

2.6.4 Social Cognitive Theory

The theory originates from Miller and Dollard's Social Learning Theory. The social cognitive theory provides an extensive model explaining health behaviours and methods to change them. The social cognitive theory comprises of three main aspects namely

environmental factors, individual factors and behavioural repertoires. The three components are highly dependent on each other and they interact often (Begum et al., 2018). The SCT theory further comprises of behavioural capability, situation and environment, expectations, reciprocal determinism, expectancies, self-efficacy, observational learning, emotional coping responses, reinforcement and self-control. The aspect of reciprocal determinism postulates that the environment, individual and he behavioural repertoire are dynamic in nature and have direct influences towards one other. One's behavioural capacity is a product of personal training, learning style and intellectual capacity (Begum et al., 2018).

Self-efficacy involves one's personal belief in their abilities towards the performance of a particular obligation. The expectations involved gives people the opportunity to anticipate what is likely to happen before they can come to it realization. Expectancies are the driving forces that lead to action. They differ from expectations in that they are aimed at a certain end result. Reinforcements are responses to a person's behaviour that increase or decrease the likelihood of reoccurrence (Jones et al., 2018). An individual may learn from different people by either received reinforcements or through the observation technique. Observation involves watching the outcomes and actions of other people's behaviour. It can only be highly effective if one identifies a role model from whom they can keenly learn from. Emotional coping responses are practices adopted by an individual to curb emotional stimuli (Jones et al., 2018).

For successful application of the social cognitive theory, researchers should use a mix of all the components and should not be limited to only one. The constructs enable social educators to clearly put their focus on the individual and their environment while at the

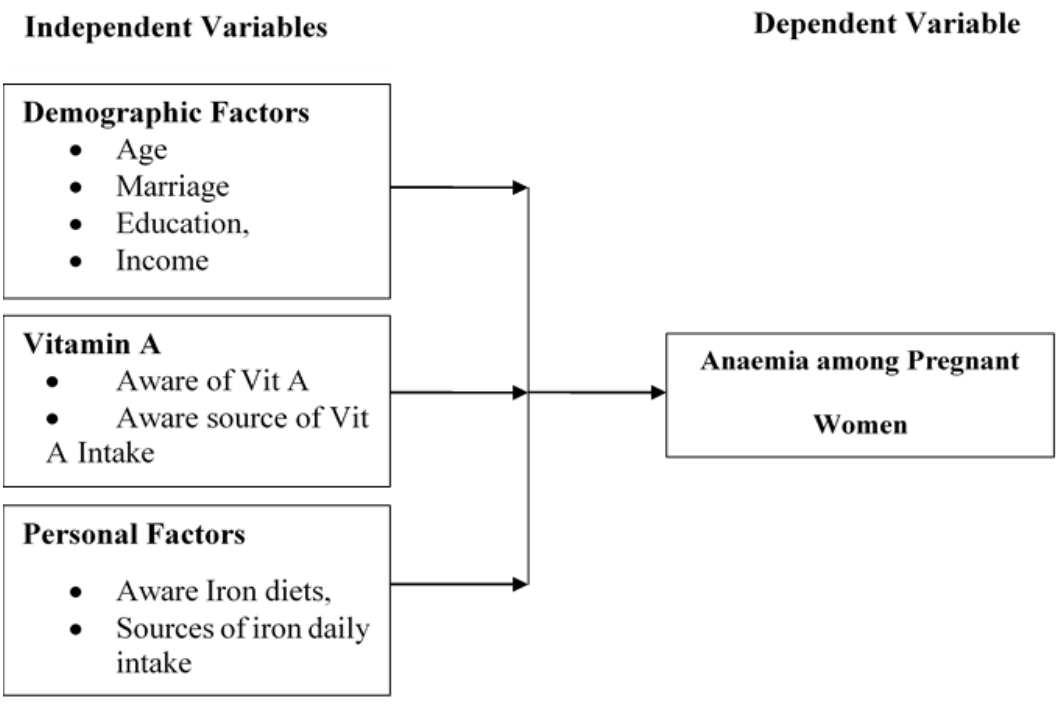
same time laying emphasis on a multidimensional tactic towards behavioural change. Every single construct provides a pathway towards the improvement of all the practices leading to fully potent health related behaviour (Tibambuya et al., 2019).

The provision of role models, construction of behavioural skills and an extension of self-confidence amidst other improvements in the environment will most likely result to behaviour change. A number of research studies on health and nutrition education have been carried out and have justified the success factors associated with SCT (Anlaakuu & Anto, 2017). In contrast, various instruments to measure knowledge and self-efficacy during the interventions were sourced from earlier research works and developed using various interventions and quite a number of methodologies.

2.7 Conceptual Framework

Figure 2.1:

Conceptual Framework



CHAPTER THREE

RESEARCH METHODOLOGY

3.1 Introduction

This chapter discusses the research methodology that was adopted to address the objectives under this study. The researcher will address research design to be adopted, respondent's selection and sampling, methods employed during data collection, processing and analysis of the problem encountered.

3.2 Study Design

The study will adopt the Cross-sectional descriptive study design. The design is preferred as it is used to obtain information concerning the current status. The purpose of this method is to describe what exist with respect to situational variable. According to Bryman & Bell (2015), in descriptive cross-sectional studies, variables that the researcher is interested in are tested only a single time and the interrelationships are established. Survey strategy is applied under the deductive approach, which allows one to collect quantitative data, which can be analyzed quantitatively using descriptive and inferential statistics (Saunders et al., 2009)

3.3 Study Site

Mandera County is situated in the previously known North Eastern Province of Kenya. The County's capital is Mandera. According to Kenya Census, 2009 the County has a population of 1,025,756 and an area of 25,797.7 km². It has border Somalia to east and Ethiopia to north. The County has six sub counties: Mandera South, Mandera North, Lafey, Banisa and Mandera West.

Mandera County Referral Hospital is a Government health centre located in Bulla Power Sub-location, Bulla Jamhuri location, Central Division, Mandera East Constituency. It has a total of 128 beds, antenatal care (ANC) services and a basic emergency obstetric care Caesarean Section. In addition, the facility has a comprehensive emergency obstetric care, curative outpatient services as well as a curative inpatient facility. The facility also offers immunization services, family planning, integrated management of childhood illnesses and an increased growth in the monitoring and promotion of HIV Counselling and testing. Mandera County Referral Hospital provides health services to its all six sub-counties Mandera has border with Somalia and Ethiopia. The serves include referrals and ANC emergency obstetric from these areas so, due to poor of equipment and unskilled staff at Mandera County during insecurity and long marginalization and negative, cultural religious practice discourages deliveries at the hospitals. Mothers living in Mandera County have the highest mortality rate than other counties of Kenya when compared to the national average (Kenya Demographic and Health Survey [KDHS], 2014).

3.4 Target population

Ngechu (2004) describes a target population as a categorized group of people, things, elements, households, services, firms or objects under investigation. A target population is a population that the researcher seeks to make deductions that are can be theoretically observed, are countable and occur within a specified timeline. The units under the timeline ought to be clearly specified (Groves, 2009). The target population simply explained is elements relevant to the research.

The study target population of this study constituted of pregnant women in Mandera County Referral Hospital the estimated number of women pregnant women aged 15-49 is estimated to be 3651 and they formed the target population for the study.

3.5 Sampling Technique and Sample Size Determination

3.5.1 Sampling Technique

Sampling techniques refers to the various methods used to collect and ascertain the necessary data from a specified group as compared to all the other possible sources. The study adopted simple random sampling and convenience sampling techniques. The convenience sampling approach is preferred due to its 'accessibility' nature (Bryman & Bell, 2003). This study selected every third pregnant woman in the hospital and questionnaire was administered.

3.5.2 Sample Size Determination

Sample size determination is a key important aspect in the planning of any empirical study. A sample represents a section of the population, which refers to a theoretical specified aggregation of a particular element. Therefore, a sample size represents a fraction of the entire population (Agresti & Finlay, 2009). This study will utilize Fischer's formula to compute sample size. According to Fischer et al., (2008) formula, at permissible error of 5% and prevalence of 50% the sample size was:

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

Where **n** = sample size

Z^2= Standard error from mean corresponds to 95% confidence interval =1.96, and is the standard normal deviate (deviation from the mean in normal distribution or curve).

p = proportion of the population with (Prevalence of anaemia among pregnant in Kenya is at 54%)

q = **1-p =1-0.54=0.46**

d (0.05) = Permissible error in the estimate of P

Thus, with permissible error of 5%, the sample size is:

$$n = \frac{1.96^2 \times 0.54 \times .0.46}{0.05^2}$$

$$n = 381.7$$

$$n \approx 382$$

Thus, the sample size of 382 was needed.

3.6 Data Collection Instrument

A number of techniques have been used in gathering of primary data in descriptive research design techniques. They include postal and telephone surveys, personal interviews, observation and self-administered surveys (Roberts-Lombard, 2006). Collection of primary data was carried out using a simple structured questionnaire. A structured questionnaire was administered to all eligible women to determine their socio-demographic and knowledge about the sources iron and challenges in terms of access and availability diet rich iron.

3.7 Data Collection

Primary data collection was carried out using a structured questionnaire that was developed by the researcher. It captured the knowledge of anaemia and practices foods that are rich in iron. The researcher issued the research questionnaires out, as most of the women in the Mandera County were informally educated and needed assistance in filling the questionnaire. Data was collected during the months of October and November 2016, the 382 of whom were contested structured questions only 312 provided their responses translated to 81.7% and this attributed to high illiteracy rates and some of the respondents did not understand the importance of the study. Further, there was the aspect of language barrier of which most of the respondents only speak Somali and thus translating the question to the local dialect presented challenges.

3.8 Data Analysis and Presentation

The collected data was presented in frequencies, cross tabulations and diagrams as necessary. A descriptive analysis included measures of central tendency such as mean, measures of variability like the standard deviation and range and univariate analysis. Inferential analysis was carried out using chi square test to determine significant association between the two variables.

3.9 Ethical Considerations

The KeMU Ethical research committee gave the approval and a go ahead to the researcher upon meeting key study requirements. An introduction letter was issued by the University marked addressing the study hospital allowing the researcher to carry out the study. Respondent's confidentiality regarding the information they provided was assured. Privacy of the respondent's information was guaranteed. After an elaborate explanation concerning

the purpose of the study, a written consent was used requesting the patients for permission to undertake the study. Involvement in the study was on a voluntary basis. The data collection tools were later kept safely in a place only reachable by the principal researcher.

CHAPTER FOUR

DATA ANALYSIS AND INTERPRETATION

4.1 Introduction

This chapter introduces the statistical summary and results from empirical analysis. Further, the chapter entails interpretations of the statistical inferences derived from the compiled data as the researcher strives to accomplish the objectives of the study.

4.2 Response Rate

The targeted sample size was 382 of who were given self-administered structured questions of whom 312 provided their responses and this translated to 81.7%. The researcher used drop and pick technique.

4.3 Bio Data of the Respondents

Table 4.1:

Bio Data of the Respondents

Variable	Responses	Frequency	Percent
Age bracket	Less than 20 years	34	10.9
	Between 21-30 years	76	24.4
	Between 31-40 years	126	40.4
	More than 40 years	76	24.4
Marital status	Single	24	7.7
	Married/cohabiting	243	77.9
	Divorced/ Separated	33	10.6
	Widow	12	3.8
Highest level of education achieved	Primary level	127	40.7
	Secondary level	63	20.2
	University level	12	3.8
	Postgraduate	12	3.8
	None	42	13.5
	College level	56	17.9
Average monthly income	Less than Ksh 30, 000	151	48.4
	Between Ksh 31,000-60,000	121	38.8
	Between Ksh 61,000-90,000	35	11.2
	More than Ksh 90,000	5	1.6

From the responses in Table 4.1, most of the respondents were between 31-40 years [40.4%] compared to 24.4% who were between 21-30 years. On their marital status, the study found that most of the respondents [243, 77.9%] were either cohabiting or married as opposed to those who were in single motherhood [24, 7.7%] and those who were either divorced or separated constituted 10.6%. Approximately 190[60.9%] of the respondents had less than secondary level education and this indicated that the illiteracy level in the County is high. The last query concerned the monthly income of the respondents. It was established that majority [151, 48.4%] of the respondents had an average income of less than Ksh 30,000 while 121[38.8%] indicated that they earned between Ksh 31,000-60,000 and thus most of the women could afford balanced diet.

4.4 Pregnancy Responses

Table 4.2

Pregnancy Responses

Variable	Responses	Frequency	Percent	Chi Square Value	Sig. (2-tailed)
Have you ever been pregnant before	Yes	205	65.7	30.782	**.000**
	No	107	34.3		
Stage of your pregnancy	First Trimester	79	25.3	47.096	**.000**
	Second Trimester	161	51.6		
	Third Trimester	72	23.1		
Number of pregnancies had before	One pregnancy	69	22.1	143.718	**.000**
	Two pregnancies	156	50.0		
	Three pregnancies	80	25.6		
	More than four pregnancies	7	2.2		

The Table 4.2 presents the summary of the responses provided by the women on their state of pregnancy. Most of the respondent were in their second or other pregnancies as they had

been pregnant before [205,65.7%] compared to those in their first pregnancy [107,34.3%] (p =0.000) while on the stage of their pregnancies, slightly more than half [161,51.6%] were in their second trimester compared to 25.3% in their first trimester (p <0.05) while half of the respondents indicated that they had a total of two pregnancies, 80(25.6%) had three pregnancies. A significant p value of 0.005 was obtained and this indicated consistency in the responses provided.

4.5 Diet Rich in Iron Intake

Table 4.3:

Responses on the Awareness and Frequency of Intake of Iron Rich Foods

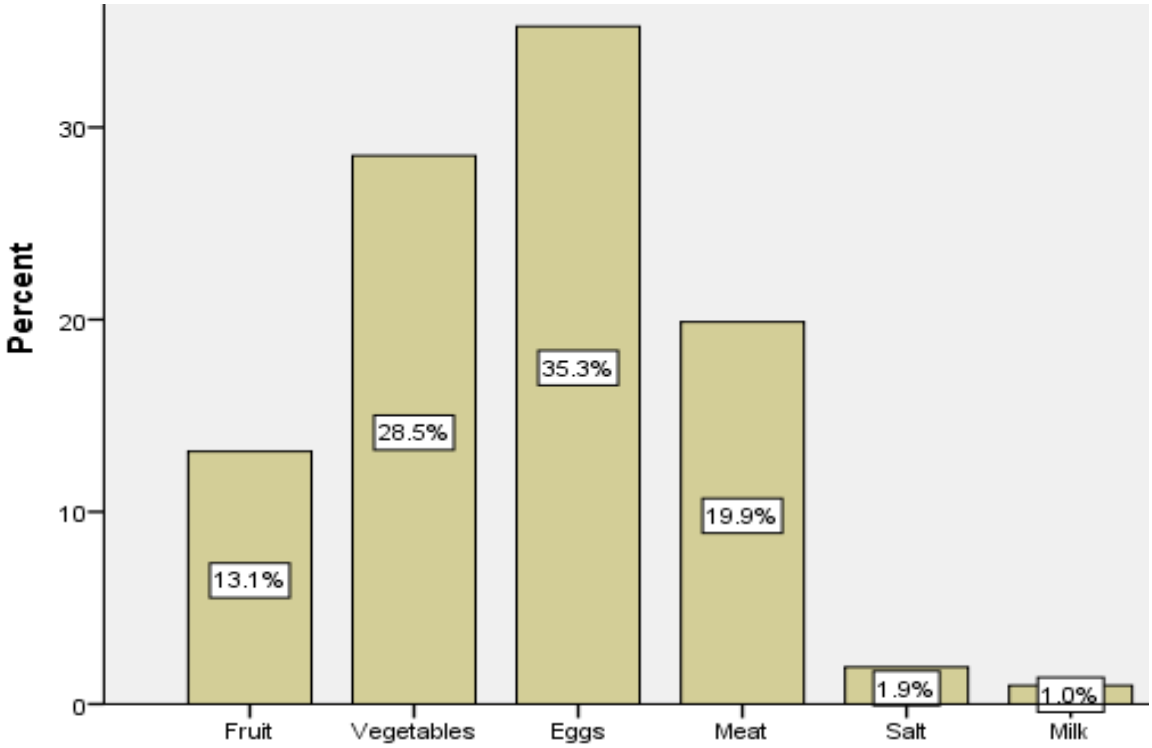
Variable	Responses	Frequency	Percent	Chi Square Value	Sig. (2-tailed)
Aware of iron	Yes	215	31.1	44.628	**.000**
	No	97	68.9		
Know the sources of iron	Yes	138	44.2	17.154	.000
	No	82	26.3		
	Not sure	92	29.5		
Intake frequency iron rich foods	Daily	74	23.7	94.872	**.000**
	Weekly	130	41.7		
	Monthly	96	30.8		
	Never	12	3.8		
Challenges in terms of access and availability of iron rich source of iron	Yes	199	63.8	23.705	**.000**
	No	113	36.2		

Table 4.3 shows the responses on the awareness and frequency of intake of iron rich foods whereby majority (68.9%) of the respondents were not aware of iron (p value <0.05) and further that 44.2% of the respondents knew the sources of iron compared to 55.8 who neither knew or not sure on the sources (p value >0.05). On the frequencies, the respondents took the iron rich foods, it was established that majority (130, 41.7%) indicated they took

them weekly compared to 30.8% who cited they took them on monthly basis. It was established majority (199, 63.8%) faced challenges to access and availability of iron rich foods and thus the need for IFAS or other iron rich supplements.

Figure 4.1:

Sources of Iron and Percentage



Among the sources of iron both animal and plant based sources that the respondents indicated they knew about, it was established that 35.3% cited eggs compared to 28.5% who indicated vegetables as the sources of iron. 19.9% indicated meat as a source of iron as presented in the Figure 4.3. The responses were significant at 5% as p value obtained was <0.05.

Table 4.4:

Intake of Vitamin A

Variable	Responses	Frequency	Percent	Chi Square Value	Sig. (2-tailed)
Aware of Vitamin A	Yes	249	20.2	110.885	**.000**
	No	63	79.8		
Aware of sources of Vitamin A	Yes	300	3.8	265.846	**.000**
	No	12	96.2		
Intake frequency of those foods	Daily	132	42.3	67.385	**.000**
	Weekly	144	46.2		
	Monthly	36	11.5		
Challenges in terms of access and availability of Vitamin A	Yes	230	73.7	70.205	**.000**
	No	82	26.3		

The Table 4.5 presents the responses on the intake of Vitamin A among the pregnant women in Mandera Referral County Hospital. Most of the women (249, 79.8%) were not aware of Vitamin A and further 96.2% were not aware of the various sources of Vitamin A and these responses were significant at 5%. On the query about frequency of intake of Vitamin A, it was established that majority 46.2% and 42.3% took foods rich in Vitamin A on weekly and daily basis. Further, most (230, 73.7%) of the respondents indicated that they experienced challenges in terms of access and availability of Vitamin.

4.6 Folate or Folic Acid

Table 4.5

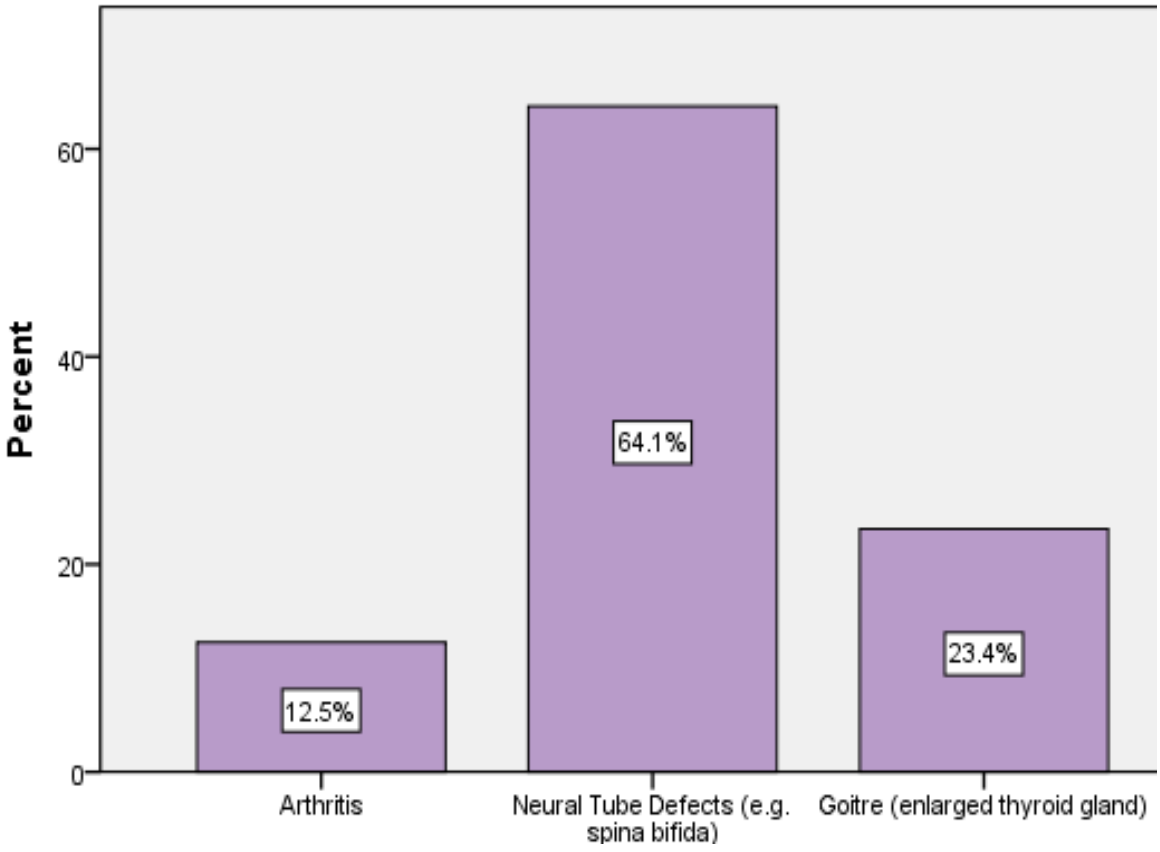
Folic Acid Awareness among Pregnant Women

Variable	Responses	Frequency	Percent	Chi Square Value	Sig. (2-tailed)
Aware of Folate or Folic Acid	Yes	224	28.2	59.282	**.000**
	No	88	71.8		
Types of foods and drinks do you think are good sources of folate	Fruit	288	92.3	138.481	**.000**
	Green vegetables	123	39.4		
	Milk	89	28.5		
	Fish/Seafood	36	11.5		
	Meat	78	25		
	Breakfast cereals	8	0.025		
	Bread	39	12.5		
Health problems are associated with lack of enough folate/folic acid in the diet	Arthritis	39	12.5	4.459	**.000**
	Neural Tube Defects (Spina bifida)	200	64.1		
	Goiter (enlarged thyroid gland)	73	23.4		

Approximately 72% the respondents who indicated that they were not aware of folate or folic acid compared to 28.2% who indicated that they were aware. Among the foods, the respondents were aware or knew as good sources of folate, 92.3% indicated fruits compared to 39.4% who indicated green vegetables while 28.5% indicated milk. Assessing knowledge of health problems are associated with not having enough folate/folic acid in the diet, majority (64.1%) indicated Neural Tube Defects (for example, Spina bifida) compared to 23.4% who said Goiter (enlarged thyroid gland). All the responses were significant at 5% level.

Figure 4.2:

Knowledge of Health Problems Associated With Lack of Enough Folate/Folic Acid in the Diet



4.7 Cross tabulations

Cross tabulations are simply data tables that present the results of the entire group of respondents as well as results from sub-groups of survey respondents. The Tables that follows presents the cross tabulation between social demographic data and awareness of iron, folic acid vitamin A.

4.7.1 Cross tabulations of Age and Nutrients Awareness

The study sought to establish the relationship existing between age and nutrients' awareness. The findings of the study were shown in the table below;

Table 4.6

Age Bracket and Nutrient Awareness

No. of Years		Aware of micronutrient iron			Chi-Square	Std Dev
		Yes	**No**	**Total**		
	Less than 20 years	26 (8%)	8 (3%)	**34**	1.057[a]	.788
	Between 21-30 years	52 (17%)	24 (8%	**76**		
	Between 31-40 years	86(28%)	40 (13%)	**126**		
	More than 40 years	51(16%)	25 (8%)	**76**		
		Aware of Vitamin A				
	Less than 20 years	28 (9%)	6 (2%)	**34**	4.785[a]	.188
	Between 21-30 years	54 (17%)	22 (7%)	**76**		
	Between 31-40 years	104 (33%)	22 (7%)	**126**		
	More than 40 years	63 (20%)	13 (4%)	**76**		
		Aware of Folate or Folic Acid				
	Less than 20 years	25 (8%)	9 (3%)	34	8.196[a]	**.042**
	Between 21-30 years	55 (18%)	21 (7%)	**76**		
	Between 31-40 years	81 (26%)	45 (14%)	**126**		
	More than 40 years	63 (20%)	13 (4%)	**76**		
Total		**224**	**88**	**312**		

From the findings of the study, it is evident that the majority of the respondents were aware of iron nutrients. 31-40 years showed an awareness rate of 28%, more than 40 years showed an awareness rate of 28%, between 21 and 40 years showed an awareness rate of 17%, while Less than 20 years showed an awareness rate of 8%. On awareness of Vitamin A, the study's findings showed that the majority were at 31-40 years, who showed an awareness rate of 33%, more than 40 years showed an awareness rate of 20%, between 21 and 40 years showed an awareness rate of 17%, while Less than 20 years showed an awareness rate of 9%. Regarding awareness of Folate or Folic Acid, the study's findings showed that the majority were at 31-40 years, who showed an awareness rate of 26%, more than 40 years showed an awareness rate of 20%, between 21 and 40 years showed an awareness rate of 18%, while Less than 20 years showed an awareness rate of 8%. The study findings demonstrate that most respondents were aware of the most important nutritional factors associated with Anaemia among pregnant women.

4.7.2 Cross tabulations of Marital Status and Nutrient Awareness

These cross tabulations were tested to establish the relationship between marital status and nutrients' awareness. The findings of the study were shown in the table below;

Table 4.7

Marital Status and Nutrient Awareness

No. of Years		Aware of micronutrient iron: Yes	Aware of micronutrient iron: No	Total	Chi-Square	Std Dev
Marital status	Single	17 (5%)	7 (2%)	24	.683[a]	.877
	Married/cohabiting	168 (54%)	75 (24)	243		
	Divorced/ Separated	21(7%)	12 (4%)	33		
	Widow	9(3%)	3 (1%)	12		
		Aware of Vitamin A				
marital status	Single	17 (5%)	7 (2%)	24	1.921[a]	.589
	Married/cohabiting	195 (63%)	48 (15%)	243		
	Divorced/ Separated	28 (9%)	5 (2%)	33		
	Widow	9 (3%)	3 (1%)	12		
		Aware of Folate or Folic Acid				
marital status	Single	16 (5%)	8 (3%)	24	3.027[a]	.387
	Married/cohabiting	174 (56%)	69 (22%)	243		
	Divorced/ Separated	27 (9%)	6 (2%)	33		
	Widow	7 (2%)	5 (2%)	12		
Total		224	88	312		

From the findings of the study, it was evident that the majority of the respondents were aware of iron, vitamin A and folate nutrients. The findings showed that the majority agreed to awareness of iron, the married/ cohabiting being on the lead as shown by 54%. The divorced/separated agreed to iron awareness as shown by 7%, the single agreed to awareness of iron as shown by 5%, and the widowed at 3%. Regarding awareness of vitamin A, the married/ cohabiting were the majority as shown by 63%. The divorced/separated agreed to iron awareness as shown by 28%, the single agreed to

awareness of iron as shown by 17%, and the widowed at 9%. Regarding awareness of folate, the married/ cohabiting were the majority as shown by 56%. The divorced/separated agreed to iron awareness as shown by 9%, the single agreed to awareness of iron as shown by 5%, and the widowed at 2%.

4.7.3 Cross Tabulations of Education Level and Nutrient Awareness

The study sought to establish the relationship between educational level and nutrients' awareness. The study's findings were as in the table below;

Table 4.8

Education Level and Awareness

	Aware of micronutrient called iron			Chi-Square	Std Dev
Highest level of education achieved	**Yes**	**No**	**Total**		
Primary level	79 (25%)	48 (15%)	127	8.375[a]	.137
Secondary level	51 (16%)	12 (4%)	63		
University level	8 (3%)	4 (1%)	12		
Postgraduate	8 (3%)	4 (1%)	12		
None	27 (9%)	15 (5%)	42		
College level	42 (13%)	14 (5%)	56		
	Aware of Vitamin A				
Primary level	94 (30%)	33 (11%)	127	7.292[a]	.200
Secondary level	51 (16%)	12 (4%)	63		
University level	11 (4%)	1 (0%	12		
Postgraduate	12 (4%)	0 (0%)	12		
None	35 (11%)	7 (2%)	42		
College level	46 (15%)	10 (3%)	56		
	Aware of Folate or Folic Acid				
Primary level	92 (29%)	35 (11%)	127	9.562[a]	.089
Secondary level	49 (16%)	14 (5%)	63		
University level	8 (3%)	4 (1%)	12		
Postgraduate	12 (4%)	0 (0%)	12		
None	29 (9%)	13 (4%)	42		
College level	34 (11%)	22 (7%)	56		
Total	**224**	**88**	**312**		

From the findings of the study, the majority of the respondents agreed to awareness of iron Vitamin A and folate. The majority of the respondents had primary level of education, who agreed to awareness of folate as shown by 25%. This was followed by secondary level of education as shown by 16%, college level at 13%, no educational level as shown by 9%, university level at 3%, and postgraduate level as shown by 3% respectively. Regarding awareness of vitamin A, the findings of the study showed that the majority of the respondents agreed to awareness, the majority having primary level of education as shown by 30%. This was followed by secondary level of education as shown by 16%, college level at 15%, no educational level as shown by 4%, university level at 3%, and postgraduate level as shown by 4%. On awareness of folate, the findings of the study showed that the majority of the respondents agreed to awareness, the majority having primary level of education as shown by 29%. This was followed by secondary level of education as shown by 16%, college level at 11%, no educational level as shown by 9%, university level at 4%, and postgraduate level as shown by 3%.

CHAPTER FIVE

DISCUSSIONS, CONCLUSIONS & RECOMMENDATIONS

5.1 Introduction

The chapter presents summary of the study findings and conclusions of the study. The chapter also gives recommendations and the suggestions for further study.

5.2 Summary of Findings

The study found out that the majority (68.9%) of the respondents were not aware of iron (p value <0.05) and further that 44.2% of the respondents knew the sources of iron compared to 54.8% who neither knew or not sure on the sources (p value >0.05). This concurred with Katai et al. (2018) who noted that most of women in developing countries especially in the marginalized areas were not aware of iron. On the frequencies, the respondents took the iron rich foods, it was established that majority (130, 41.7%) indicated they took them weekly compared to 30.8% who cited they took them on monthly basis.

The study found out that a majority of the respondents (199, 63.8%) faced challenges of access and availability of iron rich foods and thus the need for IFAS or other iron rich supplements. Most of the women (249, 79.8%) were aware of Vitamin A, a further 96.2% were aware of the various sources of Vitamin A, and these responses were significant at 5%. On the query about frequency of intake of Vitamin A, it was established that majority 46.2% and 42.3% took foods rich in Vitamin A on weekly and daily basis. Further, most (230, 73.7%) of the respondents indicated that they experienced challenges in terms of access and availability of Vitamin A. the study agrees with Anlaakuu & Anto (2017), who noted that weekly vitamin A supplementation reduced maternal mortality by 40% and

further most women may not know they have deficiency of the vitamin and presented in this study.

From the study's findings, it was clear that 72% the respondents who indicated that they were aware of folate or folic acid compared to 28.2% who indicated that they were not aware. Among the foods, the respondents were aware or knew as good sources of folate, 92.3% indicated fruits compared to 39.4% who indicated green vegetables while 28.5% indicated milk. Assessing knowledge of health problems are associated with not having enough folate/folic acid in the diet, majority (64.1%) indicated Neural Tube Defects (like spina bifida) compared to 23.4% who said Goiter (enlarged thyroid gland). All the responses were significant at 5% level. Though few studies have assessed the folate knowledge, Cook (2014) indicated that folate requirements are 5-to 10-fold higher in pregnant than in non-pregnant women. Therefore, pregnant women may be at risk for folate deficiency, and from this study, it is evident that women from Mandera community have little knowledge, their practice is sub optimal on it, and thus they may be suffering from its deficiency.

5.3 Conclusions

The study concludes that anaemia mostly affects women during their second and third trimesters. In addition, women carrying second and third pregnancies are the most affected by anaemia.

The study concludes that a majority of women are aware of iron, and that but few of them know the sources of iron, though some can cite some sources without certainty.

The study concluded that a majority of women face challenges of access and availability of iron rich foods and thus; the need for IFAS or other iron rich supplements.

Regarding knowledge of anaemia, the study concludes that most pregnant women do not have any knowledge on anaemia and its effects in pregnancy, which influences the importance to which they attach to the supplements.

The study concludes that most women are not aware of Vitamin A. While some may only be aware that there is a vitamin A, some of them know the various sources of Vitamin A. nevertheless, most of them do not take foods rich in Vitamin A on daily basis.

The study concluded that most pregnant mothers are not aware of folate or folic acid, especially those in first trimester. Among the food rich in folate, most women know about fruits, and very few are aware that vegetables are rich in folic acid.

5.4 Recommendations

i. Health professionals at the health facility should sensitize pregnant women on the need to continuously take the supplements throughout pregnancy. To ensure that the pregnant women actually take the supplements, education on anaemia in relation to pregnancy should be done. Training to the health professionals and community health workers concerning anaemia, nutrition during pregnancy and counselling skills to be applied when they come in contact with the mothers.
ii. Education on anaemia prevention should be emphasized in the community level in order to encourage dietary modifications and promote environmental control of infections contributing to anaemia. This needs to be carried out on a continuous basis and integrated with other ongoing community health programmes.

5.5 Recommendations for Further Studies

The Ministry of Health (MoH) and other research bodies should conduct more studies on the iron/folate supplementation programs for the improvement of maternal health and dietary adequacy. Further studies should be conducted to assess the effects of other nutritional disorders on pregnant women, and others that affect non-pregnant women and men, as everyone's health is important. A study should as well be done to determine the effects of anaemia on pregnant women in hospitals all over Kenya, Africa and beyond so that governments can use the results to develop concrete frameworks for prevention of anaemia.

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APPENDICES

APPENDIX I: CONSENT FORM

My name is Abdirizak Haji Mohamed**,** a master student in Kenya Methodist University. I am undertaking a study on the factors leading to anaemia among pregnant women in Mandera County. The aim of this survey is to determine the knowledge of anaemia and nutritional causes of anaemia among pregnant women in Mandera Referral County Hospital. I wish to request for your voluntary participation and consent concerning this study.

- You are free to either choose to participate or decline to participate.
- There will be no payment for those who choose to participate.
- Information given was treated with utmost confidentiality and was used for the purpose of the study only.
- No names will be used to identify you and the information gathered will help enhance better understanding of the study topic.
- You may refuse to answer any question or withdraw from the study at any time.
- There will no alteration of data during analysis and after the study; the researcher will give feedback to the hospital for necessary action.

Having read and understood the above information and that the study is voluntary, confidentiality and anonymity are guaranteed, I do hereby accept to participate in this research study.

Participant's sign…… Date……..

Principal researcher's sign…… Date……

APPENDIX II: RESEARCH QUESTIONNAIRE

Demographic Information

1. **What is your age bracket?**

Less than 20 years	[ ]
Between 21-30 years	[ ]
Between 31-40 years	[ ]
More than 40 years	[ ]

2. **What is your marital status?**

Single	[ ]
Married/cohabiting	[ ]
Divorced/ Separated	[ ]
Widow	[ ]

3. **What is the highest level of education you have achieved?**

Primary level	[ ]
Secondary level	[ ]
University level	[ ]
Postgraduate	[ ]
None	[ ]

4. What is your average monthly income?

Less than Ksh 30, 000	[ ]
Between Ksh 31,000-60,000	[ ]
Between Ksh 61,000-90,000	[ ]
More than Ksh 90,000	[ ]

5. Have you been pregnant before

Yes	[ ]
No	[ ]

6. What is the stage of your pregnancy?

First Trimester	[1Months-3Month]
Second Trimester	[3Month-6months]
Third Trimester	[6Month-9Months]

7. If yes, to the above question, how many previous pregnancies have you had?

One pregnancy	[ ]
Two pregnancies	[ ]
Three pregnancies	[ ]
More than four pregnancies	[ ]

INTAKE OF IRON

8. **Are you aware of micronutrient called iron?**

Yes	[ ]
No	[ ]
Don't know/ Not Sure	[ ]

9. **Do you know the sources of iron?**

Yes	[ ]
No	[ ]
Don't know/ Not Sure	[ ]

If yes, which are the sources of iron both animal and plant based sources?

Fruit	[ ]
Vegetables	[ ]
Eggs	[ ]
Meat	[ ]
Salt	[ ]
Milk	[ ]

10. **What is your intake frequency of those foods?**

Daily	[ ]
Weekly	[ ]

Monthly [ ]

Never [ ]

11. Do you have any challenges in terms of access and availability of iron rich source of iron?

Yes [ ]

No [ ]

Don't know/ Not Sure [ ]

INTAKE OF VITAMIN A

12. are you aware of Vitamin A

Yes [ ]

No [ ]

Don't know/ Not Sure [ ]

13. are you aware of sources of Vitamin A

Yes [ ]

No [ ]

Don't know/ Not Sure [ ]

14. What are the main sources of Vitamin A?

Fruit [ ]

Green vegetables [ ]

Orange vegetables [ ]

Yellow vegetables [ ]

Tomato [ ]

Dairy products [ ]

Liver [ ]

Fish [ ]

Fortified cereals [ ]

15. What is your intake frequency of those foods?

Daily [ ]

Weekly [ ]

Monthly [ ]

Never [ ]

16. Do you have any challenges in terms of access and availability of iron rich source of iron?

Yes [ ]

No [ ]

Don’t know/ Not Sure [ ]

INTAKE OF FOLATE

17. Are you aware of Folate or Folic Acid?

Yes [ ]

No [ ]

Do not Know/Not sure [ ]

18. Which types of foods and drinks do you think are good sources of folate?

Fruit [ ]

Green vegetables [ ]

Milk [ ]

Fish/Seafood [ ]

Meat [ ]

Breakfast cereals [ ]

Bread [ ]

19. Which health problems are associated with not having enough folate/folic acid in the diet? (More than one answer can be ticked)

Arthritis [ ]

Neural Tube Defects (Spina bifida) [ ]

Goitre (enlarged thyroid gland) [ ]

Mental retardation [ ]

APPENDIX III: APPROVAL LETTERS

MINISTRY OF HEALTH

Telegram "medical" Mandera
Telephone: (046) 52301
Fax: 046-52301
When replying please quote

HOSPITAL MANAGER,
MANDERA COUNTY REFERRAL HOSPITAL,
P.O. BOX 7-70300,
MANDERA.
22/8 /2016

REF: MCRH/GEN/VOL.1 (nut 05)

TO WHOM IT MAY CONCERN

RE: LETTER OF RECOMMENDATION

ABDIRIZAK HAJI MOHAMED

Dear Sir/Madam,
I am pleased to inform you that the above named officer has been working with us since 22/8/2016 to 5/9/2016 taking data and doing **Factors Associated with Anaemia among pregnant women, at Mandera County Referral Hospital**, during that time he was working with us, he proved to be committed, diligent and productive person who show maturity and discipline to his work.
He has been very co-operative with proven ability to produce high quality work in anywhere in the world without supervision. In relation to that during his stay with us he did the following in rotation to different sectors of the institution.

- MCH(maternal and child health clinic)
- Maternity Services
- ANC clinic
- CWC
- Stabilization centre
- Comprehensive care clinic
- E-special clinic(diabetic, comprehensive care)
- VCT
- Outpatient community based therapeutic program
- Pediatrics ward
- DHIS(DISTRICT HEALTH INFORMATION SYSTEM)
- Outpatient department
- Data entry
- Analyzing/interpreting reports

Any assistance given is highly recommended and appreciated
Thanks in advance

ABDIRASHID .A. ISSACK
SCHRIO INCHARGE/ NUTRATION OFFICER

KENYA METHODIST UNIVERSITY
P. O. BOX 267 MERU - 60200, KENYA
TEL: 254-064-30301/31229/30367/31171
FAX: 254-64-30162
EMAIL: INFO@KEMU.AC.KE

26TH JULY, 2016

Abdirizak Haji Mohamed
HND-3-2383-1/2014
Kenya Methodist University

Dear Abdirizak,

SUBJECT: ETHICAL CLEARANCE OF A MASTERS' RESEARCH PROJECT

Your request for ethical clearance for your Masters Research project titled "Factors Associated with Anaemia among Pregnant Women, A Case Study of Mandera County Referral Hospital," has been provisionally granted to you in accordance with the content of your project proposal subject to tabling it in the full Board of Scientific and Ethics Review Committee (SERC) for ratification.

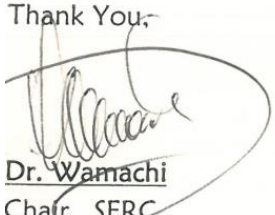
As Principal Investigator, you are responsible for fulfilling the following requirements of approval:

1. All co-investigators must be kept informed of the status of the project.
2. Changes, amendments, and addenda to the protocol or the consent form must be submitted to the SERC for re-review and approval prior to the activation of the changes. The Proposal number assigned to the project should be cited in any correspondence.
3. Adverse events should be reported to the SERC. New information that becomes available which could change the risk: benefit ratio must be submitted promptly for SERC review. The SERC and outside agencies must review the information to determine if the protocol should be modified, discontinued, or continued as originally approved.
4. Only approved consent forms are to be used in the enrollment of participants. All consent forms signed by subjects and/or witnesses should be retained on file. The SERC may conduct audits of all study records, and consent documentation may be part of such audits.

5. SERC regulations require review of an approved study not less than once per 12-month period. **Therefore, a continuing review application must be submitted to the SERC in order to continue the study beyond the approved period.** Failure to submit a continuing review application in a timely fashion will result in termination of the study, at which point new participants may not be enrolled and currently enrolled participants must be taken off the study.

Please note that any substantial changes on the scope of your research will require an approval.

Thank You,



Dr. Wamachi
Chair, SERC
Cc: Dean, RD&PGS

NATIONAL COMMISSION FOR SCIENCE,
TECHNOLOGY AND INNOVATION

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when replying please quote

9th Floor, Utalii House
Uhuru Highway
P.O. Box 30623-00100
NAIROBI-KENYA

Ref: No.

NACOSTI/P/16/64935/13312

Date:

26th August, 2016

Abdirizak Haji Mohamed
Kenya Methodist University
P.O. Box 267- 60200
MERU.

RE: RESEARCH AUTHORIZATION

Following your application for authority to carry out research on ***"Factors associated with anaemia among pregnant women, a case study of Mandera County Referral Hospital,"*** I am pleased to inform you that you have been authorized to undertake research in **Mandera County** for the period ending **26th August, 2017.**

You are advised to report to **the County Commissioner, the County Director of Education and the County Director of Health Services, Mandera County** before embarking on the research project.

On completion of the research, you are expected to submit **two hard copies and one soft copy in pdf** of the research report/thesis to our office.

BONIFACE WANYAMA
FOR: DIRECTOR-GENERAL/CEO

Copy to:

The County Commissioner
Mandera County.

The County Director of Education
Mandera County.

The County Director of Health Services
Mandera County.

National Commission for Science, Technology and Innovation is ISO 9001: 2008 Certified