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# EVALUATION OF DIETARY DIVERSITY AND ADHERENCE TO IRON AND FOLIC SUPPLEMENTS BY PREGNANT WOMEN IN HURUNGWE DISTRICT, MASHONALAND WEST

BY

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## Abstract

Iron deficiency is one common micronutrient deficiencies in the world to this day. Maternal anemia is still a reason of substantial prenatal morbidity and mortality. Anemic women statistics in the world is however, estimated to be at 56 million, the majority (75-80%) have been diagnosed with iron deficiency anemia. In Zimbabwe iron deficiency for the women of reproductive age is at 28.2% while anemia in pregnancy, is at 55%. One of the most imperative factors accountable for maternal iron deficiency is basically poor dietary practices. Dietary diversification is vital for nutrient adequacy as there is surely not one single food that can contain all the important nutrients essential to maintain the good health and good nutritional status. This study's purpose was to evaluate dietary diversity, iron supplements adherence and iron status among pregnant women in Hurungwe district. A cross- sectional analytical design method was then used and the selected sample size, was 172 pregnant women. Systematic sampling technique was used to sample the study participants. Structured researcher administered questionnaire was then used to gather data on dietary diversity, iron supplements adherence and demographic as well as socio- economic characteristics of the pregnant women. Mid upper arm circumference (MUAC) was used to evaluate nutritional status; iron status was however, assessed by recording serum hemoglobin (HB) levels measurements at the ANC. Study data was entered and analyzed using Epi info and SPSS software. Data collected from 24-hour recall was then analyzed using Nutri-survey. Pearson correlation and chi–square was then used to regulate the relationship and association between the study variables. The statistical significance was set at a value of $p< 0.05$. Data was then presented as frequencies, percentages and means. Mean age of the study participants was at 27±5.3 years, 88.4% were said to be married, and 68.3% had received secondary education. 28% of the respondents did not meeting the minimum dietary diversity for women (MDD-W). About 45.7%, were not reaching the recommended dietary allowances (RDA) for dietary iron and approximately 20.1% were anemic. MUAC mean was 26.9 ±3.7, with 86.6% having a MUAC of 23 or more. A significant relationship was found between the level of education and dietary diversity score (DDS) ($r=0.39$; $p=0.047$),DDS and HB ($r=0.48$; $p=0.041$),iron intake and DDS ($r=0.57$; $p=0.038$ ) and between iron intake and HB ($r=0.54$; $p=0.031$).A significant relationship was also found between the MUAC and DDS ($r=0.26$; $p=0.03$).A significant association, was however noted HB and morbidity ($\chi 2$) = 7.98; $p= 0.034$).It is however, recommended that dietary diversity and intake of adequate dietary iron could be promoted through regular health talks and demonstrations to the pregnant women attending the Anti Natal Clinic (ANC) at all the health facilities. The information attained from this current study may be very useful to the ministry of health in Hurungwe district in designing much more appropriate interventions to promote adequate dietary iron intake and alleviate iron deficiency anemia among pregnant mothers in Hurungwe district

**Key words: Adherence; Dietary diversity; Micro nutrients and Supplements**

## Declaration Page

I declare that this dissertation is my original work except where sources have been cited and acknowledged. The work has never been submitted, nor will it ever be submitted to another university for the award of a degree

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9/5/2022

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## Copyright

## Dedication

The dissertation which is dedicated to my dear children Aaliyah and Collence Mushore, for their support and encouragement.

**Acknowledgement**

I surely express my sincere gratitude to almighty God through whom and by whom this work has been done. I gladly acknowledge my supervisors Dr. E Mugomeri Dr G Kambondo and Mrs A. Kapfunde for their unwavering guidance, support, patience and encouragement throughout the research time and the writing of this dissertation. I specially thank Mrs. A Kapfunde for the guidance accorded during the dissertation writing. May the almighty God bless all of you abundantly.

## Acronyms and Abbreviations

| | |
|---|---|
| ACC: | Administrative Committee on Coordination |
| ANC: | Antenatal Clinic |
| APGAR: | Appearance, Pulse, Grimace, Activity, Respiration. |
| ASAL: | Arid and Semi-Arid Land |
| CBOs: | Community Based Organizations |
| CBS: | Central Bureau of Statistics |
| CHW: | Community Health Worker |
| DNA: | Deoxyribonucleic Acid |
| Hb: | Hemoglobin |
| DDS: | Individual Dietary Diversity |
| IDDS: | Individual Dietary Diversity Score |
| INACG: | International Nutritional Anemia Consultative Group |
| LBW: | Low Birth Weight |
| MDD | Minimum Dietary Diversity |
| NGOs: | Non-Governmental Organizations |
| RDA | Recommended dietary Allowance |
| WHO: | World Health Organisation? |
| IFA: | Iron and Folic Acid Supplements |
| ZDHS | Zimbabwe Demographic Health surveys |
| APGAR score: | Appearance, Pulse, Grimace Activity and Respiration score |

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# CHAPTER 1 INTRODUCTION

## 1.1 Introduction

Iron deficiency anemia has been labelled as one of the supreme common nutritional deficiencies during pregnancy. Dietary diversification has basically been defined as an important food-based approach to meet iron need and comprises the consumption of different types of the foods from different food groups. Pregnant women are said to have inadequate iron intake when their daily diet lack diversity and are mainly dominated by staple, starchy foods. There is trifling information on dietary diversity, iron intake and iron supplements among pregnant women in Zimbabwe. Iron deficiency, as the most popular form of under-nutrition, affects approximately two billion people worldwide. (Stoltzfus, 2004). Iron deficit is also known to be the major cause of anaemia mutually in developed and developing countries. Iron and folate acid deficiency anaemia has been said to be a global public health problem that causes high maternal morbidity and mortality.

Proper dietary diversity and provision as well as utilization of iron and folic supplementations among pregnant women prevent the threat of maternal health and perinatal outcomes. The general population which is, the children, pregnant and post-natal women are poorly affected by iron deficiency anaemia, as a result of the increased need of iron for the growth of the infant and development (Stoltzfus, 2004). It has been noted by (de Benoist, 2008) that, approximately 42% of pregnant women globally suffer from anaemia and approximately 50% of the cases as a result of iron deficiency. To add to that several previous reviews by (de Benoist, 2008) have reported there is a relationship between anaemia and an increased risk of maternal and perinatal mortality.

Dietary diversity has been assessed as the number of foods consumed across and within food groups, over a referential period. It is however an important dimension of diet quality Olumakaiye MF (2013). Lack of dietary diversity leading to consumption of some monotonous diets and basically inadequate uptake of fruits and vegetables as well food from a variety of animal sources among the pregnant mothers has been said to be the main contributing factor to under nutrition and so iron deficiency anemia Olumakaiye MF (2013). The uptake of a very wide range of foods across different food clusters is surely a recommended approach to help achieve adequate intake of dietary iron and also improve the iron status among the pregnant women. However, in Zimbabwe, the diets in most times are monotonous, consisting mainly of starchy staples, grains and cereals also often lacking vegetables, fruits and animal-based foods rich in bioavailable iron. These diets contribute to inadequate dietary iron intake among pregnant mothers. However, the predomination of the diets of pregnant mothers by cereals and legumes in Zimbabwe is a major concern these foods are rich in non-heme, iron which is less bio-available as compared to heme iron from animal-based foods.

Dietary diversity has been known as a long-term measure in the direction of preventing iron deficiency anemia and another micronutrient deficiency Olumakaiye MF (2013). Nevertheless, the association between the two which is dietary diversity, iron intake and iron and folate supplements adherence levels among the pregnant women of Zimbabwe has not been sufficiently documented. Therefore, there is incomplete literature in regard to dietary diversity and iron supplements adherence. This current study was so carried out to evaluate dietary diversity and iron and folic supplements adherence among pregnant women so as to increase knowledge in this area. In addition, there were other maternal factors that affected dietary diversity and

thus iron intake as well as hemoglobin levels amongst pregnant women that were not sufficiently documented. Therefore, this present study sought to address such gaps by evaluating the dietary diversity, iron supplements adherence among pregnant women and identifying factors influencing the dietary diversity and iron and folic supplements in the Hurungwe district. Such information has added to the existing body of knowledge and is valuable towards improving dietary diversity, iron intake and hemoglobin levels among pregnant women by the program implementers.

### 1.2 Background to the Study

Maternal malnutrition is said to be a global problem and is much more prevalent in low- and middle-income-countries (LMICs). According to the Zimbabwe Demographic and Health Survey (ZDHS) (2015). In Zimbabwe, a majority of pregnant women have poor nutritional status, with approximately 42% of them suffering from anaemia and about 12.3% of women of the reproductive age having a BMI of less than 18.5. Low birth weight of (< 2500 g), which is one of the best composite indicators of short- and long-term undernutrition in women affects one in ten new-borns in Zimbabwe. Pregnant women are basically vulnerable to iron deficiency as more iron is required primarily to supply the then growing fetus and the placenta as well as to increase maternal red cell mass. However, very little information is known on the dietary diversity and adherence to iron and folate supplement during pregnancy.

Iron deficiency is then defined as a condition whereby there are no mobilizable iron stores therefore there is reduced supply of iron to the body tissues. Iron deficiency anemia through pregnancy has been defined as hemoglobin level of below 11gm/dl above the sea level (WHO, 2011; WHO, 2012). Iron deficiency occurs due to

insufficient dietary iron intake, consumption of staples with low bio-available iron, inadequate intake of food that enhances iron absorption from diet such as vitamin C rich foods, meat, fish and poultry as well as consumption of foods high in phytates or phenolic compounds that inhibit iron absorption. Pregnant women are among those at high risk of suffering from iron deficiency as high demands of iron are needed because of expanding blood volume, the demands of the foetus and placenta and the blood losses to be incurred during childbirth (Gropper et al., 2009). Moreover, iron requirement is high throughout pregnancy with a net iron requirement of about 840mg (Nuzhat et al., 2011). Malnutrition amongst women of the reproductive age has been shown to range from 10% to 19% across the world in most of the countries. In Africa, about 27% to 51% women of reproductive age are estimated to be underweight (Black et al., 2008; Conceição et al., 2011).

Iron and folate acid are, micronutrients needed in relatively small amounts for normal functioning, growth and development of the human body. Iron has also many functions in the body which include: It is an important element of haemoglobin found in the erythrocytes accountable for carrying oxygen from lungs to the cells; It is also an integral of myoglobin which assists as a reservoir of oxygen to the human muscles; It is also vital in the synthesis of hormones and neurotransmitters; It is again a component of most enzymes necessary for metabolism of glucose and fatty acids required for the functioning of the body (Gathigi, 2011). Deficiency in iron often leads to anaemia, a problem that is mainly common in women in the reproductive age and mostly during pregnancy. Anaemia is a worldwide health problem affecting most countries with major cost on human health (World Health Organization (WHO), 2010). According to Christensen and Ohls (2004), the demands for iron rise by six to around seven times from the early pregnancy to the

late pregnancy. It is estimated that around 30% which is about 2 billion of the total world's population is anaemic, largely as a result of iron deficiency (World Health Organization (WHO), 2010. Anaemia in pregnancy doubles the risk for preterm labour and delivery, low birth-weight as well as perinatal and maternal morbidity and mortality rates (WHO, 2010).

Just like in other developing countries, the magnitude of anaemia in Zimbabwe remains a foremost concern. One of the interventions done nationally and recommended to prevent iron deficiency anaemia amongst the pregnant women is through antenatal iron/folic acid supplementation. In Zimbabwe, a pregnant woman is recommended to basically take at least 90 pills of iron/folic acid supplements which consist of 60 mg of iron (ferrous sulphate) and about 0.25 mg of folic acid, during pregnancy. These iron supplements tablets are provided for free to all pregnant women throughout the country. Studies that have been conducted before have revealed the benefit of iron/folate acid supplementation in a reduced risk of neonatal deaths, low birth weight and preterm delivery (Zeng, 2001.)

In developing Countries, insufficient dietary iron intake is a major concern because most foods eaten by pregnant women comprise of cereals and legumes which are sources of non-haeme iron. The body absorbs haeme iron about two to approximately three times better than nonhaeme iron and a small amount of haeme iron in the diet is known to improve absorption of non-haeme iron. The diet composition is an important determinant of the amount of iron actually absorbed. This is because some dietary content such as diets rich in whole grains, legumes and maize contain phytic acid which forms insoluble complexes (iron chelates) with iron thus averts the absorption of iron and thereby contribute to iron deficiency (Gropper, 2009)

The noted high prevalence of iron deficiency emphasizes the need for an evaluation of dietary diversity and adherence to iron and folate supplementation in pregnancy. The intake of iron during pregnancy is particularly much more important as the demand of iron by the expecting mother and the fetus upsurges during pregnancy. This noted increased demand cannot be met without adequate iron intake from food items or iron supplementation. It is said that during pregnancy the whole maternal need for the extra iron averages approximately to 800 mg (elemental iron), of which around 300 mg is meant for the fetus and placenta and the rest is meant for the maternal hemoglobin mass expansion (WHO, 2010). The placental and fetal requirement is compulsory and dietary intake will be diverted to this end even if the mother is iron-deficient. About 200 mg of iron more is shed through the gut, urine, and the skin. Practically all of this iron is used during the latter half of pregnancy. Consequently, the iron requirements increase from about 0.8 mg/day in the first trimester of the pregnancy to about 6 to 7 mg/day in the other second half of pregnancy. Generally, a pregnant woman needs about 2 to 4.8 mg of iron each day (Christensen and Ohls, 2004).

Maternal factors that include as age, marital status, education, income and occupation are some of the demographical and socio - economic characteristics that have been proven to correlate with dietary practice and hence dietary diversity amongst the pregnant women (Fatima, Inayat & Shahzad, 2014; Fatemesh, Tabrizi & Saraswathi, 2012; Koryo et al., 2012). Educational accomplishment has been proven to have a strong effect on the health and eating habits of an individual. Dietary patterns have been correlated to demographic and socio-economic factors such as parity, maternal age, education and occupation. Increasing maternal age and high maternal education have been correlated with a healthy and a very diverse diet

among the expecting mothers. Nevertheless, women who received little education and are not working and have a high parity have been said to be more prone to unhealthy and non-diverse diet (Fatima et al., 2014; KNBS&ICFMacro,2010; Northstone et al.,2007).

### 1.3 Statement of the Problem

Iron deficiency anemia has adverse effect on the health of the expecting mothers and that of her child, hence it is then important to address factors that contribute to its occurrence. Dietary diversity has been predicted as a long-term approach towards the prevention of iron deficiency anemia. On the other hand, a little on the association between dietary diversity and iron status among pregnant women has been documented in the past studies There is generally limited literature in regard to dietary diversity and adherence of iron supplements amongst the pregnant women in Zimbabwe, more so in Hurungwe which this study aimed at addressing.

Despite the efforts made by the Ministry of health and child welfare to try and promote high intake of iron rich foods and the supplementation of iron and folate among pregnant mothers, the iron uptake remains significantly low in Hurungwe district. Low uptake of iron rich foods and iron supplements in pregnancy has showed major public health problems, resulting in a condition called Anemia. According to the Zimbabwe Demographic and Health Survey (ZDHS) (2010), adherence to iron/folate supplements by expecting mothers in Zimbabwe is low. Nationally only 9% of the pregnant women take iron supplements more than 90 days of the suggested 180 days. Therefore, there is need to evaluate dietary diversity and the adherence of iron and folic supplements to understand the iron levels as well as to facilitate initiatives towards strengthening the iron supplementation programmes.

The Zimbabwe National Nutrition Strategy identified that insufficient knowledge and practices concerning appropriate and healthy diets for the children and adults, particularly among mothers and caregivers of children in the first 1,000 days of their life.

## 1.4 Research Objectives

### 1.4.1Broad Objective

To evaluate dietary diversity for pregnant women in Hurungwe district Mashonaland west and their adherence to iron and folic supplements.

### 1.4.2 Specific Objectives

- To determine the dietary diversity and iron intake among pregnant women in Hurungwe district.
- To evaluate iron and folate supplementation adherence among the pregnant mother in the district
- To determine the haemoglobin levels and nutritional status among pregnant women.
- To determine the morbidity, health seeking behaviour, antenatal care attendance and micronutrient supplementation among the pregnant women.
- To establish the relationship between study variables.

## 1.5 Research Questions

- What are the different food groups that are consumed by pregnant mothers in the Hurungwe district?
- What are the adherence patterns among pregnant women to iron and folic acid in Hurungwe district?

- What are the haemoglobin levels and nutritional status among pregnant women?
- What is the morbidity, health seeking behaviour, antenatal care attendance and micronutrient supplementation among the pregnant women?
- What is the relationship between study variables?

### 1.6 Justification of the Study

The study is trying to understand and evaluate the different types of foods that are consumed by the pregnant mothers to see if they are rich in iron and if not, are they taking their iron supplements. In a brief, the study seeks to try and find ways in which we can improve the uptake to contribute to the global goal of reducing anemia effects on the vulnerable populations. Iron deficiency anaemia has several adverse effects that include impaired cognitive development, neurological dysfunction, impaired immunity leading to increased risk to infections and low birth weight, congenital anaemia to the newborn leading to increased perinatal and infant morbidity and mortality (WHO, 2014).Maternal negative effects include premature delivery, increased hemorrhage during and after delivery, increased risk to infections and heart failure resulting in high maternal morbidity and mortality (WHO, 2010). Meanwhile, the Zimbabwe National Statistics Agency (ZIMSTAT) and ICF International (2012) reported that one of the current programmes to prevent anaemia is routine iron supplementation to pregnant women through the antenatal clinics. Therefore, there was need to evaluate the dietary diversity and later find out the adherence to iron and folic supplements by pregnant mothers.

The information gathered from this study would help health authorities and nurses understand the prevailing situation and address the identified gaps. The knowledge acquired would help the Mashonaland west provincial health department to

understand the diet and uptake of iron supplements by pregnant mothers. This would assist responsible health personnel to be able to help pregnant women to comply to iron rich diet and to adhere to iron supplements thus prevent anaemia and indirectly reduce maternal morbidity and mortality. The findings would be used as an educational tool to student nurses, qualified nurses, midwives as well as medical practitioners to effectively understand the dietary diversity and later adherence to iron supplements and subsequently improve uptake of iron supplements by pregnant mothers. The public health research will surely benefit through new knowledge developed from research findings as well as refining the already existing facts. The study shall benefit as new strategies will be developed to mitigate the barriers, they are facing to take the iron and iron supplements during pregnancy.

### 1.6 Delimitation of the Study

The study was carried out in Hurungwe's 15 health centers offering the ANC The study only investigated pregnant women who were attending ANC at these facilities at the time of the study. Therefore, the research findings of this study are only applicable to areas with similar characteristic

### 1.7 Limitation of the study

This study was a cross sectional study therefore, the data was collected at a point in time and hence the data does no show dietary diversity across the seasons of the year round.

# CHAPTER 2 REVIEW OF RELATED LITERATURE

## 2.1 Introduction

Kumar (2011), elaborates that literature review is conducted to generate a picture of what is known about a situation and the knowledge gaps that exist in the situation. This chapter looked at literature that addresses dietary diversity, iron status and adherence of the iron and folic supplements among pregnant women. Maternal malnutrition is a multifaceted problem which is sad to be caused by a wide range of both direct and indirect factors. These include inadequate nutritional intake as an outcome of household food insecurity or as an infection which can however, the increase nutritional requirements and surely prevent the body from absorbing those consumed. As for the women in sub-Saharan Africa, the environmental and economic conditions also put an extra burden on their nutritional status.

Unescapable poverty significantly affects quality of their diet, their heavy workload increases their nutritional needs, frequently and brief reproductive cycles leave the mothers moving from one pregnancy to the supposedly next without sufficiently refilling the body's nutrients stores, Lack of nutritional know how makes them consume unsuitable nutrition.

Iron deficiency anaemia is said to be the most common nutritional deficiency in the world and is also the most common hematological disorder surfacing during pregnancy with considerable complication to both the expecting mother and fetus. Anemia in pregnancy basically contribute to about 12% to 28% of neonatal deaths. It has been noted that iron deficiency anaemia through pregnancy is associated with high rates of premature birth and also low birth weight as well as maternal mortality and morbidity (WHO, 2007). Studies have shown that anaemia early in pregnancy is

related to increased risk of preterm premature rupture of membranes while anaemia later in pregnancy may result to spontaneous premature labor (Zhang, 2009).

## 2.2 Theoretical Framework

The study will utilize Rosenstocks Health Belief Model (1966), which was altered by Beckers (1974). The framework has proven to be frequently used theoretical concepts in health education and health promotion by scholars. It was however developed as a way to explain why health screening programmes offered by the health care sector were not exclusively very successful. The Model was selected by the investigator because it intends to predict which individuals would or would not use preventive and screening measures to note early physiological changes and diseases that are likely to happen due to one being pregnant such as hemodilution and anaemia respectively. The Health Belief Model includes basically individual perceptions, modifying factors and variables that are likely to affect initiation of action. The model has four key concepts: perceived seriousness, perceived susceptibility, perceived benefits and perceived barriers. Each of the perception can be used to explain one's behaviour towards health and health services. Other concepts have been added lately to the model and they embrace cues to action, motivating factors and self-efficacy.

## 2.3 Relevance of the Theoretical Frame to the Study

Conceptual framework denotes to a set of concepts that are linked and described by broad generalizations which are articulated by an individual for a purpose (Rosenstocks 1966). The Health Belief Model will be adopted in this study to try and explain the perceptions pinned in the study, as quantitative studies need to be based

on existing body of knowledge or theory. The health belief model originated originally from a groundwork of cognitive theories of human behaviour. Cognitive theorists however, it is suggested that, behaviour is dependent upon the value that an individual place on a desired perceived seriousness of the diseases. Perceived seriousness of anaemia in pregnancy outcome, and the belief that behaviour, if performed well, will result in the desired outcome, (Bandura 1977). Additionally, the model goes on to explain that a range of health behaviors can be foretold based on information from determinants such as perceived susceptibility, perceived severity, perceived benefits or noted barriers and modifying factors associated with engaging in a behaviour. The application of the above-mentioned health model in this current study has been outlined in subsequent paragraphs below.

### 2.3.1 Perceived susceptibility

Perceived susceptibility denotes to an individual's judgment of their risk of contracting a health problem. The likelihood of seeking health interventions increases as the level of perceived susceptibility increases (Rosenstocks 1974). In a way, pregnant women would be more likely to consider consuming nutritious meals and seek antenatal care services if they believe that they are susceptible of developing some sort of complications during pregnancy.

### 2.3.2 Perceived severity

Perceived severity refers, mainly to the subjective evaluation of the likelihood that a problem/illness or disability, if contracted or left untreated, will have serious consequences such as pain, death, handicap, or reduced quality of life in general, (Backer and Maiman 1977). In the setting of this study, willingness of pregnant

mother to consume iron rich foods and utilize iron supplements would depend largely on personal evaluation of the seriousness of the consequences associated with pregnancy problems for example, death of the fetus.

### 2.3.3 Perceived benefits/barriers

Individual's choice of behavioural options depends largely on their perception of benefits and barriers in a way. Consequently, a cost benefit analysis allows an individual to evaluate the outcome expectations and assess whether the expected benefit of a behaviour outweigh the perceived outlay incurred by appealing in the behaviour (Rosenstocks 1974). Compliance with recommended health seeking behaviour is hindered to the extent that perceived barriers outweigh perceived benefits that would result from engaging in the health behaviour (Rosenstocks 1974) Generally, inconveniences such more house hold chore as well as long waiting time at antenatal clinics and distance to the health facility would act as the major barriers to eating and drinking of iron rich foods and in some cases the uptake of iron and folate supplements. Usually, a pregnant mother would opt not to seek for dietary diversity or rather not go to the ante-natal clinic if she sees no benefit in doing so. Additionally, health care workers' negative attitude towards fixated antenatal care, inadequate resources both material and human, inadequate equipment and supplies, lack of knowledge regarding benefits of iron supplements would also obstruct uptake of iron supplements (Simkhada et al.2008)

### 2.3.4 Modifying factors

These may include socio-cultural factors as well as demographic aspects such as age, parity, religion, educational status, social values, beliefs and practices of the pregnant

woman in relation to uptake of dietary diversity and well as supplements (Chivonivoni et al.2008)

## 2.4 Anaemia and iron deficiency

The known global prevalence of anaemia through pregnancy has been approximated at 41.8%, equivalent to 56.4 million women (Maclean et al, 2012). Similar studies have highlighted that, Sub-Saharan Africa is predominantly affected with anaemia and the incidence is estimated at 17.2 million pregnant women. This then corresponds roughly to about 30% of total global cases (WHO, 2014). Iron needs almost double during pregnancy, moreover the body's ability to absorb iron from the diet may be much compromised in late pregnancy (Stoltzfus &Wu, 2012). Anaemia is common among women who begin their pregnancies with adequate iron stores due to the increased demands. (Klemm, 2011) cited that those women who become pregnant already anaemic are at an increased risk of negative pregnancy outcomes in comparison to those who become anaemic whilst pregnant. Routine iron supplements were given weekly to women of the reproductive age (WHO, 2011) especially in pregnancy to fight both iron and folic acid deficiency anaemia during pregnancy. Ronnenberg (2004), initiates that moderate anaemia prior to pregnancy was drastically connected with fetal growth restriction and low birth weight among Chinese women.

Pregnancy is a nutritionally demanding period and adequate dietary intake is important in order to meet the increasing nutritional needs for the mother and the fetus. Moreover, pregnant women are often nutritionally vulnerable because of the physiological demands of the pregnancy and therefore they require a more nutrient dense diet (Akther et al., 2015; Torheim & Arimond, 2013). Insufficient dietary

intake during pregnancy affects both the woman and their infant and yet many pregnant women don't consume adequate diet. Studies have shown that an adequate diet during pregnancy is positively associated with the infant development, maternal as well as child health, a healthier pregnancy and its delivery, there is lower risk of chronic diseases and better education achievement for the children (Vakili, 2013; World Health Organization, 2012).

Adequate dietary intake during pregnancy plays a significant role in the wellbeing of the expectant mother and her newborn baby and also influences the so-called health of the child during childhood and adulthood. Strong evidence indicates that insufficient dietary intake during pregnancy, may result in spontaneous abortion, poor pregnancy weight gain, impaired fetal growth, learning impairment and also behavioral problems of the children (Koryo et al.,2012). Therefore, during pregnancy the diet quantity and the quality of the diet is very importance for positive birth outcome.

### 2.5 Dietary diversification and modification

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

developed dietary diversity guidelines to obtain data on the food consumption of individuals or households. Dietary diversity is a qualitative measure for food consumption that serves as a substitution of the 19-nutrient adequacy of the diet of a person. The dietary diversity score is created through adding up the number of food groups that are consumed over a specified reference period of time such as 24hours (FAO, 2007

### 2.5.1 Dietary intake based on dietary diversity among the pregnant women

Dietary diversity is the number of food clusters consumed by an individual over a specific reference period of time (Kennedy, 2009; Ruel, 2004). Dietary diversity is usually regarded as a major indicator in measuring the access, utilization and the quality of an individual's diet (FAO, 2011; Fatima, 2016). A diversified diet is related to the micronutrient adequacy and good nutritional status of an individual (Jayewardene et al., 2013; Kennedy, 2009; Mirmiran, 2006; Ruel, 2004). Consumption of a variety of food or food stuffs in the diet has been considered important in achieving adequate intake of major nutrients and realizing an optimal nutritional status (Drimie et al., 2013 & EY et al., 2012). A satisfactory diet is distinct as a diet that delivers sufficient amounts of essential micronutrients to meet the dietary requirements of the pregnant women (Deniels & Melissa, 2009).

Dissimilar studies have been conducted to establish the relationship between micronutrient adequacy of diets of women of the reproductive age and their dietary diversity. These researches were conducted in five different regions and in all the sites dietary diversity was shown to be significantly correlated with micronutrient adequacy (Arimond et al., 2011; Kennedy, 2009). Moreover, some other studies which were conducted in different countries involving different age groups showed

correlations ranging between 0.36 to 0.66 between various dietary diversity scores and micronutrient adequacy of the diets of an individual (Arimond et al., 2011; FAO,2011; Kennedy ,2009).

The Women's Dietary Diversity Project carried out by FAO measured the possibility of simple dietary diversity scores to be a measure of the micronutrient sufficiency of diets of women. These studies were conducted in five countries and various food groups were used to measure the dietary diversity score (Arimond et al., 2010; Arimond, 2011; FAO, 2011). The findings of these studies then resolved that all the dietary diversity scores were associated significantly with micronutrient sufficiency of the diet (Arimond et al., 2011).

Most of the previous studies on dietary diversity amongst women have been done using the women dietary diversity score. The women dietary diversity score is said to reflect the probability of a diet that meets the micronutrient requirement of the women of reproductive age. The WDDS is based on nine food groups which include; starchy staples, dark greenish leafy vegetables, other vitamin A rich fruits and vegetables, other fruits and vegetables, organ meat, meat and fish, eggs, legumes, nuts and seeds, milk and milk products (FAO, 2011). However, the WDDS does not include the threshold or the number of food groups that the women should have consumed in order to be described to have consumed sufficient micronutrients.

FAO has therefore developed another dietary diversity indicator namely minimum dietary diversity for women (MDD-W) which applies an open recall approach to collect data on all the food and drinks consumed by individual woman over previous 24 hours (FAO & FHI 360, 2016). The minimum dietary diversity has been described as a food group diversity indicator that has been shown to reflect micronutrient adequacy. The micronutrient adequacy has been summarized across

eleven micronutrients which include; Iron ,Zinc, Calcium ,Vitamin A, Thiamine, Riboflavin, Niacin, Vitamin B6, Folate, Vitamin B12 and Vitamin C (Martin-Prevel et al., 2015).The MDD-W dietary diversity indicator is calculated based on 10 food groups which include; grains, white roots and tubers and plantains, pulses (beans, peas and lentils), nuts and seeds, dairy, meat, poultry & fish foods, eggs, dark green leafy vegetables, other vitamin A-rich fruits and vegetables, other vegetables, and lastly other fruits (FAO & FHI 360, 2016).

Promotional of a diverse diet is one of the many approaches to improve micronutrients adequacy for pregnant women. The MDD-W is regarded unique because unlike the former dietary diversity scores, it not only gauges the amount of dietary diversity in a woman's diet but it usually offers a specific threshold for meeting the micronutrient needs of women of the reproductive age. It states that a woman of reproductive age who consumes food or food stuffs from at least 5 out of the ten stated food groups has a higher possibility of micronutrient adequacy (FAO & FANTA III, 2014).

An adequate quality diet has been identified as a diet that gives an adequate number of selected micronutrients to meet the need of the expecting women. In addition to micronutrients adequacy, high quality diets are characterized by balance in intake of protein, carbohydrates and fat and moderation of foods that are low in nutrients density and those associated with increased risks for chronic diseases (Deniels & Melissa, 2009; FAO & FHI 360, 2016; Institute of medicine, 2005).

Based on the MDD-W, the pregnant women who consume food items from at least 5 of the set 10 food groups can be said to have a higher probability of achieving micronutrient adequacy than the other groups that has lower proportion of women achieving the brink of food items from at least five food groups. This implies that a

higher prevalence of a MDD-W is a substitution for better micronutrients adequacy among the women that are in the range of reproductive age including the pregnant women. The expecting mothers' women who then consume food items from 5 or more of the 10 food groups are likely to consume at least 1 animal source food and a pulse or nuts and maybe seeds and food items from the two or more of the fruit/vegetable food groups (FAO & FHI.360,2016; Martin-Prevel et al., 2015; Torheim & Arimond, 2013).

### 2.5.2 Dietary intake of pregnant women based on 24-hour recall

The 24-hour recall is quantitative method of assessing the dietary intake of an individual over previous 24 hours (FAO & WHO, 1996; Geffen, 2003). A 24-hour recall relies on the memory of the participants who are required to recall all the foods stuffs and beverage consumed in the previous 24 hours. Further information is elicited on whether the food or drink was consumed during the meal time or as a snack and the ingredient of the dish and method of preparation after the listing of the foods and drinks reported to have been consumed by the respondents (Perez-Escamill & Segall-Correa 2008).

### 2.5.3 Dietary intake of the pregnant women based on food frequency questionnaire

Food frequency questionnaire is a limited checklist of foods and beverage with a frequency response section for the respondents to indicate how often each item was consumed the previous week. Consumption of a food stuff for at least three times a week is measured to be regular intake while consuming less than thrice in a week is regarded to be irregular consumption (Ahmed et al. 2008; Chege, 2012; Dahl, Maeland & Bjorlkkjaer, 2012

### 2.5.4 Dietary diversity and dietary iron intake among the pregnant women

Dietary diversification has been defined as the art of including a certain variety of foods or food stuffs in a meal with the aim of getting sufficient nutrients through complementation and is one food-based approaches of tackling iron deficiency anemia. Studies have sufficiently demonstrated that dietary diversity is strongly connected with micronutrient adequacy (GoK, 2008; Jayawardena, 2013; Kennedy, 2009; Mirmiran, 2006; Ruel, 2003). This has been based on the dispute that there is no any one single food which may contain the essential nutrients that are required for optimal nutritional status (Kennedy, 2009). To add to that, studies have proven that a diet that is diversified is correlated with an optimal nutritional status and that including different food stuffs from different food groups in the diet is important in order to ensure acceptable intake of essential micronutrients and macronutrients (Drimie, 2013; Ey, 2012; Kennedy ,2009).

In most developing countries Kenya included, iron deficiency is still a chief public health problem (Kenndey, 2007). This problem is attributed to the intake of monotonous cereals, grains and starch-based diets that are absent in diversity. Moreover diets in most developing countries have been described as that which lacks fruits, vegetables and animal source foods (Daniels & Melissa, 2009; Kennedy,2007; Kiboi,Kimiywe & Chege,2016). It is due to the inadequate nutrient intake amongst the women, iron deficiency anemia has however, remained prevalent in the developing countries including Kenya (Abebe,2014; Allen,2014; Kiboi, Kimiywe&Chege,2016; Rodriguez-Bernel,2012).

To overcome this problem, food-based approaches like dietary diversification have been recommended and appears that in many countries' dietary guidelines (Kennedy, 2009). Pregnant women are said to be most vulnerable to iron deficiency and many other micronutrients deficiency when their diets lack diversity thus failing to meet

the increased nutrients needs (Lee et al., 2013). Unfortunately, in most developing countries dietary diversity, iron intake and iron status among the pregnant women has received little attention and therefore the need for further research which this study aimed at achieving (Willy et al., 2016; Rashid, 2011).

### 2.6 Utilization of health services and personal beliefs

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

#### 2.6.2 Fluctuation in supplies

Insufficient and sporadic supplies of iron tablets and the failure to distribute them emerged as barriers to adherence (Galloway et al., 2002; Ritsuko et al., 2006; Lacerete et al., 2011). Although it is a policy in many developing countries to give iron supplements to pregnant women, clients are often not given enough pills to effectively improve their iron status. This may be due to: lack of overall government

resources, probably a low priority for health expenditures within the government departments, and a lack of awareness of the policy makers about the basic importance of iron supplements (ACC/SCN, 1991). Supplies have been found to be a problem in the country of Indonesia where by 83% of participants in the Nutrition Development Program said they had never seen any iron tablets (Griffiths, 1980). Upon further investigation around the matter, it was then brought to light that the health care professionals had not distributed iron because they did not understand its 18 importance.

**2.7 Morbidity, health seeking behavior and antenatal clinic attendance among pregnant women**

Morbidity affects the nutritional status as well as iron status of pregnant women directly and is an immediate cause of malnutrition (Olumakaiye, 2013; Ruel, 2010; UNICEF, 1990). The dietary intake and dietary diversity of an individual is affected negatively by the illness and also by the treatment given to cure the illness. Helminthiasis has been proven to be one of the factors which contribute to anemia amongst the pregnant women. Malaria has also been found to be a leading cause of morbidity and mortality in Zimbabwe (KNBS & ICF Macro, 2014).

In Zimbabwe malaria is one of the most popular and common diseases affecting pregnant women (Agan et al., 2010). Pregnant women who have co-morbidities such as existence of hypertension, anemia and low MUAC are more likely to give birth to low weight babies (Assefa, Berhane & Workua, 2012). Life threatening morbidity during pregnancy includes, swelling of both the hands and feet, paleness, virginal bleeding, hypertension and also convulsions (Sigh et al., 2013). Seeking health early is very crucial during pregnancy to ensure that all infections and diseases are treated or managed promptly for a health pregnancy and positive pregnancy outcome.

Attending antenatal care regularly is considered important as to monitor the progress of the pregnancy and therefore by reduce the risk of morbidity for mother and fetus. Furthermore, ANC attendance is very crucial in order to detect and treat anaemia and other infections as early as possible

### 2.9 Summary of literature review

Basically, studies have sufficiently demonstrated that dietary diversity is strongly associated with micronutrient adequacy and that a diet that is diversified has been correlated significantly with good nutritional status. Moreover, variety of foods clusterx77i8j in the diet has been shown to be important in ensuring adequate intake of essential nutrients and in realizing an optimal nutritional status. There are major gaps that exit in the reviewed literature such as limited knowledge on dietary diversity and adherence of iron and folic among pregnant women in Hurungwe.

# CHAPTER 3 METHODOLOGY

## 3.1 Introduction

The chapter discusses methods that used in conducting the study. It focuses primarily on the research design, setting, sample, sampling procedure and target population. It also then highlights the data collecting instrument that is its structure and examining the reliability and validity of the data collection tool used. The chapter justifies selection of respondents and also ethical considerations observed in this study. Finally, the chapter discussed the data collection and analysis procedures followed throughout in the study

## 3.2 The Research Design

A research design, is a framework that guides and controls research in a way. It is a conceptual structure which the research is conducted and it constitutes the blue print for collection, measurements and the analysis of data (Edmonds & Kennedy, 2012). The study adapted a cross-sectional analytical study design. This study was carried out at the district's main hospital and 15 RDC clinics. The rural clinics are located across the entire district and target population for the study were the expecting mothers who visited the ANC at the clinics at the time of the study. Only pregnant women attending ANC clinic who given informed consent were included in the study. Cross sectional studies capture the population in a single point in time, it can also help remove assumptions. The gathered data is from a pool of respondents of varied characteristics and demographics usually known as variables.

The demographic information may include the age, gender, income, education, geographic locations and ethnicity, these were the variables. Cross sectional studies are appropriate as the study was conducted on mothers attending ANC. This helped remove the aligned assumptions and replace them with actual data on the specific variables studied during the time period accounted for in the cross-sectional study. The type of study is not costly and is suitable for academic purposes. These mothers who are the target population were attending ANC and the PNC follow up were asked about their Iron/Folate acid uptake throughout their pregnancy time in order to depict the surrounding factors leading to the uptake. Cross sectional studies then provide a snapshot of the frequency of the disease and exposures.

**3. Study Setting**


***Figure 3.1 Area of Research***

The study was conducted at 15 health facilities including the Hurungwe district hospital, these are situated in the Hurungwe district which is in the Mashonaland West Province of Zimbabwe. The district has a total of 42 health care facilities which provide anti natal care to the pregnant mothers. The district offers routine and specialized health services, including maternal and child health clinics. The health care facilities offer iron and folic acid supplements services as well as healthy eating to pregnant women during the antenatal clinic. This is in line with the national guideline for micronutrient deficiency control (MOHCW, 2009). Established over fifty years ago, during the pre- independence era, the health care facilities have continued to cater for an ever-growing community population which now stands close to 400 people per clinic, according to the last census results (ZIMSTAT, 2012). The district health facilities used in the study because have antenatal clinics where pregnant mothers receive Iron and folate supplements.

### 3.4 Study Population

#### 3.4.1 Inclusion criteria

A population is the aggregation of cases in which an investigator is interested (Polit & Beck 2009). Chiromo (2009), further emphasizes that a population refers to the individuals, units, objects or events that was considered in a research project. In this study, the target population was the women of the child bearing age, 18-49 years attending antenatal clinic at the selected health facilities.

The inclusion criteria were the women visiting Antenatal Care and post-natal care who were in their second and third-trimester and also the post-natal mothers attending PNC services at all the selected health centers in Hurungwe district throughout the data collection period. Furthermore, pregnant mothers living with

disabilities but meeting the required criterion were included in the study. Only women who gave the informed consent were included in the study

### 3.4 2 Exclusion criteria

Mothers who were seriously ill at the time of data collection and mothers who are on anemia treatment were be excluded. The investigator had English and Shona questionnaires. Participants were excluded from the study on the basis that they are not able to understand either English and/or Shona questionnaires. To add to that, women coming to the antenatal clinic for the first time were excluded from being part of the study. Lastly Women who declined to give informed consent were also excluded from the study

### 3.5 Sample Size

Polite and Beck (2009) have clearly defined a sample as a subset of population elements. A sample is more economical and practical to work with a sample, rather than a total population (Morrison et. al, 2011). Springer (2010) claimed that a sample consists of those individuals who actually participate in a study. In the study, the investigator selected a sample that was a representative of the total target population so that the research findings could be generalised. Chikoko and Mhloyi (1995), further reiterated that minimum of a third of the population is usually adequate.

Systematic sampling was then used to select the sample built on the hospital records. The sample size of the study was 172 calculated using the formula ($n = Z^2Pq /e^2$) by (Israel, 1992) was used in determining the sample size. Where, n is the desired sample size, Z is the standard normal deviation at 95% level (1.96), p is the proportion of the target population estimated to have the characteristics being

measured, q is 1-p and e is the level of statistical significance set (0.05). The prevalence of under nutrition of 0.17 among women in Hurungwe district where the study was done was used (KNBS & ICF macro, 2010).

$n = (1.96)^2(0.17)(0.83)/(0.05)^2 = 217$. The finite population correction for population less than 10,000 was done to produce a sample size proportional to the population by the formula (Israel, 1992).

$$n = \frac{n}{1+(n_o-1)/N}$$

n = sample size, $n_o$ = desired sample size ,N=estimate of the population size. The estimate of the population size was the average monthly attendance calculated from the previous year ANC records. The total monthly average attendances of the 5 health centers were 550 pregnant women.

$$n = \frac{217}{1+(217-1)/550} = 156$$

The sample size is often increased by10% to compensate for non-response. Therefore, the calculated sample size of 156 was increased by 10% to make a total of 172 to cater for non-response (Israel, 1992).

### 3.6 Sampling Procedure

Polite and Beck, (2009), defines sampling as a process of selecting a few participants from a bigger group to become the basis for estimating the prevalence of information of interest. Simple random sampling was used to select 172 participants from the selected health facilities. Simple random sampling ensures that each unit in the population has an equal chance of being included in the sample (Cohen & Manion, 1996). Feasibility study shows that the Antenatal Care from the selected health care facilities serves about more than 300 pregnant women per month and on an average

10-15 women are attended to every day from Monday to Friday. The pregnant women being attended on the day had the Antenatal Care cards arranged on a nurses' trolley and the nurses manning the clinic then called patients who were be sitting on benches into the consultation room on a first come first serve basis as this is the norm of the day at the health facilities. The investigator screened the women for eligibility by referring to their ANC cards. All women attending Antenatal Care for the 2nd time or more were selected. Yes or no cards were put in a hat where they were randomly selected without replacement. Those who picked the cards with a yes were selected into the study.

### 3.7 Study variables

#### 3.7.1 Independent variables

The independent variables included; dietary diversity which was measured by minimum dietary diversity, for women (MDD-W), iron intake which was assessed using the 24-hour recall and analyzed in terms of frequencies, percentages and mean, morbidity and health seeking behavior, ANC attendance analyzed in terms of frequencies and percentages. Demographic and socio-economic characteristics which were measured by age, parity, marital status, education level, occupation, and analyzed in terms of frequencies, percentages and mean.

#### 3.7.2 Dependent variable

The dependent variables of the study were, micronutrients supplementation and nutritional status which was measured by the MUAC.

### 3.8 Sampling technique

Hurungwe district hospital was purposively selected because it is the major referral hospital in Hurungwe district and the neighboring districts. 4 other clinics situated in the north, east, west and south of Hurungwe were chosen to be part of the sample. Systematic sampling method was used to select the sample. Systematic sampling technique involves selection of subjects directly from the sampling frame that was listed progressively (Mugenda,2008). For this study the sampling frame will be listed numerically by assigning each pregnant women a number from the selected hospital and clinics. The ANC visits records at the main hospital which have an average of 250 attendance per month and the cumulatively 300 on the other 4 clinics. The researcher will then start at a random point and selected every pregnant woman. In the selected areas Where k=N/n. The N (550) is the average monthly attendance in ANC clinic and n (172) is the required 54 sample size k=550/172=3.20 thus approximately every 3rd pregnant woman will be included in the sample until the required sample size will be obtained. Sampling will be done from Monday to Friday within a period of one month during the research period until the required sample size is obtained.

### 3.9 Recruitment of the study participants

The study participants were recruited during the study period which was one month. The researcher visited the ANC clinic at the Hurungwe district hospital and the other four clinics in Hurungwe each week day and explain to the pregnant women the purpose and procedure of study to the sampled pregnant women and those who agreed to sign the informed consent were recruited to partake in the study. 45,5%of

the total participant were selected from the district hospital whereas the remaining 55,5% were selected across the 4 district clinics and hospital.

### 3.10 Data Collection Instruments

A research instrument is said to be a stool used for the collection of data (Creswell, 2010). This study used a structured interview schedule. A structured interview schedule, according to Dillon et al (1994) follows a specific questionnaire and this research instrument is usually used as the basis for most quantitative surveys. The investigator conducted standardized interviews with specific questions which asked in a stipulated set order to ensure there was no variation between interviews what so ever. Data was be gathered with a researcher administered structured food frequency questionnaire, dietary diversity data, was then collected using a 24-hour recall dietary diversity questionnaire and then followed by an iron supplements adherence questionnaire. The 24- hour recall was adapted from the Food and Agriculture Organization (FAO). To include the locally available foods, dietary diversity questionnaire was adjusted. The dietary diversity questionnaire included ten food cluster.

The researcher together with research assistants visited the ANC clinic in daily for a period of a month during January and Fed 2022. Through the help of the nurse in charge, the researcher managed to recruit the research respondents and then explained the key purpose, objectives and also the procedure of the study to the participants. The questionnaire was administered to women who only gave an informed consent through signing to partake in the study by local nurses. The interview was conducted after mothers had been given the routine antenatal care services. The dietary diversity questionnaire, was be used to collect information on

all the foods and the drinks that were consumed by individual expecting mothers for the previous 24-hour period. Food and drinks reported by the participants was recorded in a ten-food group questionnaire used to calculate minimum dietary diversity for the expecting women. Details pertaining the time of meals, place meal was consumed, details of method of preparation and lastly the amount consumed was also collected

A 3-day food frequency data collection tool was used to collect data on number of times the reported food stuffs were consumed per week. The food frequency table comprised the food items, which were readily accessible in the market and season throughout the period of the study and the participants were asked on the number of times they had consumed a given food per week, the number of times the foods items were consumed and this was recorded in the questionnaire.

Expecting mothers attending antenatal care services after the third-trimester and who had already given birth and basically reporting for postnatal care services were assessed about their Iron/Folate acid supplementation consumption during their pregnancy time using their recall response. Adherence was regarded as taking an Iron/Folate acid supplement for at least 90 days (WHO 2012) during first 6 months at pregnancy time. The investigator and the registered general nurses collected the data. The investigator monitored the data collection procedures including moments before the data entry and the questionnaire was then checked for completeness.

### 3.10.1 Reliability of research instruments

The reliability of the research instruments was tested to measure the mark to which the research instruments would yield the same results after repeated trials. Test-retest method was however used to test reliability of the questionnaire and test-retest

coefficient was used to assess the reliability of the research instruments. Test-retest coefficient is the measure of how consistent the instrument is. Test-retest reliability coefficients of 0.9 or greater have excellent reliability while coefficient between 0.9 and 0.8 are good reliability (Robert, 2010

### 3.10.2 Validity of the instruments

Validity of the research instruments was tested to ensure that the instrument was measuring what it was supposed to measure. The questionnaires to be used were pretested and clarity of information ascertained. To ensure validity of the study questionnaire a panel of experts who were competent in the field of maternal nutrition were involved in the assessment of the questionnaire to examine the relevance and also validity of the content of the questionnaires and give their independent feedback to the researcher. All the contributions from the experts were then used to construct the final questionnaires.

### 3.11. Pre-Testing of instrument

Pretesting in a study occurs when the selected study questions and questionnaires are tested on members of the target population, to evaluate reliability and validity of the study instruments preceding to the final distribution. The procedure of bringing together members, of the key audience to respond to the components of a communication operation before the final distribution increases the impact of the questionnaire by determining if what have been designed is suitable for audience and the study. A pilot test of the tools was done in a nearby community to the priority audience. This motive encourages honesty and openness during the pretesting process. Both the questionnaires were pre-tested before the final distribution

*Table 1 Pretesting elements*

| Pretesting element | Recommendations | Sample questions |
|---|---|---|
| Comprehension | Try to focus the participants on the main idea of the study | What do you think this material is telling you to do?<br>What words or sentences are difficult to read or understand? |
| Acceptance | Explore issues that could potentially be overlooked | Is there anything about the material that you find offensive?<br>Is there anything about the material that you find annoying? |
| Relevance | Have participants confirm whether the material is appropriate for them | What type of people should be asked about this?<br>In what ways are people in the material like/ different from you? |
| Motivation/ Persuasion | Explore the effect on behaviour and desires | What does the material want you to do?<br>How likely are you to do that? |
| Improvement | Find out other ways to enhance the materials | What new information did you learn?<br>What material do you think is missing |

**Table 1. Pre-test feedback**

The questionnaire was pre-tested to check on the content, the wording, the language, the length and for any omissions and corrections. The pre-testing sample for the questionnaire included 17 pregnant women (10% of the sample size) attending Mukaro health center in Hurungwe district. The questionnaire was modified by correcting all mistakes and including missing information as well as including all the foods that could have been left out

### 3.12 Data Collection Procedure

The researcher assisted by the research assistants who were mostly local nurses visited the Hurungwe district hospital and 15 other RDC clinics daily for a period of a month during the month of January and February and with the assistance of the nurse in charge recruited the research participants and then narrated the study purpose, broad objectives and the procedure of the study to the participants. The recruitment was done after the pregnant mothers had been given the routine ANC services. Data on iron status and MUAC was collected at the hospital after the respondents had given informed consent to partake in the study. The respondents were then followed to their households to collect data on 24-hour dietary recall, food frequency, dietary diversity and demographic and socio-economic characteristics.

#### 3.12.1 Demographic and socioeconomic data

A researcher administered questionnaire was then used to beseech information on demographic and socioeconomic characteristics of the respondents. The demographic and socio-economic information included the age, parity and education level.

#### 3.12.2 Dietary diversity data

A dietary diversity questionnaire, was used to gather information on the foods and food items and the drinks consumed by the individual pregnant woman for the previous 24-hour period. The participants were asked to report all the foods, beverages and snacks they had consumed in the last day since the time they woke up in the morning and throughout the day up to the time they went to sleep at night. Probing was used to ensure that no food consumed was left out. All the food and drinks reported by the participants were recorded to a 16-food cluster questionnaire

which was later consolidated to a standardized 10 food group to analyze the minimum dietary diversity for women.

### 3.12.3 Nutrients intake based 24-hour dietary recall data

A 24-hour dietary recall questionnaire has been used to gather data on all the food items, snacks and drinks consumed the previous day counting details on the time of the meals, the place the meals were consumed, details of the method of preparation and the amount consumed. 24-hour dietary recall questionnaire has been administered at the household of the study respondents The 24-hour dietary recall involved soliciting information from the respondents on all the foods and beverages consumed in the previous day from the time they woke up to the time they went to sleep. All the foods, beverages and snacks consumed, the time of consumption, detailed description of the food item and preparation method, amount eaten and weight in grams of the foods and beverage were then recorded in the respective columns. Household's utensils that included glasses, cups, bowls, tablespoons, teaspoons, serving spoons; plates have been used to approximate the amount of food and drinks consumed by the respondents. Fruits which were in season were bought and used for estimation of the portion's sizes. Probing on respondents was used to ensure that no food or drinks was forgotten during the session.

### 3.12.4 Dietary intake based on food frequency questionnaire

Food frequency questionnaire was the tool used to collect data on number of times the food stuff was consumed per week. It included the food items that were readily available in the market during the period of this study. The participants were asked on the number of times that they had consumed a certain food stuff per week and number of times that food items were consumed, then this was recorded in the

questionnaire. A seven-day food frequency questionnaire was used to collect information on the consumption of the locally available foods which were identified at the market and at the households. A list of 77 commonly consumed food stuffs was drafted and the respondents were asked to then state the number of days that they had consumed each of the food within a week. Basically, the consumption of a food stuff for at least three times a week was then considered to be regular intake where when it was less than 3 days, it was considered as irregular consumption (Ahmed et al., 2008; Chege, 2012, Dahl, Maeland & Bjorlkkjaer, 2012).

### 3.12.5 Assessment of nutritional status of the pregnant women.

The nutritional status of pregnant women was assessed using the MUAC measurement. The MUAC measurement of expecting mothers was taken in the private room in the hospital and local selected clinic during the interviews. The MUAC of the respondents was measured using the adult standard MUAC tape and recorded on the questionnaire. The MUAC was measured in the midpoint of the upper arm of the left arm to the nearest 0.1 centimeter with no clothing. The MUAC measurement was done at least twice for each respondent to ensure accuracy.

### 3.12.6 Assessment of iron and folic adherence among the pregnant women

The iron adherence of the respondent was determined by assessing the intake of the supplements throughout pregnancy. This was noted by the verbal responses that were given by the pregnant mothers during interviews.

### 3.12.7 Morbidity, health seeking behaviors, antenatal clinic attendance and micronutrients supplementation among the respondents.

The data on the morbidity and health seeking behavior, ANC attendance and micronutrient supplementation were collected and recorded in section E of the

questionnaire. The respondents were asked whether they had been sick for the last two weeks and the illness they were suffering from and whether medical care was sought. The participants were asked to report the gestation age when they had their first ANC visit, the number of times they have had ANC visit, whether they were consuming any micronutrient supplement as well as whether they were consuming the micronutrient on daily basis. The information was then cross checked by the information on the mother and child ANC clinic attendance booklet by the ANC nurses.

### 3.13 Analysis and Organization of Data

(Burns & Groove, 2009) defines data analysis as categorizing, ordering, manipulating and summarizing data into meaningful terms. The data was collected, edited, coded, cleaned and entered using MS excel. It was entered and analyzed through the use an Epidemiology statistical software (EPI. Info) version 7 and Statistical Package for Social Sciences (SPSS) version (20) into statistical package. The data which was gathered using the 24- hour recall was entered and analyzed using the Nutri-survey software for analysis of macronutrients and micronutrients intake and presented as frequencies, percentages and means. The collected data was organized in a logical and concise manner. Descriptive statistics were then used to present the data in the form of bar graphs, tables, pie charts and narration by the researcher to illustrate trends of data.

### 3.14 Data dissemination

After the final dissertation report has been drawn, the investigator will then share the research findings with the interested parties just to mention a few; the PMD Mash

West, the PHO Mash Wests, the DMO Hurungwe, ANC nurses and mid wives, research participants and other related ministries

### 3.15 Ethical Consideration

Ethics are systems of moral values that are concerned with the degree to which research procedures adhere to professional, legal and social obligations (Polit & Hungler, 2006). Permission to conduct the study was sought and approved from the Provincial Medical Director of Mashonaland West and the department of Health Sciences Africa University. An ethical review approval to conduct the study was sort from AUREC. The purpose and type of the study, waiting times, risks and benefits was explained to the participants before the interviews. The investigator informed the respondents that participation was on voluntary basis and they were free to turn down the request of participation at any time without being prejudiced. Right of privacy was surely observed by informing the respondents that no home address, name or phone numbers was necessary at all, coding was used to ensure anonymity. Information was treated with strict confidentiality. The data collectors conducted the interviews writing down the information given on the structured questionnaire, and kept them under lock and key. There was no form of coercion or any undue influence what so ever.

# CHAPTER 4 DATA PRESENTATION, ANALYSIS AND INTERPRETATION

## 4.1 Introduction

This chapter presents the study findings according to the objectives of this study which include; the demographic and socio-economic status of pregnant women attending the ANC in the Hurungwe district hospital and the other 15 selected RDC clinics, dietary diversity and the iron intake and nutritional status, morbidity, health seeking behaviour, antenatal clinic attendance and micronutrient supplementation as well as relationship between variables. This specific study targeted 172 pregnant women but only a total of 164 pregnant women fully participated in the study. Out of the targeted sample of 172, eight respondents did not respond to the questions. The eight respondents declined to finish the interview saying they had farm duties to attend to since it was at the peak of the rain season therefore, the eight questionnaires were incomplete. The results were analyzed from a total sample of 164 pregnant women visiting the ANC who fully completed the questionnaire throughout the days of the interviews. This particular study was designed to evaluate dietary diversity, iron supplements adherence and iron status amongst the pregnant women attending ANC clinic in the Hurungwe district of Mashonaland West province. The dietary diversity was assessed by MDD-W; iron intake was assessed by 24-hour recall while nutritional status was however, assessed by MUAC measurements.

## 4.2 Data Presentation and Analysis

At the end of each data collection day the completed copies of the questionnaire were reviewed to ensure errors and were corrected on time and clarification sought from the data collector where necessary. Data was then edited, coded, cleaned and

entered using MS excel. Into an Epidemiology statistical package Epi Info version 7 and Statistical Package for Social Sciences (SPSS) version (20) to analyze the data from the demographic and socio -economic status, dietary diversity questionnaire, food frequency questionnaire, morbidity, health seeking behavior and antenatal clinic attendance and micronutrient supplementation. The data which was gathered using the 24- hour recall was entered and analyzed using the Nutri-survey software for analysis of macronutrients and micronutrients intake and presented as frequencies, percentages and means in a nutshell. The MDD-W dietary diversity indicator was then calculated based on the 10 food groups which included basically grains, white roots and tubers and pulses (beans, peas and lentils), nuts and seeds, dairy, meat, poultry & fish foods, eggs, dark green leafy vegetables, other vitamin A-rich fruits and vegetables, other vegetables, other fruits. Generally, who did not consume the foods from at least five groups were regarded as not meeting the minimum dietary diversity in what so ever while those consuming foods from five food clusters or more were described as having met the minimum dietary diversity for women (FAO & FHI 360, 2016). The findings were then presented as frequencies and percentages.

### 4.2.1 Demographic Characteristics of Respondents

The demographic and socio-economic characteristics of respondents are clearly presented in the below Table 4.1. They were aged between 15-39 years. The noted mean age of the study population was 27±5.3 years with highest proportion of the respondents being between 25-29 years of age (35.4%), followed by those in 20-24 years (25%) with the least number (4.9%) being within the age group of 15-19 years. Regarding parity, 77.4% of study respondents were in their first pregnancy. In regard to gestation age more than a half (56.7%) of the respondents were in their second

trimester. About 88.4% of study respondents were married. About (40.2%) of the respondents said they had completed secondary education while 29.9% had completed primary education. In regard to occupation, source of income, most of the respondents (42.1%) mentioned that their main source of income was small scale farming business while 16.5% obtained their income from formal and informal employment and another 10.9% from children and relatives from out of Zimbabwe

Table 2 ***Demographic Characteristics of Respondents***

| ***Variables*** | ***n=164*** | ***%*** |
|---|---|---|
| ***Age*** | | |
| 15-19 | 8 | 4.9 |
| 20-24 | 41 | 25 |
| 25-29 | 58 | 35.4 |
| 30-34 | 35 | 21.3 |
| 35-39 | 22 | 13.4 |
| ***Parity*** $\leq$ **1** | 127 | 77.4 |
| 2 | 29 | 17.7 |
| $\geq$3 | 8 | 4.9 |
| ***Marital status*** | | |
| Married | 145 | 88.4 |
| Not married | 19 | 11.6 |
| ***Gestational age*** | | |
| 1st trimester (0-12 weeks) | 3 | 1.8 |
| 2nd trimester (13-28 weeks) | 68 | 56.7 |
| 3rd trimester (29-40 weeks) | 93 | 41.5 |
| ***Education level*** | | |
| Primary education | 52 | 31.7 |
| Secondary education | 66 | 40.2 |
| Post-secondary | 46 | 28.1 |

### 4.3 Data Interpretation

#### 4.3.1 Dietary intake among the pregnant women

The dietary intake amongst the study participants was assessed based on the dietary diversity, 24-hour recall and food frequency questionnaire.

#### 4.3.2 Dietary intake among the pregnant women based on Dietary Diversity

The dietary diversity for the participants was calculated based on the minimum dietary diversity for women that comprised of the 10 food groups as recommended by FAO (FAO & FHI 360, 2016) and presented in Figure 4.2. Most of this study participants (72.6%) met the minimum dietary diversity for women as they were consuming food stuffs from more than five food groups. Approximately 27.4% did not met the minimum dietary 72 diversity for women as they were consuming foods from less than 5 food groups (Figure 4.1)

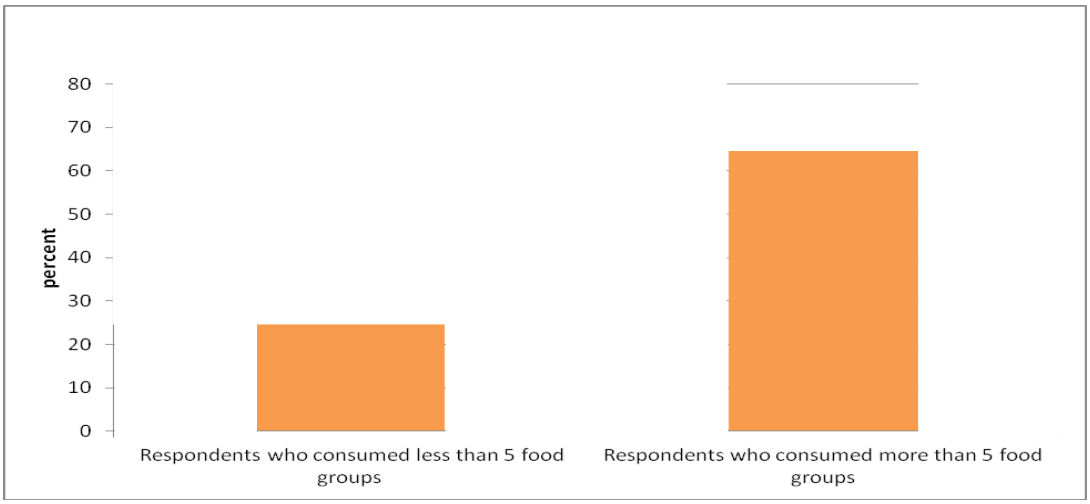


***Figure 2.1 Dietary intake among the pregnant women based on Dietary Diversity***

The mostly consumed food clusters based on the highlighted 10 food groups used to gather data on minimum dietary diversity for women were; grains, white roots and tuber and other vegetables which were consumed with 100% of the study respondents. Pulses (beans, and lentils) were being consumed by 96.3% of the

respondents. Vitamin A rich fruits as well as vegetables were consumed by 73.8 % while dark green leafy vegetables were being consumed by 63.4%. Eggs were consumed by 82.7%. 73 Meat, poultry and fish were consumed by 39.7% of the respondents while nuts and seeds food groups were consumed by 30.5% (Figure 4.2).

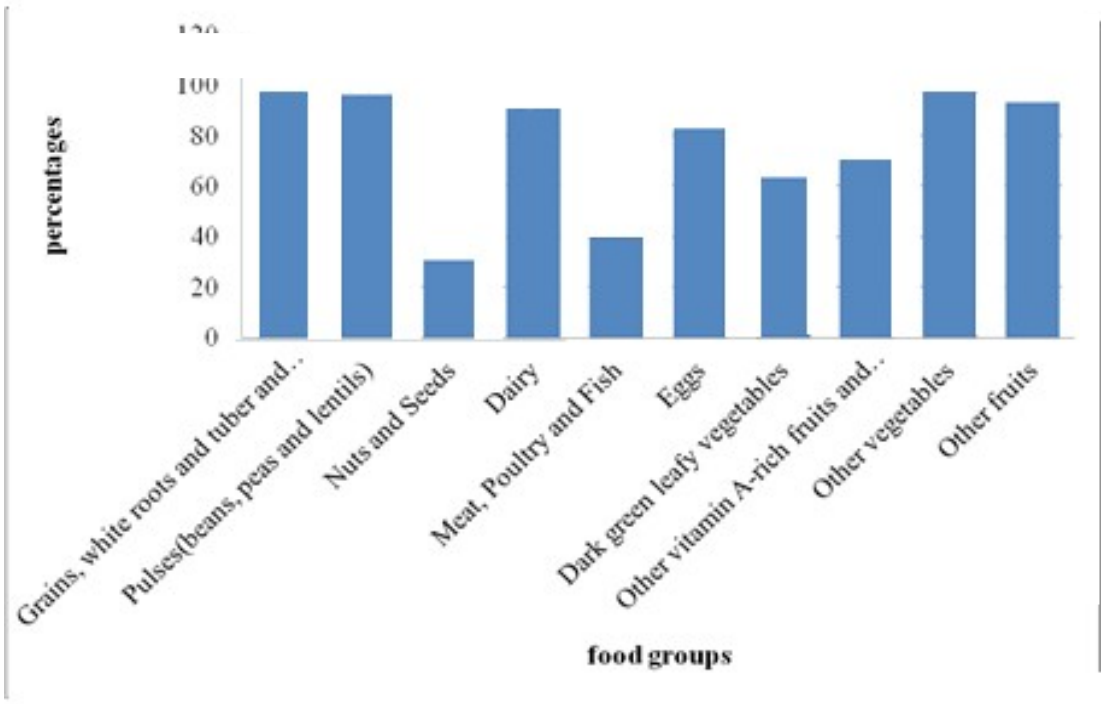


***Figure 4.2 Dietary intake of the respondents based on food groups***.

## 4.4 Dietary intake of the pregnant women based on 24-hour recall

Dietary iron intake and intake of other micronutrients was assessed by a 24-hour recall and presented in the Table 4.3 below. All forms of foods that were reported to have been consumed by the participant in the last 24 hours were converted from household measures into grams and other relevant measures and then into some values of energy, protein, iron, folic acid, zinc, calcium, magnesium, Vitamin A, Vitamin C, Vitamin $B_2$, Vitamin $B_1$, Vitamin $B_{12}$ Vitamin $B_6$ and Selenium. The noted mean energy intake of the respondents was 2263± 94.9 kilocalories with

values ranging from between 2100 to 2426 kilocalories. The majority of the respondents (86.6%) met the RDA for energy from their diet (Table 4.3)

***Table 3 Proportion of respondents consuming sufficient number of selected macronutrients and micronutrients based on 24-hour dietary recall***

| ***Nutrients*** | ***Frequency*** | ***Percent*** | ***RDA*** | ***Mean*** | | ***Minimum*** | ***Maximum*** |
|---|---|---|---|---|---|---|---|
| Energy (Kcal) | 142 | 86.6 | 2350 | 2263.0 | 94.9 | 2100 | 2426 |
| Protein(g) | 134 | 81.7 | | 72.4 | 20.3 | 51.3 | 105.6 |
| | | | | | | | |
| Vitamin A(IU) | 135 | 82.3 | 2500 | 68.6 | | 42.3 | 78.5 |
| Zinc(mg) | 95 | 57.9 | | 13.34 | 1.92 | 9.2 | 17.8 |
| Folic acid (mg) | 121 | 73.8 | | 4.94 | 1.02 | 2.1 | 7.8 |
| Iron (mg) | 89 | 54.3 | | 29.9 | | 17.3 | 41.12 |
| Vitamin $B_1$(mg) | 121 | 73.8 | | 1.51 | 0.74 | 0.6 | 2.6 |
| Vitamin $B_2$(mg) | 109 | 66.5 | | 1.63 | 0.74 | 0.8 | 2.82 |
| Magnesium(mg) | 135 | 82.3 | | 288.4 | | 236.4 | 625.25 |
| Calcium(mg) | 150 | 91.5 | 1500 | 1560.56 | 14.5 | 1140.14 | 1786.63 |
| Selenium(mg) | 106 | 64.6 | | 62.2 | | 52.3 | 71.6 |
| Vitamin C(mg) | 152 | 92.7 | | 90.6 | 0.87 | 74.2 | 98.3 |
| Vitamin $B_{12}$(mg) | 149 | 90.9 | | 3.01 | | 2.03 | 3.9 |
| Vitamin $B_6$(mg) | 138 | 84.1 | | 2.2 | 0.05 | 1.08 | 2.75 |

***RDA values obtained from WHO 2004; FAO&WHO 1996 and Food and nutrition dietary board***

About 81.7% of the respondents consumed adequate proteins from the diet with a mean of 74.4 ± 2.5 and a consumption ranging from a minimum range of 51.3 and 105.6 g. this was more than half (54.3%) of the study respondents met the RDA for iron with a mean of 29.9 ± 5.1mg consumption ranging from a 17.3 to 41.12 mg. Approximately 73.8% of the respondents were meeting the RDA for folic acid with a mean of 4.94 ± 1.02 mg. Most of the participants (90.9%) and (92.7%) were consuming adequate B12 and vitamin C food sources respectively from their diet (Table 4.3).

### 4.4.1 Dietary intake among the pregnant women based on food frequency

The frequently consumed foods were gritty based on the seven-day food frequency questionnaire. Systematic consumption referrers to consumption of a given food for more than 3 times per week while irregular consumption referrers to consumption of a given food for less than three times per week.

Foods rich in haeme iron, such as fish, chicken, flesh meat and liver were not regularly consumed. Fish was often consumed only by 7.3% of the respondents with consumption range of 0-3 and a median of once per week. Poultry was habitually consumed by only 3.0 % with a range of about 0 to 4 times per week and a median of about 2 times per week. Meat was consumed basically for more than three times per week by at least 28% of the respondents with a range of around 0-6 days and a median of 3 times per week respectively. Nearly 18.3% consumed liver regularly with a range of 0 - 4 and a median of 2 times per week. Eggs were consumed regularly by 31.7% of the respondents with a notable consumption of between 0 - 6 and a median of 3 time per week. During the interviews, the women affirmed that meat, chicken, fish and liver were not regularly consumed with cost being the

common reason for not consuming them. The women also acknowledged that many of the pregnant mothers did not consume eggs frequently for fear of having big babies.

Milk was noted to be consumed for more than three days per week by 47.0 % of the respondents with a range of between 0 to 7 time per week and a median of 4 times per week. However, a majority (82.3%) of the respondent reported to consume milk in form of tea with consumption ranging from 0 to 7 times per week and median of 4 times per week.

Among the Vitamin C rich fruits, oranges which were the most regularly consumed with 42.7% of the respondent reporting to consume oranges for more than three time a week with a range of between 0 to 7 times per week and a median of 4 times per week. Vitamin A rich fruits such as mangoes were regularly consumed by 39% and 28.1% of the respondents respectively with a range of between 0 to 6 times per week.

The most regularly consumed legumes, were the famous cowpeas which were being consumed by around 26.8% of the respondents for more than three days per week with a range of between 0 to 6 times per week. The participants mentioned that beans were also commonly consumed in the area with about 25% of the respondents reporting to consume beans for more than 3 times per week with consumption ranging of 0 to 6 times per week.

Concerning the consumption of the green leafy vegetable, Amaranth was the most regularly consumed vegetable with about 37.3% of the participants reporting to consume the vegetable for more than 3 times per week .pumpkin leaves was also regularly consumed with 36.6% of the respondents reporting to consume pumpkin

leaves for more than 3 time per week., Other vegetables consumed regularly included tomatoes (48.2%) with a range of 0-7 and a median of 4, cabbage (34.8%) with a consumption ranging from 0 to 6 times per week and a median of 3, onions (90.9%) with consumption range of 0-7 times per week and a median of 4 times per week. During the interviews most of the participants pointed out that nyevhe was commonly consumed mainly mixed with amaranth and kales.

Maize meal as a staple was consumed regularly with 76.8% of the respondents reporting to consume maize for more than three times per week with a range 3 to 7 days per week. Maize flour was also frequently consumed with 51.8% of the respondents reporting to consume maize flour for more than 3 days per week with consumption range of between 0 to 7 times per week and a median of about 4 times per week. Sorghum as well as millets were consumed regularly by close to 74.4% and 70% of the respondent respectively mainly in form of porridge and sadza with consumption ranging from 0 to 7 days per week and a median of 4. Wheat flour was consumed regularly by 34.8% of the respondents in form of bread and buns with a consumption range of between 0 to 4 times per week. Rice was consumed regularly by 66.6% of the respondents with a consumption range of between 0 to 7 times per week. This was affirmed during the interviews where the women confirmed that, maize, wheat and rice were the most consumed staples with most women agreeing to be consuming these cereals and their products almost daily because there were readily available and within their economic reach.

Sweet potatoes were the most regularly tubers being consumed regularly by 58.5% of the respondents ranging from 0 to 6 times per week when in season. Vitamin A rich foods such as pumpkins was not regularly consumed with only 28.1% reporting to consume pumpkin for more than three time per week with a consumption range of

between 0 to 3 times per week. Among the sugary food items, sugar was regularly consumed by 51.2 % with consumption range of 0 to 7 times per week. Most of the participants noted that sugary food items were regularly consumed with sugar and soda being the most commonly consumed (Appendix C).

### 4.5 Nutritional status of the pregnant women

The nutritional status of the pregnant mothers was assessed using MUAC respectively. Approximately 13.4 % of the respondents were malnourished with a MUAC value of less than 23cm however, (86.6 %) were well nourished with a MUAC value of greater than 23cm (Table 4).

***Table 4 Nutritional status of the respondents***

| *Mid Upper Arm Circumference in cm* | *n=164* | *%* |
|---|---|---|
| <23cm | 22 | 13.4 |
| >23cm | 142 | 86.6 |
| Total | 164 | 100 |

*References for MUAC (mid-upper arm circumference) were obtained from UNICEF, (2009).*

### 4.6 The iron status of the pregnant women

A total of 164 blood samples from 164 pregnant women was analysed for haemoglobin levels in grams/decilitre (g/dl) using the clinical records obtained during the first booking at the ANC. Approximately, 4.3% of the participants had a haemoglobin level of below 10g/dl, 15.9% had haemoglobin levels ranging from 10.1 g/dl and 10.9g/dl while 76.9% had haemoglobin of between 11.1 g/dl and 12 g/dl. Generally, the blood haemoglobin levels were used to assess iron status of the pregnant women and women with haemoglobin levels of less than 11grams/decilitre

were classified as being iron deficient. In this particular study, about 20.1 % of the respondents were found to be anaemic with haemoglobin level of less than 11g/dl (Table 4.5).

***Table 5 Iron status of the respondents***

| *Haemoglobin level(g/dl)* | *n=164* | *%* |
|---|---|---|
| 7.1-10.0 | 7 | 4.3 |
| 10.1-10.9 | 26 | 15.9 |
| 11 -12 | 126 | 76.9 |
| 12.1- 14 | 4 | 2.4 |
| 14.1- 1 5 | 1 | 0.6 |
| Total anaemic (HB <11 g/dl) | 33 | 20.1 |
| Total Non anaemic (HB>11g/dl) | 131 | 79.9 |
| Total | 164 | 100 |

*References HB (hemoglobin level) was obtained from WHO, (2011)*

### 4.6.1 Iron intake, iron status and dietary diversify of the pregnant women

An approximate of 54.3% of the respondents were meeting the RDA for iron from their diet while 45.7% were not meeting the RDA for iron from their diet. All the respondents who were meeting the RDA for iron (54.3%) were non-anemic at the point of interview. Midst the respondents who did not meet the RDA for iron, 56% were non-anemic and 44% were however anemic. Amongst the respondents who did not meet the RDA for iron, 3.4% had not met their minimum dietary diversity.

A majority (96.6%) of the respondent who had met the RDA for iron had met the minimum dietary diversity for the women. However most (98.7 %) of the

respondents who were meeting the minimum dietary diversity for women were also meeting the RDA for iron. Dietary diversity was positively related to iron intake of the pregnant women ($r= 0.57$, $p = 0.038$) and to the iron status of the pregnant women. ($r=0.48$, $p = 0.031$) (Table 4.6).

***Table 6 Iron intake, iron status and dietary diversity of the respondents***

| ***Iron status*** | ***Respondent w iron ho met RDA for*** | | ***Respondents not meeting RDA for iron*** | |
|---|---|---|---|---|
| | ***n*** | ***%*** | ***N*** | ***%*** |
| Anemic (HB<11) | 0 | 0 | 33 | 44 |
| Non- anemic (HB>11) | 89 | 100 | 42 | 56 |
| **Total** | 89 | 54.3 | 75 | 45.7 |

| ***Iron intake*** | ***Respondents who did not meet MDD-W*** | | ***Respondents who met MDD-W*** | |
|---|---|---|---|---|
| | ***n*** | ***%*** | ***n*** | ***%*** |
| Respondents not meeting RDA for iron | 3 | 3.4 | 86 | 96.6 |
| Respondents who were meeting RDA for iron | 1 | 1.3 | 74 | 98.7 |

| ***Dietary diversity*** | ***r*** | ***p=value*** |
|---|---|---|
| iron intake | r= 0.57 | 0.038 |
| iron status | r=0.48 | 0.041 |

### 4.6.2 Iron intake, Iron status and intake of iron supplements among the pregnant women

Data on iron and other micronutrient intake was collected using the 24-hour recall and then analyzed and then cross tabulated with iron status and intake of selected supplements and presented in Table 4.7 below. The iron intake, iron status and intake of selected supplements such as vitamin C, Vitamin $B_{12}$, and Folic acid were also cross tabulated. More than a half (54.4%) to note of the respondents met the RDA for iron. However, for all who did not meet the RDA for iron 44% were found to be anemic at the point. Approximately (26.2%) of the respondents were not meeting the RDA for folic acid. Close to about 51.2% of those who did not meet RDA for folic acid were found to be anemic. Almost 92.7% of the participants met RDA for vitamin C. About 33.3% of the respondents who were not meeting RDA for vitamin C were found to be anemic (Table 4.7).

Table 7 Iron intake, micronutrients iron status and selected

| ***Intake of selected micronutrients by the-respondents*** | ***Respondents who were anemic (HB<11)*** | | ***Respondents who were non –anemic (HB>11)*** | | ***Total*** | |
|---|---|---|---|---|---|---|
| | ***N*** | ***%*** | ***N*** | ***%*** | ***n*** | ***%*** |
| Those who did not meet RDA for iron | 33 | 44 | 42 | 56 | 75 | 45.7 |
| Those who met RDA for iron | 0 | 0 | 89 | 100 | 89 | 54.3 |
| Total | 33 | 20.1 | 131 | 79.9 | 164 | 100 |
| Those who did notmeet RDA for | 4 | 33.3 | 8 | 66.7 | 12 | 7.3 |
| Those who meet RDA for vitamin C | 29 | 19.1 | 123 | 80.9 | 152 | 92.7 |

### 4.6.3 Iron status and selected demographic and socio-economic status of the pregnant women

The iron status of pregnant women was cross tabulated with demographic and socio-economic factors such as gestation age, maternal age, marital status and education level and was presented in Table 4.9 below. In reference to iron status and gestation age, about 23.2% of pregnant women who were in their respective second trimester were reportedly anemic while 11.1% of women who were in the third trimester were found to be anemic as well. Anemia was then estimated for each age group category and approximately (27.3%) of those pregnant women who were in the age groups of between 35-39 years were anemic. (26.8%) in age group of between 20-24 years were reported to be anemic while the other17.1% of those in age group between 30-34 years were anemic. Furthermore 15.5% of those in the 25-29 age group were anemic and (12.5%) of the pregnant women in the age group of between 15-19 years of age were anemic. About 21.4% of the married pregnant women were anemic while 11.8% of those who were not married were anemic. In reference to iron status and education level, about 21.7% of those who had post-secondary education were anemic while the other 19.2% of those who had primary or secondary education were anemic (Table 8).

*Table 7 Iron intake, iron status and demographic and socio-economic characteristics of the respondents*

| *Variables* | *Anemic (HB* | *<11g/dl)* | *Non-anemic (11g/dl* | *HB>* | *Total* | % |
|---|---|---|---|---|---|---|
| ***Gestation age*** | ***N*** | ***%*** | ***N*** | ***%*** | ***n*** | ***%*** |
| 1st trimester | 0 | 0 | 3 | 1.8 | 3 | 1.8 |
| 2nd trimester | 29 | 23.2 | 96 | 76.8 | 68 | 56.7 |
| 3rd trimester | 4 | 11.1 | 32 | 88.9 | 93 | 41.5 |
| ***Age*** | | | | | | |
| 15-19 | 1 | 12.5 | 7 | 87.5 | 8 | 4.9 |
| 20-24 | 11 | 26.8 | 30 | 73.2 | 41 | 25 |
| 25-29 | 9 | 15.5 | 49 | 84.5 | 58 | 35.4 |
| 30-34 | 6 | 17.1 | 29 | 82.9 | 35 | 21.3 |
| 35-39 | 6 | 27.3 | 16 | 72.7 | 22 | 13.4 |
| ***Marital status*** | | | | | | |
| Married | 31 | 21.4 | 114 | 78.6 | 145 | 88.4 |
| Not married | 2 | 11.8 | 15 | 88.2 | 17 | 10.4 |
| Separated | 0 | 0 | 2 | 100 | 2 | 1.2 |
| ***Education level*** | | | | | | |
| Primary | 10 | 19.2 | 42 | 77.8 | 52 | 31.7 |
| Secondary | 13 | 19.7 | 53 | 80.3 | 66 | 40.2 |

| | | | | | | |
|---|---|---|---|---|---|---|
| Post-secondary | 10 | 21.7 | 36 | 78.3 | 46 | 28.1 |

### 4.6.4 Iron and folic supplementation among pregnant women

In this current study (90.2%) of the participants had received and were taking micronutrients supplements from the local health facilities (Table 4.10). Notably only 9.8% of the participants had not received supplements. About 84.8% of the study participants were consuming iron and folic tablets (IFAS) which contained some dried ferrous sulphate 200mg which is equivalent to ferrous iron 65mg and folate Acid 0.4mg. Approximately 77.4% of the respondents consumed the supplements daily while 9.8% did not ingest the supplements on daily basis. Nearly 12.8% were not ingesting the supplements at all during their pregnancies. Intake of iron fortified foods can also contribute positively to the improving of iron status of the pregnant women. In the current study it was noted that 92.1% of the respondents reported not to have access to iron fortified food especially fortified processed wheat and maize flour (Table 9).

***Table 8 Micronutrients supplementation among the respondents***

| ***Taking micronutrients Supplements*** | ***Frequency*** | ***Percentage*** |
|---|---|---|
| Yes | 148 | 90.2 |
| No | 16 | 9.8 |
| ***Micronutrient type*** iron - folic acid pills (IFAS) | 139 | 84.8% |
| multiple micronutrient | 9 | 5.5 |
| ***Respondents ingesting micronutrient daily*** yes | 127 | 77.4 |
| No | 21 | 12.8 |
| ***Reasons for not ingesting the supplement*** bad taste | 8 | 4.9 |
| Forgetting | 11 | 6.7 |
| does not see the importance | 1 | 0.6 |
| first visit | 1 | 0.6 |
| ***Access to iron fortified food*** | | |
| No | 152 | 92.7 |

| | | |
|---|---|---|
| Yes | 12 | 7.3 |
| Others | 13 | 8.6 |

### 4.7 Morbidity, health seeking behavior and antenatal clinic attendance amongst the pregnant women

Amongst the study participants, 39% reported to have been sick in the previous two weeks while 61% reported not to have been sick (Table 4.10). A majority of (48.4%) of the respondents who had been sick reported to have had suffered from malaria, 15.6% had suffered from sexually transmitted infections and the other 23.4% had suffered from respiratory tract infection. A reasonable number of the participants (79.7%) who had been sick reported to have sought medical care services while 20.3 % did not seek any medical care services. The majority (90.2%) of the participants who sought medical care visited the government hospital and the district rural health facilities while (7.8%) visited private clinic in other areas.

Midst the participants only 29.9% started attending ANC in their first trimester yet about 65.2% of the respondents started attending ANC in second trimester while 4.9% of the respondents started attending ANC in the third and final trimester. Majority of the study respondents (43.9%) had attended ANC twice. ANC attendance by the rest of the respondents was as follows 23.8% once, 23.8% thrice and 8.6% had attended more than four times in the past (Table 10).

***Table 9 Health seeking behaviour***

| ***Sick*** | ***Frequency(n)*** | ***Percentage (%)*** |
|---|---|---|
| No | 100 | 61.0 |
| Yes | 64 | 39 |
| ***Sickness*** Malaria | | |
| | 31 | 48.4 |
| Sexually transmitted disease | 10 | 23.4 |
| Respiratory tract infection | 15 | 15.6 |
| 0thers | 8 | 12.5 |
| ***Seeking medical care*** Yes | | |

| | | |
|---|---|---|
| | 51 | 79.7 |
| No | 13 | 20.3 |
| ***Health facility visited*** | | |
| Government hospital | 46 | 90.2 |
| Private clinic | 4 | 7.8 |
| Bought medicine from chemist | 1 | 2 |
| ***Time the respondent started attending ANC*** | 49 | 29.9 |
| first trimester | | |
| second trimester | 107 | 65.2 |
| third trimester | 8 | 4.9 |
| ***Number of times of attending ANC once*** | 39 | 23.8 |
| Twice | 72 | 43.9 |
| three times | 39 | 23.8 |
| four times | 7 | 4.3 |
| more than five times | 7 | 4.3 |

## 4.8 Relationship between variables

### 4.8.1 Relationship between dietary diversity, maternal demographic and socio-economic factors

A very significant association was found between the level of education and the dietary diversity ($\chi^2$=16.17, p=0.042) of the study respondents. This implies that, as the level of education increased within a mother the dietary diversity increased. A notable positive significant relationship was also found between the level of income and the dietary diversity (r=0.39; p=0.047) of the study respondents. It is when chi-square test was performed, a significant association was then found between marital status and the dietary diversity of these expecting women ($\chi^2$ =18.58, p=0.037). Notably a very negative insignificant relationship was found between the gestation age and the dietary diversity (r=-0.004, P=0.958) of the respondents. A negative insignificant relationship was also found between maternal age and dietary diversity (r=-0.038, p=0.626) (Table 4.11).

***Table 10 Relationship between dietary diversity and demographic and socio- economic status among pregnant women***

| *Dietary diversity* | *Variables* | *Statistics* | *p-value* |
|---|---|---|---|
| | Education | ($\chi^2$) = 16.17 | 0.042 |
| | Income | r= 0.39 | 0.047 |
| | Marital status | ($\chi^2$) =18.58 | 0.037 |
| | Gestational age | -0.004 | 0.958 |
| | Maternal age | -0.038 | 0.626 |

### 4.8.2 Relationship between dietary diversity, iron intake and iron status

The Pearson's correlation coefficient revealed, a significant positive relationship (r=0.48, p=0.031) between the dietary diversity and iron status of the pregnant women. Moreover, a positive significant relationship was found between dietary diversity and iron intake of the pregnant women (r=0.57; p=0.0038) (Table 4.12).

***Table 11. The relationship between dietary diversity, iron intake and iron status of the pregnant women***

| Dietary diversity | Variables | r | p=value |
|---|---|---|---|
| | iron intake | r= 0.57 | 0.038 |
| | iron status | r=0.48 | 0.041 |

### 4.8.3 Relationship between nutrition status and other variables

A positive significant relationship was established between the MUAC and dietary diversity of these pregnant mothers (r=0.26; p=0.035). A significant association was then found between the MUAC and morbidity ($\chi^2$=1.3; p=0.025). A significant positive relationship of (r=0.275 p=0.000) was also found between MUAC and maternal age in this current study. The MUAC reading of the expecting mothers in question increased with the increase in age. There was no significant relationship (r=0.004, p=0.962) found between the MUAC and the gestation age. The Chi-square

test showed that there was a significant association ($\chi^2$ = 5.2, p= 0.041) between education level and MUAC. Pearson's correlation coefficient shown a positive significant relationship (r= 0.34, p=0.038) between MUAC and income (Table 4.13).

***Table 12 Relationship between MUAC and other variables among pregnant women***

| *MUAC* | *Variables* | *Statistics* | *p-value* |
|---|---|---|---|
| | Dietary diversity | r=0.26 | 0.035 |
| | Education | ($\chi^2$) =5.2 | 0.041 |
| | Occupation | ($\chi^2$) =3.6 | 0.063 |
| | Income | r=0.34 | 0.038 |
| | maternal age | r= 0.275 | 0.000 |
| | Parity | ($\chi^2$) =185 | 0.574 |
| | Marital status | ($\chi^2$) =0.14 | 0.214 |
| | Gestational age | r=0.004 | 0.963 |
| | Maternal age | r=0.004 | 0.963 |
| | Morbidity | $\chi^{2=}$1.3 | 0.025 |

### 4.8.4 The relationship between iron status and demographic and socio-economic status of the pregnant women.

In this study, it was established that parity of the pregnant women was positively correlated to iron status (r= 0.218, p=0.005). Maternal age was however, negatively related with iron status (r= -0.011, p=0.893) but the relationship though was not statistically significant. The gestational age (r= 0.011, p=0.893) was not significantly related to iron status what so ever. Marital status of the participants was associated with their iron status ($\chi^2$=3.074; p=0. 380) but the association was not very significant at all.

Furthermore, a very positive significant relationship (r=0.34, p=0.014) was found between iron status of the pregnant women and wealth index and also the aspect of education level of the respondents was associated ($\chi^2$=2.282, p= 0.62) with their iron status but the association was not statistically significant (p> 0.05). The other factor which was associated with iron status among pregnant women in this study was the gestation age at which ANC clinic was started ($\chi^2$= 8.7, p=0.012) (Table 14).

***Table 13 Relationship between demographic and socio-economic status and iron status of the pregnant women***

| *Iron status* | *Variables* | *Statistics* | *P value* |
|---|---|---|---|
| | parity | r=0.218 | 0.005 |
| | gestation | r=0.011 | 0.893 |
| | maternal age | r= -0.138 | 0.078 |
| | marital status | ($\chi^2$) =3.074 | 0.380 |
| | income | ($\chi^2$) =16.814 | 0.019 |
| | education | ($\chi^2$) =2.282 | 0.682 |
| | occupation | ($\chi^2$) =5.36 | 0.605 |
| | Gestation period when first ANC was attended | ($\chi^2$) =8.785 | 0.012 |
| | Number of times ANC was attended | ($\chi^2$) =8.517 | 0.074 |

*($\chi^2$)= standard deviation r= correlation co efficient*

### 4.8.5 The relationship between iron status and morbidity among pregnant women

The respondents who reported to have been sick, 32.8% were anemic while 67.2% were non-anemic. However, 12% of those who were reported not to have been sick were found to be anemic as well. A high proportion (88%) of the respondents who reported not to have been sick were also found to be non-anemic and a significant association was found between morbidity of the pregnant women and their iron status ($\chi^2$=11.23; p=0.000) with those who were sick having a high likelihood of been anemic (Table 15).

*Table 14. The relationship between iron status and morbidity among the pregnant women*

| *Iron status* | *Respondents who were previous two* | | *Respondents were not sick n in the previous two weeks* | | *% sick in the* | |
|---|---|---|---|---|---|---|
| Anemic | n | % | n | % | 33 | 20.1 |
| | 21 | 32.8 | 12 | 12 | | |
| Non-anemic | 43 | 67.2 | 88 | 88 | 131 | 79.9 |
| ***Total*** | ***64*** | ***100*** | ***100*** | ***100*** | ***164*** | ***100*** |

($\chi^2$) =11.23, P=0.000

### 4.8.6 The relationship between iron status and micronutrients supplementation among pregnant women.

Remarkably 87.8% of pregnant mothers who reported to be on supplements were found to be non-anemic. On the contrary, 93.8% of the participants who reported not to be on micronutrient supplements were then found to be anemic. In this present study significant association was found between iron status and micronutrients supplementation

($\chi^2$=4.538, p=0.024) (Table 16).

***Table 15 Relationship between micronutrients supplementation and iron status of the pregnant women***

| *Iron status* | *Respondents on Supplements* | | *Respondents not on supplements* | | *n* | *%* |
|---|---|---|---|---|---|---|
| Anemic | n | % | n | % | 33 | 20.1 |
| | 18 | 12.1 | 15 | 93.8 | | |
| Non-anemic | 130 | 87.9 | 1 | 6.2 | 131 | 79.9 |
| Total | 148 | 100 | 16 | 100 | 164 | 100 |

($\chi^2$) =4.538; P=0.024

### 4.8.7 Relationship between iron status and iron intake

Dietary iron intake (r=0.54, p=0.031) in the study was positively related to iron status of the pregnant mothers in a way. Moreover, logical regression analysis revealed that 38% (R= 0.6153; R2=0.378; P=0.000) of hemoglobin level could be clarified by the dietary iron intake while controlling for supplementation and morbidity as confounding variables (Table 4.17).

**Table 16: Model Summary**

| model | R | R Square | Adjusted R Square | Std.Error of the Estimate |
|---|---|---|---|---|
| 1 | .6153 | .378 | .038 | 1.19696 |

# CHAPTER FIVE: SUMMARY, CONCLUSIONS AND RECOMMANDATIONS

## 5.1 Introduction

This was a cross sectional analytical study that sought to determine the dietary diversity, adherence to iron supplements and iron status amongst pregnant women in the Hurungwe district. This chapter specifically discusses the findings of the study in relation to this study objectives in reference to how the finding of this study compared with findings from other studies both locally and globally.

## 5.2 Discussion

### 5.2.1 Demographic and socio-economic characteristics of the study participants.

The demographic and socio-economic status and their relationship to dietary diversity, iron intake and iron status of the pregnant mothers were evaluated in this study. The present study basically examined a population cutting across the reproductive age group women. The noted mean age of the study population was a 27±5.3 years with ages ranging from 15 to 39 years. This study presented a relatively young population with majority of the study respondents being below the age of 30 years. This implies that most of participants were in their youthful stage of life.

In relation to marital status, majority (88.4%) of the respondents in the present study said they were married. Regarding to the issue of parity the present study indicated that majority (77.4%) of the study respondents were in the first pregnancy which may be ascribed to the youthful age of these study participants. A majority (56.7%) of the participants were in their second trimester at the moment data for the study

was collected. The chief source of income for the respondents in the present study was small scale farming businesses with only a small proportion of this study respondents reported to be engaged in formal employment. This implies that majority of the study population were unemployed which is in agreement with the report

### 5.2.2 Dietary diversity amongst the pregnant women

In regard to the dietary diversity the majority (72.6%) of the pregnant mothers in the study were achieving a minimum dietary diversity, for women with most of them consuming foods from more than five food groups out of the set ten food groups. However, a small proportion (27.4%) of this study participants were observed to have not however met the MDD-W due to the fact that they were basically consuming food stuffs from less than five food groups. Approximately (72.6%) of the respondent which is the majority were meeting the MDDW which is higher than findings conveyed in a study conducted in Ghana were 46.1% of the pregnant women were meeting the MDD-W (Saaka et al., 2017).

Dietary diversity more so was significantly associated with demographic and socio-economic characteristics such as the maternal educational level ($x^2$=16.17, p=0.042) and marital status ($x^2$=18.58, p=0.037). This current finding in this study is in consistent with finding reported in various studies which indicated that, dietary diversity was significantly associated with socio demographics factors of the pregnant mothers (Ali et al.,2014; Savy et al., 2008; Torheim et al., 2004).

### 5.2.3 Micronutrients intake including iron intake among the pregnant women based on 24-hour recall

When the magnitudes of the participants who were consuming adequate nutrients based on 24-hour dietary recall was determined, it was observed that approximately 54.3% of the respondents were meeting this recommended daily allowance (RDA) for iron whilst slightly less than half which is (45.7%) were not meeting their RDA for iron. Majority of the participants were meeting the RDA for selected micronutrients such as vitamin C (92.7%), Vitamin $B^{12}$ (90.9), Folic acid (73.8%). A significantly higher proportion of participant in the study achieved minimum dietary diversity for women (MDD-W)

Likeminded with various studies which have pointed out that, all dietary diversity scores are a proxy measure of the micronutrient adequacy of these women of the reproductive age including pregnant women. Dietary diversity, is positively associated with a diet that is adequate in essential the micronutrients (Arimond, 2011; FAO, 2011). Therefore, the participants who had achieved the MDD-W had a higher possibility of achieving micronutrient adequacy from the diet than those who were not achieving the MDD-W (FAO, 2011; FAO, 2014).

Relationship between dietary diversity and adequacy of micronutrients of the diets consumed by these women of the reproductive age has been done in several studies too and has been proved that dietary diversity is close related positively with adequacy of essential micronutrients of the diet. Correlation of between 0.36 to 0.66 has been however found between dietary diversity scores and the micronutrient adequacy of the diet in these previous studies (Arimond et al., 2010; Arimond, 2011; Kennedy et al., 2007; Mirmiran et al., 2004). The current study compares significantly with these studies findings because the findings in this present showed

a positive correlation between dietary diversity and iron intake of (r=0.57, p=0.038) and positive correlation of (r=0.48, p=0.041) between dietary diversity and iron status.

### 5.2.4 Dietary intake among the pregnant women based on food frequency

Built on a seven-day food frequency questionnaire foods rich in haeme iron such as fish, chicken, flesh meat, organ meet and eggs were not regularly consumed with the majority of the participants reporting to consume them for less than three times per week. The general finding is that, of this present study agrees with the other study that pointed out that diets of most women in developing countries lack or have little animal source food (Daniels &

Melissa 2009).

Milk was consumed frequently with majority of respondent reporting to consume milk in form of tea and sadza. Tea a beverage that is known to hinder the iron absorption was the most consumed beverage by participants. Numerous other dietary habits which could disturb iron absorption were observed in this specific study. Majority of this current study participants reported to consume tea together with their meals at times, a finding that was similar to finding obtained from a study carried out amongst pregnant attending ANC in Pumwani hospital in Nairobi which reported that 93.4% of the pregnant mother regularly drunk beverages such as tea, cocoa or coffee and 66% of them drink the beverages in less than 20 minutes before or after meals (Okube et al., 2016).

The majority of the participants also described that they consume kales as their major vegetables. A high proportion of the study respondents also reported to consume maize and its product, wheat and its products and legumes frequently.

These dietary habits could contribute in reduction of iron absorption in the body due to the presence of anti-nutrients (phytates, oxalates, tannins) that bind the iron and thus lessening its absorption. This study findings totally agree with other study findings that pointed out that, diet of most pregnant women in most developing countries is predominantly based on cereals, legumes and grains (Ekesa et al., 2011; Kennedy et al., 2007; Ruel, 2003).

### 5.2.5 Iron status among the pregnant women

This current study findings revealed, 20.1% of the study participants were anaemic a value lower than that of the global (43.8%) and national (55.1%) values (Ministry of Health, Zimbabwe 2013; WHO, 2012). The prevalence of anemia in this study is lower than (51.9–59.6%) estimated prevalence of anemia among pregnant women in Africa (Mclean, 2009). It is also lower when compared with prevalence of anemia (58.6%) among pregnant mothers reported in China (Ma AG, 2009). The prevalence of anemia amongst the pregnant women in the current study is also lower than findings reported in studies conducted in India where about (87–100%) pregnant women were found to be anemic (Vemullapalli & Rao,2014).

Anemia prevalence finding reported from this present study is in contrast to findings reported from other studies conducted in different counties in Kenya whereby varying anemia prevalence among pregnant women has been reported for different counties with 73.6% in West Pokot County, 69% in Kisumu County, 57% in Nairobi County, 40% in Kakamega County, and 16.9% in Laikipia County (Kemuto, et al., 2013; Okube et al., 2016; Siteti et al., 2014; Willy et al., 2016). This present study finding is also in contrast with findings obtained in other studies carried out in other African countries that reported anemia prevalence among pregnant women ranging from 63% in Uganda (Mbule et al., 2013), 62.2% in Egypt

(Ibrahim, 2011), 56.8% in Ethiopia (Alene, 2014), 54.6% in Nigeria (Olatunbosum , 2014) and 47.4% in Tanzania (Msuya, 2011) .

This present study findings are yet similar to those reported in a study carried out in the Mekelle township in Ethiopia that indicated that the total prevalence of anemia amongst the pregnant women was 19.7% (Abriha et al., 2014) however higher than the finding of a study carried out in Sudan which reported that only 10% of the study participants had low haemoglobin levels (Enaam et al.,2014).This current study findings are also comparable to findings reported in a study carried out in Northwest Ethiopia which revealed that the overall prevalence of anemia was 22% as well as with finding reported in a study carried out in Addis Ababa with prevalence of 21.3% (Alem et al., 2013; Jufar & Zewede ,2013).

Another study a carried out in Pakistan indicated that 29.1% of the study respondents were iron deficient which is slightly higher than the finding in the present study (Ali et al., 2014).The prevalence of anemia among pregnant women in the present study was also found to be much lower than anemia prevalence found in studies conducted in other countries including: Northen Ghana (70%), Boditi (61.6%), Eastern Ethiopia (56.8%), Northern Ethiopia **(**36.1%) and (32.8%) in Gamo Gofa Zone, Ethiopia (Addis & Abdulahi,2014; Bekele et al.,2016; Gebre &Afework Mulugeta,2015; Hailu & Zewde,2013; Lellisa et al., 2015; Lokare et al., 2012 ;Melku et al., 2014).

The disparities in the results obtained from different studies could be attributed to dietary differences, differences in demographic and socio-economic factors between the pregnant women from different regions, population variances, differences in study designs and differences in methodology used in determining iron status. Furthermore, the circumstantial factors contributing to anemia among the pregnant

women vary. Interactions of several factors such as women's demographic and socio-economic status, dietary diversity, nutritional and health related factors may contribute to iron deficiency amongst pregnant women (Abriha et al., 2014; Siteti et al., 2014).

Anemia was however found to be a moderate health problem in the current study. Presence of moderate anemia among the pregnant women in this study is of concern because anemia in pregnancy whether mild, moderate or severe is known to have detrimental effect on the health of both the mother and the fetus (Nuzhat et al., 2011). The incidence of anemia among pregnant women in this present study regardless of a greater proportion of study respondents achieving who were achieving minimum dietary diversity, would then be explained by the due fact that other factors apart from dietary diversity affect the iron status among pregnant mothers .This however, is in agreement to other studies that have reported that hemoglobin level may be affected by other factors other than dietary diversity among pregnant women ( Kubuga et al., 2016; Mcdonat et al., 2015; Saaka, 2017). Nevertheless, many studies are in agreement that, those pregnant women who consumed food items from the five or more of the 10 food groups had a higher likelihood of having a higher micronutrient adequacy. In addition to that, promotion of diverse diets is one of the several methods to improving micronutrients intake including iron among women of the reproductive age including the pregnant women (FAO & FHI 360, 2016; GoK, 2008;).

### 5.2.6 Nutritional status of the pregnant women

In this current study the nutritional status of the pregnant mothers was established by use of a measurement tape called the MUAC tape to measure the mid upper arm circumference of the participants. A MUAC value below 23 cm was categorized as

under nutrition. On the contrary a MUAC value above 23 cm was classified as normal nutritional status (Assefa, 2012; UNICEF 2009; Ververs, 2013). Based on the MUAC, more than two thirds of the participants (86.6%) had normal nutrition status at the time of the study. Therefore 13.4% of the participants in this present study were malnourished which is lower than 19.3% of pregnant women who were reported to be malnourished in a study carried out in Laikipia County in Kenya (Willy et al., 2016). This was also lower than 31.7% stated in a study carried in West Pokot County in Kenya (Kemuto et al., 2013).

The findings of this study are higher than finding reported in a study carried out amongst pregnant Women in Southern Ethiopia which reported that (9.2%) of the study respondents were undernourished (Ali et al., 2014). The proportion of malnourished pregnant women observed in this study was slightly higher than that reported in study carried out in Pakistan where 12.8% of the pregnant women were undernourished (Kuche1 et al., 2015). The finding in the present study is lower than finding reported in a study carried out in Northern Ghana which reported that 28% of the pregnant mothers were malnourished (Saaka et al.,2017).

Nutritional status in this current study was associated with dietary diversity ($r=0.26$, $p=0.035$) which is in agreement with other studies that pointed out that dietary diversity scores have been associated with anthropometric outcomes (Kennedy,2009; Willy et al.,2016).This is also in agreement with several studies which have documented that a diversified diet, is associated with nutrient adequacy as well as good nutritional status (Jayewardene et al., 2013; Kennedy, 2009; Mirmiran, 2006; Reul, 2004). On the contrary inadequate intake of essential nutrients causes malnutrition among the pregnant women (Olumakaiye, 2013).

### 5.2.7 Micronutrients supplements adherence among pregnant women

In this present study most of the participants reported to be taking iron and folic acid (IFAS) with a highest proportion taking the supplements daily which is higher than finding recorded in the study conducted in Kenya which reported that about 8% of the pregnant women consumed iron and folic acid tablets for 90 day or more in their recent pregnancy,5% reported to have taken the iron supplement for 60 -89 days and 53% reported to have taken the IFAS for less than 60 days while 30% of the women reported that they did not consume IFAS at all ( KNBS & ICF macro 2015). Likewise, the number of the pregnant mothers consumig IFAS in this present study is higher than numbers reported in a simillar study conducted in West Pokot where only 26.9% were consuming the IFAS (Kemuto et al.,2013). This finding may differ because the iron and folic supplements were readily available at the facilities where the current study was carried out.

Regardless of the high consumption of IFAS observed in this study, 20.1% of the respondents were found to be anaemic. Some scholars have shown that supplements may not consistently decrease the incidence of iron deficiency anaemia among women who have entered the pregnancy with low haemoglobin levels and low iron stores thus anaemia during pregnancy, can be decreased significantly if supplementation is started before conception (Hassan et al., 2014). Regardless of varying study outcome, routine iron supplementation reduces incidences of iron deficiency anaemia during pregnancy and should be practiced and emphasized (Hassan et al., 2014). Regarding accessibility to iron fortified food, 92.1% of the respondents in this current study reported to have access to iron fortified food.

### 5.2.8 Morbidity and health seeking behavior among the respondents.

On the issue of morbidity and maternal health seeking behaviour a relatively small proportion of study participants reported that they had been sick in the last two weeks with majority reporting to had suffered from malaria whilst a small proportion reported to have suffered from sexually transmitted infections and respiratory tract infections while others reported to have suffered from other sickness. A greater proportion of those that reported to have been sick reported to have sought medical care from a government hospital and local rural health centers yet a small proportion reported to have visited private clinic or bought medicine from the chemist.

In this study morbidity amongst the pregnant women was significantly associated with the iron status (HB) and nutrition status (MUAC) respectively. This genuinely concurs with other related studies that have highlighted that morbidity affects the nutritional status so as iron status of pregnant women directly in a way and is an immediate cause of malnutrition (Fatima, 2014; UNICEF, 2010). This also in agreement with other study which pointed out that morbidity affects food intake, nutrient absorption as well as, the utilization of the nutrients leading to poor nutritional status (Pieters et al.,2013). On the contrary poor maternal nutritional status and anaemia are major causes of morbidity during pregnancy (Fatima et al., 2014).

### 5.2.9. Antenatal clinic attendance of the pregnant women

Antenatal clinic attendance during pregnancy has been found to be imperative in order to prevent negative pregnancy outcomes and it is recommended to be started early enough and continued throughout until delivery (KBNBS & ICF macro, 2010;

KDHS, 2014). Antenatal care has been seen as an important entry point for the implementation of health and nutrition interventions that aimed at improving maternal nutrition status and iron status (Perumal et al., 2013). Health professionals recommend that the first antenatal visit occurs within the first three months of the pregnancy and also recommends that the women with no complications during the pregnancy should attend at least four ante natal clinics with the first visits taking place in the first trimester. According to KDHS (2014) report, 99.2% of pregnant women obtained antenatal care from a qualified health provider. Basically, more than half of the present study participants reported to have attended their first ANC clinic in their second trimester while a small proportion reported to have started the ANC clinic in their first and third trimester.

The chief purpose of antenatal care in pregnancy is mainly to detect early enough and therefore treat problems such as anaemia, infections and other diseases (KDHS, 2014). According KDHS (2014), 99.2 % of pregnant women in Embu received ANC from a qualified health provider and about 56.3% made four or more ANC visits. In the study only 8.6% of the respondent had four or more ANC visits. This is far much lower than 56.3% who made four or more visits in Embu County in the KHDS (2014). This may be accredited to the fact that, most of the participants (65.2%) in this present study reported to have started their first ANC visit in their second trimester. In the present study, the gestational age at which the ANC visit was started was meaningfully associated with iron status of the pregnant women.

### 5.3 Relationship between study variables.

#### 5.3.1 Relationship between dietary diversity and demographic and socio-economic factors

In the current study, marital status was significantly correlated to dietary diversity. Concurring with another study, demographic characteristics such as marital status are positively associated with dietary diversity (Nuzhat, 2011). However, negative relationships were noted between dietary diversity and maternal age. Socio economic characteristics, such as education level affects access to a diverse diet. Education level determines the lifestyle and the position a person enjoys in the society what so ever. This present study has then established a positive relationship between the pregnant women education level and their dietary diversity score. This is in agreement with the other studies that have reflected that educational attainment has a strong effect on the dietary practices of an individual (Ali et al .,2014; Savy et al., 2008;Torheim et al., 2004).The findings of this study are also in agreement with the other studies conducted by Nord (2007); Tiyou et al., (2012), Walingo & Kidake (2013), which found out that more educated people tend to get better jobs or engage in quality enterprise that generate more income and hence tend to have access to diverse diet.

Fatima et al (2014), also reported that dietary practices have been positively related to demographic and socio-economic factors such as parity, education and occupation. Increased education has been correlated with a health, balanced and diverse diet among pregnant women. Other studies have found a significant association between the monthly income, education level of the women to dietary diversity (Chowdhuny et al 2015, Saaka et al.,2017). In sincere contrast, women who are less educated, are not working and have high parity are more likely to

consume diets that are unhealthy and monotonous (Fatima et al., 2014; Northstone et al., 2007).

Education more often than not determines type of occupation one engages in. People with post-secondary training often have access to formal employment compared to those with secondary education or lower (Nord, 2007; Tiyou et al., 2012; Walingo & Kidake 2013). Majority of the respondent in the present study had only secondary or primary education and were self-employed mainly in small scale businesses.

In conclusion the current study findings demonstrated that; education level was significantly associated with dietary diversity of the study participant ($\chi^2$) =16.17, p= 0.042). These findings are in agreement with other studies that have found out that dietary diversity is associated with socio-economic factors such as education. Increasing education and income has been associated with a diet that is diverse. Never the less, women who are less educated and are not working are more prone to non-diverse diet (Okube et al., 2016; Northstone et al., 2007).

### 5.3.2 Relationship between dietary diversity, iron intake and iron status

A notable positive significant relationship was then found between dietary diversity and iron intake (r=0.57, p=0.038) of the respondents. A positive significant relationship was also found between iron intake and haemoglobin level (r=0.54, p=0.031). Those pregnant women who were consuming more dietary iron were likely to have had a higher iron status. There was also a positive significant relationship between the haemoglobin level and dietary diversity (r=0.48, p=0.041). This corresponds with findings of a study conducted in Northern Ghana which found out that dietary diversity of pregnant women is significantly associated with haemoglobin level (Saaka & Rauf ,2015). On the other hand this finding is in

contrast with finding of another study carried out in Northern Ghana which indicted that haemoglobin level of pregnant women was not associated with maternal dietary diversity (Saaka et al.,2017). A positive significant relationship was also found between dietary diversity and nutritional status of the study participants (r=0.26, p=0.035).

All these positive significant correlations in this present study are in agreement with other studies which have shown that a diversified diet is associated with nutrient adequacy as well as good nutritional status (Jayewardene et al 2013; Kennedy, 2009; Mirmiran, 2006; Reul, 2004). It also corresponds that dietary diversity is essential to nutrient adequacy as there is no single food that may contains all of the essential nutrients that are needed for good optimal health and good nutritional status (Kennedy, 2009). Additionally, when an individual consumes different foods or food items among and within the various food groups it promotes sufficient intake of essential micronutrients from the diet (Allen, 2008; FAO/WHO, 2002, Kennedy, 2009).

### 5.3.3 Relationship between iron status and demographic and economic factors of the participants

The iron status of the study participants had a positive significant relationship with parity (r=0.218, p= 0.005). This finding is similar to finding obtained in a study by Alem et al., (2013), where significant association between anemia and number of children was observed. The iron status of the pregnant women in this study was insignificantly associated with marital status ($\chi^2$=3.074, p=0.380) of the pregnant women in question. These findings are in great contrast with findings reported in a study done in a study conducted in Ethiopia which reported that marital status of the

pregnant women showed a significant association to maternal anemia (Abriha et al., 2014).

No notable significant relationship was found between haemoglobin level and gestation age (r=0.011, p=0.893) and between haemoglobin level and maternal age (r=0.0138, p=0.078) in this present study. This finding is in contrast with findings from other studies which have shown that the possibility of developing anaemia rises with maternal age as well as gestational age (Adinima, 2002; Gebremedhin, 2014, Hinderaka, 2001; Morsy, 2014; Odimu, 2002, Okube et al., 2016).

In the present study the level of education of the pregnant women was association with

hemoglobin level ($\chi 2$=2.282, p=0.682) although the association was not statistically significant in a way (p>0.05). These findings are in agreement with findings reported in a study carried out in Northern Ghana which revealed that low maternal educational level significantly predicted anemia and that women who had higher education level were less likely to be anemic while those with low education were more likely to be anemic (Saaka et al., 2017). This finding is also in indenture with finding of Chowdhuny et al (2015) & Erlindawati et al (2008) in which literacy of the pregnant women had a significant association with maternal anemia. The findings are also not in agreement with another study that was carried out in China that demonstrated that the level of education was statistically associated with anemia (p = 0.005) (MA AG, 2009). Insignificant association ($\chi^2$=5.36, p=0.605) was also found between iron status and the occupation of the pregnant mothers.

### 5.3.4 Relationship between iron status and dietary diversity

The hemoglobin level of the pregnant women in this study was significantly associated with their dietary diversity (r=0.48, p= 0.04).This finding is in contract with a certain study done in nine regional states of Ethiopia which found that anemia was significantly associated with dietary diversity (Abriha et al., 2014) but on the contrary to studies carried out in Ghana and Pakistan which revealed that dietary diversity was not associated with heamoglobin level (Ali et al., 2014; Saaka et al., 2017). Other studies had reported lack of association between dietary diversity and hemoglobin level especially in the environments where other factors other than dietary intake affect hemoglobin level amongst the pregnant women (Kubuga et al 2016; Mcdonat et al 2015; Saaka et al., 2017). Dietary iron intake of the participants was significantly correlated to the iron status of the study respondent (r=0.54, p=0.031) in the current study.

### 5.3.5 Relationship between morbidity, nutrition status and iron status

Sickness is generally a direct factor that affects the iron status and nutrition status of the pregnant mothers. In this current study, morbidity, specifically malaria was a key contributing factor as reported by 48.4% of those who had reported to have been sick in the two weeks prior to the study. More so morbidity was significantly associated with iron status ($\chi^2$) =7.78, p=0.034) in the present study. This study findings are comparable to a study conducted out in Northwest Ethiopia, that revealed that presence of parasitic infections especially hookworm was significantly associated with anemia in pregnant women. Anemia was also significantly associated with history of some malaria attack in the same study (Alem et al., 2013). In this present study presence of illness was associated with low hemoglobin ($\chi^2$=4.8, p=0.034). This finding compares well with finding reported in a study

which found a significant association between iron status based on hemoglobin level and presence of illness ($\chi^2$ =3.325, p=0.005) (Kemuto et al., 2013).

In the present study morbidity had a significant association with nutritional status ($\chi$2 =1.3, p=0.025) of the study respondents. The finding of the present study agrees with other studies which have shown that morbidity affects the nutritional status as well as iron status of pregnant women negatively and is an immediate cause of malnutrition (Fatima et al., 2014; Olumakaiye, 2013; UNICEF, 1990). However, these findings are in contrast with findings reported in another study which also found no significant relationship between morbidity pattern and nutritional status ($\chi^2$ = 0.348, p=0.555) ( Willy et al., 2016).The same study also found no significant relationship between morbidity pattern and hemoglobin level ($\chi^2$=0.059,p=0.808) among pregnant women ( Willy et al., 2016).However when logical regression was performed in the present study it showed that 38% (R=0.6153;$R^2$=0.378;p=0.000) of hemoglobin level could be explained by dietary iron intake while controlling for supplementation and morbidity as confounding variables.

From the findings of the present study, it can however, be concluded that factors associated with iron status among pregnant women are numerous with the parity being the main demographic factor significantly associated with iron status in this study. The gestational age when the pregnant women started attending ANC clinic is also a major factor that is significantly associated with iron status of the pregnant women in this study. Dietary diversity was positively related to the iron status of the study participants. When controlling for morbidity and supplementation as the confounding variables dietary iron intake is the major determinant of iron status among the pregnant women in the present study.

## 5.4 Conclusions

Marital status was positively correlated with dietary diversity. Socio economic characteristics such as education level had a significant positive relationship with dietary diversity of the study participants.

Parity in the present study was found to have a positive significant relationship with the haemoglobin level of the pregnant women.

In this current study dietary diversity had a significant positive relationship with haemoglobin level of the study respondents. Iron intake in this present study was found to have a significant positive relationship with haemoglobin levels of the study participants. Iron intake was found to have a positive significantly relationship with dietary diversity of the pregnant women.

Nutritional status among the pregnant women in the present study was found to have a significant positive relationship with dietary diversity of the pregnant women.

Morbidity more so among the study participant in the present study was found to be significantly associated with the haemoglobin levels of the pregnant women.

Based on the relationships observed between the different variables in the present study, all the study hypothesizes were rejected.

From the finding of the current study, it can be concluded that (20.1%) of the study participants were anaemic, 13.4% were undernourished and 27.4% had not met the MDD-W while 45.7% were not meeting RDA for dietary iron. Most of the study participants were married. Majority of study participants had a null or single parity. Majority of the participants were below 30 years of age.

Iron status was significantly correlated to iron intake, dietary diversity, parity, monthly income, wealth index, gestational age when ANC clinic was started and

presence of illness. Dietary diversity was basically positively correlated to level of education, income level, marital status, iron status, nutritional status and iron intake. Iron intake was associated with dietary diversity and iron status. Nutritional status was also significantly correlated to dietary diversity, morbidity and maternal age.

## 5.5 Implications

### 5.5.1 Implications for nursing education

The Nursing curriculum should however, emphasize on the importance of dietary diversity and the taking iron supplements especially educating student nurses and, qualified ANC nurses on how to efficiently counsel, guide and educate pregnant women on the general importance of iron supplements as they are the ones who are in constant contact with the women of the child bearing age. The various factors affecting uptake of iron supplements should then be considered in nursing education to equip the nurses with vital information and basic skills required to improve uptake of iron supplements among the pregnant women.

### 5.5.2 Implications for public health administration

There is need for the public health administrators to take a leading role in ensuring the availability of the tablets mostly in the public health sectors for easy accessibility. Policy formulation is essential, policies which ensure iron supplementation programmes run smoothly without prejudice to religion, culture or place of residence. Public health administrators should hence forth provide in-service education to nurses and midwives so to create awareness of factors that affect utilization of iron supplementation programmes.

## 5.6 Recommendations

The study recommendations for policy, practice and further research are given to the nongovernmental organizations, the government of Zimbabwe, the ministry of health and child welfare, the ministry of youth and gender, Mashonaland West, Hurungwe district through the ministry of health, health care facilities, health service providers and women of reproductive age.

### 5.6.1 Recommendation for policy

The study findings have demonstrated that factors such as education affect dietary diversity among pregnant women. Therefore, the government of Zimbabwe should enact new and improve existing policies on access to education especially among girls and women because increase education could translate to better income and therefore better economic status.

Majority of the respondent were involved in small scale farming. As such, the governments of Zimbabwe through the ministry of youth and gender need to support the women to strengthen their agriculture businesses in order to generate adequate income that will enable the women to access a diverse diet.

Dietary diversity has been shown to be significantly associated with iron intake and iron status in this study. Thus, the policy makers and policy implementers at the health facilities level need to create more awareness on the importance of consuming a diverse diet throughout the pregnancy.

Parity has been shown to be significantly associated with iron deficiency anemia therefore more awareness needs to be created on the need to reduce the number of children as well as spacing the pregnancies in order to prevent iron deficiency in pregnancy by any chances.

Morbidity is a major contributor of poor nutritional status and anemia among the pregnant women. It is therefore recommended that the government through the ministry of health and other stake holders enhances public awareness on the importance of seeking medical care for early identification and treatment of diseases and infections.

The gestation age when antenatal care clinic is started has been shown to be significantly related to iron status. Hence, the government and other stakeholders need to create more awareness on the importance of starting ANC clinics as earlier as in the first trimester to ensure that all micronutrients are given on time since micronutrient supplementation in this study significantly correlated with iron status of the pregnant women.

### 5.6.2 Recommendations for practice

The study has brought to light that dietary iron intake has a positive relationship with the iron status of the pregnant women. It is hence forth paramount that the health facilities through the health service provider promote regular consumption of heme iron rich food such as meat, poultry and fish through regular talks on the importance of dietary diversity among the pregnant women during the routine ANC visits in all health facilities.

Dietary diversity, has been found to have a significant relationship to the iron intake, iron status as well as the nutritional status of the expecting mothers in this study. The health service providers especially the nutritionist have an important role in educating women of reproductive age on the importance of consuming a diet that is diverse in order to prevent iron deficiency anemia and thus achieve optimum nutritional status for positive pregnancy outcome. More so, regular consumption of

a diverse diet amongst the pregnant women should be enhanced through regular talks, health talks and demonstrations in ANC visits in all health facilities.

### 5.6.3 Suggestion for further research

A certain similar study on the iron status among the pregnant using more parameters such as serum ferritin, Serum iron, transferrin and transferrin saturation and Serum transferrin receptors to measures different aspects of iron status among pregnant women. Longitudinal study on the dietary diversity, nutrients intake and iron status and its impact on the pregnancy outcome is strongly recommended. On the same note since there is limited information in the country on dietary diversity, iron intakes and iron status during pregnancy further research in other counties is highly recommended.

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## APPENDICES

### APPENDIX A: Informed consent (English)

Dear Respondent;

My name is Nyaradzo Masvosve. I am an MPH research student from Africa University. I am conducting a study on dietary diversity and adherence of iron supplements among pregnant women in Hurungwe district, Mashonaland West.

**The purpose of the study**

The purpose of the study is to assess the dietary diversity, adherence to iron supplements.

**Procedure to be followed**

Participation in this study will require that I ask you some questions on the types of food you have eaten for the last 24 hours and other iron supplements adherence questions. The information from you will be recorded in a questionnaire.

You have the right to refuse participation in this study. You will get the same care and medical treatment whether you agree to join the study or not and your decision will not change the care you receive from the hospital today.

Remember participation in the study is voluntary and no payment or gifts will be offered to those who will participate in the study. You may ask questions related to the study at any time and you may refuse to respond to any question. You may stop the interview at any time without any consequences to the service you receive from this hospital today or in the future.

**Discomforts and risks**

All the procedures to be performed are safe and will not harm you or the unborn baby. There are no risks associated with the study to either you or the unborn baby.

The interview may add approximately half an hour on the time you wait before you receive your routine services.

**Benefits**

If you participate in this study, you will be able to know, your nutritional status as well as your dietary diversity score.

**Protection of the research participant's confidentiality**

The interviews will be conducted in a private setting within the hospital. You name will not be recorded on the questionnaire. The questionnaires will be kept in a safe locked cabinet and everything will be kept private. The information collected from the research will be confidential and will not be used for any other purposes other than in this research.

**Community considerations**

In case you have low dietary diversity, you may be advised on how to modify your diet in order to meet your dietary requirement or you may be referred to nutritionists for further assistance.

**Contact information**

If you have any question you may contact:

Ms A Kapfunde on 077 6466815 the Africa University Ethical Review Committee on aurec@africau.edu

**Participant statement**

The above information regarding my participation in the study is clear to me. I have been given a chance to ask questions and my questions have been answered to my satisfaction. My participation in this study is entirely voluntary. I understand that my records will be kept private and that I will get the same care and medical whether I decide to leave the study or not.

Name of the participant……

**Signature/ thumbprint_____DATE _____**

Investigator's statement,

I the undersigned have explained to the volunteer in a language she understands the procedures to be followed in the study and the risks and benefits involved.

Name of interviewer _____signature_____Date_____

## APPENDIX B: Chibvumirano

Wadiwa Mudaviri;

Zita rangu ndinonzi Nyaradzo Patience Masvosve. Ndiri mudzidziwe Masters in Public Health paAfrica University. Ini ndriri kuitawo tsvakurudzoma maringe nezvekudya zvakasiyana siyana zvingadyiwa neavo vakazvitakura uye kunwa kwavo mapiritsi aya anobetsera kuwedzera iron muropa reavo vakazvitakuramunzvimbo yeHurungwe district, Mashonaland West.

**Chinangwa chetsvakurudzo**

Chinangwa chetsvakurudzo iyi ndechekunzvera uye kuongorora zvokudya zvakasiyana siyana zvinodyiwa neavo vakazvitakura kuti zvinekudya kwe iron here zvakare kutarira kuti vakazvitakura ava vanonwa here mapiritsi ekubetseredza kuti miviri iwane iron.

**Nzira dzichashandiswa**

Kuita chiitiko ichi zvinoda kuti imi mupindure mimwe yemibvunzo maringe nezvekudya izvo makadya pama awa 24 apfuura. Pachange pane imwe mibvunzo iri maringe nemamwiro enyu amunoita mapiritsi ayo anowedzera iron muropa renyu kana muchinge makazvitakura Mhinduro dzenyu dzichange dzichi nyorwa pabepa iri remibvunzo.

Mune mvumo yekuramba kupinda muchiito ichi uye ndinovimbisa kuti machawana zvimwe chete izvo manga muchifana kuwana zvisinei kuti mabvuma kupindura kana kuti marimba

Rangarirai kuti kupinda muchiitiko ichi kupinda nokuzvidirasezvo pasina muripo kuna zvipo zvichapiwa kune avo vachange vapinda muchirongwa ichi. Munokwanisa kubvunzawo mibvunzo iri maererana netsvakurudzo iyi uyu munokwanisa kutizivisa

kuti hamuchakwasnisa kuenderera mberi nechiitiko ichi pasina kushaya rubetsero nhasi kana rimwe zuva ramuchauya kuchipatara zvakare.

**Zvingashungurudza kana kukuvadza**

Zvose zvichaitwa hazvitarisirwe kunge zvichikuvadza mwana wamakatakura uye zvakare hapana chingakuvadza imi. Mibvunzo iyi inotarisirwa kutora nguva yakareba sechidimbu che awa.

**Zvichabatsira**

Kana muchinge mapinda muchiitiko ichi muchakwanisawo kuziva maringe nemamiriro ekudya kwakasiyana siyana kwenyu.

**Kuchengetedzwa kwetsindidzo kweavo vachadaira mibvunzo**

Kubvunzwa kwemibvunzoiyi kuchaitwa muchnzvimbo ine chivande pannvimbo ino echipatatra. Zita renyu hapana apo richanyorwa. Bepa remhinduro richachengetedzwa munzvimbo yakavanzika uye inokiyiwa uye hapanazve kumwe kwaichashandiswa kunze kwetsvakurudzo ino bedzi.

**Maererano nenharaunda**

Mushure mekunge maonekwa kuti hamusi kudya chikafu chakasiyana siyana munokwanisa kuwana ruzivo maringe nekudya chikafu chakasiyana siyanauye munokwanisa kubetserwa nachiremba wezvekudya munharaunda menyu.

**Ruzivo**

Kana muchinge muine zvamungade kuziva maringe netsvakurudzo iyi munokwanisa kubata:

Mrs A Kapfunde on 077 6466815 kana kuti Africa University Ethical Review Committee on aurec@africau.edu

**Mhiko yeachapindura**

Zvose zvandinotarisirwa kuita muchiitiko ichi ndazvinzwisisa uye ndapiwa bvumo yekubvunza mibvunzo kusvika ndanzwisisa. Kupinda kwandichaita muchiitiko ichi kuchava kuda kwangu. Ndinonzwisisa kuti zvinyorwa zvangu zvichachengetedzwa panzvimbo yakavanda uye ndichawana rubatsiro kunyangwe ndaramba kupindura mibvunzo yese inoteera.

**Runyoro/ thumbprint_____DATE _____**

Mhiko yemubvunzi,

Ndinonzwisisa zvose zvandatsanangurakuti uyo achapindura achange apinda pamadiro ake uye mururimi rwaanonzwisisa uye.

Zita remubvunzi _____signature_____Date_____

**APPENDIX C: DD Questionnaire (English)**

**SECTION A: Dietary diversity questionnaire for the pregnant women respondents**

**(Adopted from FAO, 2011; FAO & FHI 360, 2016).**

**PART 1:**

Please describe the foods (meals and snacks) that you ate or drank yesterday during the day and night, whether at home or outside the home. Start with the first food or drink of the morning up to the last meal of the day before going to sleep (FAO, 2011).

| Breakfast | Snack | Lunch | Snack | Dinner | Snack |
|---|---|---|---|---|---|
| | | | | | |

**Part 2: Dietary diversity food groups**

Please write down (1) if any food was consumed in the last 24-hour period in the given food group and write (0) if none of the food was consumed in the given food group (**FAO,2011; FAO & FHI 360, 2016).**

| | | | |
|---|---|---|---|
| A | food made from grains | examples of food items | Consumed YES=1 NO=0 |

| | | | |
|---|---|---|---|
| A | Food made from grains | Maize, rice, wheat, sorghum, millet or other grains or foods made from these (e.g. bread, cakes, biscuit samosa, pancakes noodles, spaghettis porridge) | |
| B | White roots and tubers and plantains | White potatoes, white cassava, white sweet potatoes other food made from roots, green bananas | |
| C | Pulses (beans, peas and lentils | Dried beans, dried peas, green grams, cowpeas, lentils, soy beans | |
| D | Nuts and Seeds | Any tree nuts, groundnuts/peanuts, seeds or food made from these (e.g. peanut butter), coconuts | |
| E | Milk and milk | Milk, cheese, yogurt or other milk product but not | |
| | product | including butter, ice cream, cream or sour cream | |
| F | Organ meat | Liver, kidney, heart or other organ meats or blood based foods, including game | |
| G | Meat and Poultry | Beef, pork, lamb, goat, rabbit, wild game meat, chicken, duck or other bird | |
| H | Fish and sea food | Fresh or dried fish, shellfish or seafood | |
| I | Eggs | Eggs from chicken, duck guinea fowl or any other egg | |
| J | Dark green leafy vegetables | Dark green leafy vegetables, including wild forms plus vitamin A rich vegetables such as amaranth, cassava leaves, kales, spinach, pumpkin leaves. | |
| K | Vitamin A-rich vegetables, roots and tubers | Pumpkin, carrots, squash or sweet potatoes that are yellow or orange in color and other locally available vitamin A rich vegetables | |

| | | | |
|---|---|---|---|
| L | Vitamin A rich fruit | Ripe mangos, ripe papaya, and 100% juice made from these juices plus other locally available vitamin A rich fruits. | |
| M | Other vegetables | Other vegetables (e.g. tomatoes, onions eggplant) plus other locally available vegetables, cabbage, cucumber, green peas, French beans, beetroots | |
| N | Other fruits | Other fruits, including wild fruits and 100% fruit juices made from passion guava, plums, pears, apple, watermelon, pineapple, ripe bananas, avocado, oranges, lemon, strawberry. | |
| O | Other oils and fats | Oil, fats or butter added to food or used for cooking, margarine, including oil from nuts, fruits and seeds and animal fat | |
| P | Spices condiments , beverages | Spices (black pepper, salt), condiments (soy sauce, hot sauce), coffee, tea, cocoa, chocolate alcoholic beverages. | |

**PART 3: 24-hour recall**

Starting from morning to evening yesterday, please name all foods and drinks that you consumed as well as the amounts that were prepared.

| Meal | Time | Place eaten (Home/ out) | Food or drink | Detailed description of food item and preparation method | Amount eaten | Weight Equivalent (grams) | Food code |
|---|---|---|---|---|---|---|---|
| Break -fast | | | | | | | |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Snack 1 | | | | | | | |
| lunch | | | | | | | |
| Snack 2 | | | | | | | |
| supper | | | | | | | |
| snack 3 | | | | | | | |

**APPENDIX D: DD QUESTIONNAIRE (SHONA)**

**CHIKAMU A: zvekudya zvakasiyana siyana zvinodyiwa neavo vakazvitakura**

**(Yakabva muFAO,2011; FAO & FHI 360, 2016).**

**Ndima yokutanga:**

Tsanangura chikafu chawakadya uye kunwa nezuro , pangava pamusha kana kuti pamwewo. Tanga kubvira mangwanani kusvika usati warara (FAO, 2011).

| **Kudya kwamangwana ni** | **Kudya kwecher o nguva** | **Kudya kwamasika ti** | **Kudya kwechero nguva** | **Kudya kwamadeko** | Kudya kwechero nguva |
|---|---|---|---|---|---|
| | | | | | |

**Ndima yepiri: mhando dzezvikafu zvakasiyana siyana**

Nyora (1) kana chikafu ichi chakadyiwa panguva inoita 24-hour yapfuura. Izvi zvichanyorwa muzvitsauko zvinoteera. Zvakare nyora (0) kana pasina chikafu chakadaro chakadyiwa. (**FAO, 2011; FAO & FHI 360, 2016).**

| A | Kudya kunobva mutsanga | Mufananidzo | Chakadyiwa here<br><br>hongu=1<br><br>kwete=0 |
|---|---|---|---|
| A | Kudya kunobva mutsanga | chibage, mupunga,gorosi,mapfunde, mhunga, nezvimwewo (se. chingwa, makeke, | |
| B | Chikafu chemidzi and uye mabanana | magwiri, mujumbura, mbambaira uye mabanana | |
| C | Ndumba | ndumba, pizi, nyemba lendurus, soy beans | |
| D | Nzungu ne mhodzi | Nzungu dzemiti, nyimo/nzungu, mhodzi kana chikafu chinogadzirwa nenzungu nemhodzi(se dovi) | |
| E | Mukaka uye zvinogadzirwa nemukaka | Mukaka, chizi, yogat nezvimwewo | |
| F | Nyama yemukati | Chiropa, itsvo,moyo uye zvimwewo kana nyama yemhuka kana nyama ine ropa rakawanda mairi | |
| G | Nyama kana Shiri | Nyama yemombe, nguruve hwai, mbudzi, tsuro, nyama yemhuka, huku,dhadha kana dzimwewo. | |
| H | Hove uye zvimwe zvingawanikwe munzizi | Hove nyoro, dzakaoma nezvimwewo zvinogara mumvura. | |

| | | | |
|---|---|---|---|
| I | Mazai | Mazai ehuku, edhadha,ehanga,kana mamwewo. | |
| J | Mirivo yakasvibira | Mirivo yakasvibira, ikusanganisira yemusango semowa. Doora sipinachi uye covo, | |
| K | Vitamin A-miriwo, midzi uye zvinhanga | nhanga, macarrots, mbambaira tsvuku mukati. Neimwewo mirivo yakazodzwa ne vitamin A | |
| L | Vitamin A - Muchero | Mango, popo, uye muto wemichero kusanganisira michero inowanikwa munharaunda. | |
| M | Imwewo mirivo | Sematomato, hanyanisi, kavichi magaka uye beans | |
| N | Imwe michero | Imwe michero | |
| O | mafuta | Mafuta, ruomba. Mafuta enzungu | |

**Ndima yetatu: Food frequency table**

State the frequency of the consumptions of the selected food items by week

| Food items | Freq per week | Food item | Freq per week | Food item | Freq per week | Food item | Freq per week |
|---|---|---|---|---|---|---|---|

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Maize | | Sweet potatoes | | carrots | | Lemon | |
| Maize flour | | Beans | | Mangoes | | Pineapple | |
| Wheat flour | | (cowpea) | | Passion fruits | | | |
| Rice | | | | Plums | | Tree tomato | |
| Sorghum | | Dried peas | | Ripe bananas | | Kales | |
| Millet | | Lentils | | Oranges | | Cabbage | |
| Irish potatoes | | Groundnuts | | Guava | | Spinach | |
| Yam | | Peanut | | Water melon | | Derere /amaranth | |
| Cassava | | Soybeans | | pears | | Pumpkin leaves | |
| Arrowroot | | Coconuts | | Spices | | | |
| Green /raw bananas | | Avocado | | sweets | | | |
| Pumpkin | | Pawpaw | | Sugar | | Arrowroot leaves | |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Carrots | | Supplemen<br><br>ts | | Soda | | Tomatoes | |
| Beet roots | | | | Sausages | | Onions | |
| Eggs | | fish | | Chips | | Eggplants | |
| Liver<br><br>Meat | | chicken | | Cakes<br><br>/ doughnut | | Cucumber | |
| Milk/ milk product | | herbs | | Samosa | | Courgette | |
| Tea | | coffee | | biscuits | | French beans | |
| Cocoa | | chocolate | | Alcoholic beverage | | Green peas | |

**APPENDIX E Iron Supplement Adherence Questionnaire (English)**

| Q # | Question | Response | Options | Comments |
|---|---|---|---|---|
| | | | | |
| A 1 | Date of interview | DD/MM/ YYYY | | |
| A 2 | Interviewer code | __ __ | 01-200 | |
| Basic information | | | | |
| A 3 | Age | _____. | | 18-49 |
| A 4 | Marital status | _____.____ | 1 Married<br>2 single/ never married<br>3 divorced<br>4 separated<br>05 widowed | |
| A 5 | Level of education | _____. | 1 Primary<br>02 Secondary<br>1 tertiary<br>2 never went to school. | |
| A 6 | Occupation | | 1 Farmer, ,2 Causal worker, 3.housewife, 5.formal employed | |

| | | | | |
|---|---|---|---|---|
| A 7 | How many children do you have? Number of pregnancies that you have had | __ __ | 1-15 | |
| A 8 | Previous history of anaemia | __ __ | 01 yes<br>02 no | |
| A 9 | How long does it usually take you to get to your nearest community health facility? [This should be by whatever means or transport they would typically use] | Number in minutes: ___ | 999 Don't Know | |
| A 10 | Have you ever heard of Iron Folic Acid (IFA) tablets? | __ __ | 1 yes<br>2 No<br>99 Don't Know | 02 skip to QK11 |
| A 11 | Did you take any supplements/ vitamins that contain iron in the last 7 days? | __ __ | 1 Yes<br>2 No<br>99 Don't Know | |
| A 1 | At what gestation period did you start attending | __ __ | 1 1st trimester<br>2 2nd trimester | |

| | | | | |
|---|---|---|---|---|
| 2 | antennal clinic? | | 3 3rd trimester | |
| A13 | How many antenatal visits have you had so far? | | 01 1<br>02 2<br>03 3<br>4 4<br>05 5<br>06 6 | |
| A14 | Have you received iron supplement during the current pregnancy? | | 1 Yes<br>2 No<br>99 Don't Know | |
| A15 | Have you been sick in the past 2 weeks | | 01 yes<br>02 no | |
| A16 | If yes, did you seek any medical assistance | | 01 yes<br>02 no | |
| Nutrition and health promotion | | | | |
| A17 | Where you give any information on iron supplement during the antenatal counselling | __ | 1 Yes<br>2 No<br>99 Don't Know | |

| | | | | |
|---|---|---|---|---|
| A18 | Have been taking any micronutrient supplement for the last two weeks? | | 3 01 yes<br>4 02 no | |
| A19 | Do you take the supplement daily? | | 5 01 yes<br>6 02 no | |
| A20 | If NO why? | | 7 Due to bad taste, 2= Forgetting, 3= I do not see the importance 4= not available in the clinic, 5=1st visit 6= Have the completed dose, 7=others specify…….. . | |
| A21 | If yes, how old was the pregnancy when you started taking iron supplements? | __ __ | 8 1st trimaster<br>9 2nd trimester<br>10 3rd trimester | |
| A22 | Are the iron supplements affordable? | __ __ | 1 Yes<br>2 No<br>99 Don't Know | |
| A23 | Do you have access to iron fortified food? | | 1=processed wheat and maize flour, 2.others specify..... | |

**APPENDIX F: Iron Supplement Adherence Questionnaire (SHONA)**

| Q # | Mubvunzo | Mhinduro | Sarudzo | Zvingataurika |
|---|---|---|---|---|
| | | | | |
| A1 | Zuva | DD/MM/ YYYY | | |
| A2 | Mufananidzo | __ __ | 01-100 | |
| Basic information | | | | |
| A3 | Makore | _____. | | 18-49 |
| A4 | Chimiro | _____.____ | 5 ndakaroorwa<br>6 handina kuroorwa<br>7 ndakasiyana nemurume | |
| A5 | Chipimo chedzidzo | _____. | 2 purimari<br>02 Sekondari<br>3 kukoreji<br>4 Handina kuenda kuchikoro | |
| A6 | Une vana vangani uye pamuviri pamakatakura pangani | __ __ | 1-15 | |
| A7 | Previous history of anemia | __ __ | 01 hongu<br>02 kwete | |

| | | | | |
|---|---|---|---|---|
| A9 | Munotora nguva yakadii kusvika kuchipatara chiri pedo nemi | **Number in minutes:** ___ | 999 Handizive | |
| A10 | Mungaite ruzivo rwema IFA supplements | __ __ | 3 Hongu<br>4 kwete<br>99 handizive | 02 skip to QK11 |
| A11 | Kana mati hongu, mungati pamazuva manomwe adarika manga muchimanwa here? | __ __ | 3 hongu<br>4 kwete<br>99 handizive | |
| A12 | Makatanga kushanyira kuchipatara nunoonekwa nananyamukuta muine mavhiki mangani? | __ __ | 5 2 vhiki<br>6 16 vhiki<br>7 20 vhiki<br>8 24 vhiki<br>9 28< vhiki | |
| A13 | Mava nenzendo ngani muchiuya kuzotariswa nana mbuya kuchipatara? | | 1 -3<br>02 4-6<br>2 7-9<br>04 10< | |

| | | | | |
|---|---|---|---|---|
| A14 | Makambopiwa her mapiritsi aya pamakauya kuzoongororwa pamuviri penyu? | | 1 Hongu<br>2 Kwete<br>99 handizive | |
| Nutrition and health promotion | | | | |
| A15 | Makambopiwa ruzivo maringe nekunwa kwakanaka kungaitwamapiritsi aya nanambuya nyamukuta pazvipatara? | __ | 11 01hongu<br>12 02 kwete<br>99.handiziv e | |
| A16 | Kana zviri izvo munenguva yakareba seimuchinwa zvinokurudzirwa? | __ | 13 01 1st trimaster<br>14 02 2nd trimester<br>15 03 3rd trimester | |
| A17 | Murikunwa mapiristsi aya sekurairwa kwamakaita navarapi here? | __ | 1 Hongu<br>2 kwete<br>99.handiziv | |
| A18 | Mune dambudziko here kuwana mapirits aya? | __ | 16 01hongu<br>17 02 kwete<br>99.handizive | |
| A19 | Kana pane dambudziko tsanangurai zvizere. | | | |
| A20 | Mapiritsi aya anotengeka here | __ | 18 01hongu | |

| | | | | |
|---|---|---|---|---|
| | muchipatara. | 19 | 02 kwete<br>99.handizive | |

**APPENDIX.G Food consumption of respondents based on food frequency**

| ***Meats*** | ***(n)*** | ***(%)*** | ***Median*** | ***range*** |
|---|---|---|---|---|
| Fresh meat | | | | |
| Fish | | | | |
| Poultry | | | | |
| Liver | | | | |
| Eggs | | | | |
| Milk | | | | |
| ***Beverages, sweets and spices*** | ***(n)*** | ***(%)*** | ***median*** | ***range*** |
| Tea | | | | |
| Chocolate | | | | |
| Cocoa | | | | |
| Coffee | | | | |
| Sugar | | | | |
| Soda | | | | |
| Alcohol | | | | |
| Sweets | | | | |
| Biscuits | | | | |
| Cakes | | | | |
| Spices | | | | |
| samosas | | | | |
| sausages | | | | |
| Chips | | | | |
| ***Fruits*** | ***n*** | ***%*** | ***median*** | ***range*** |
| Oranges | | | | |
| Lemons | | | | |
| Passion | | | | |
| Guava | | | | |
| Pineapples | | | | |

| | | | | |
|---|---|---|---|---|
| Pawpaw | | | | |
| Mangoes | | | | |
| Ripe bananas | | | | |
| Water melon | | | | |
| Plum | | | | |
| Pears | | | | |
| Avocado | | | | |
| Thorn melon | | | | |
| Tree tomato | | | | |
| ***Legumes*** | ***n*** | ***%*** | ***median*** | ***range*** |
| Cowpeas | | | | |
| Beans | | | | |
| | | | | |
| Dried peas | | | | |
| Njahi | | | | |
| Green grams | | | | |
| Soy beans | | | | |
| Lentils | | | | |
| Nuts | n | % | | |
| Ground nuts | | | | |
| Coconuts | | | | |
| Vegetables | (n) | (%) | median | range |
| Derere | | | | |
| Spinach | | | | |
| Pumpkin leaves | | | | |
| Kales | | | | |
| Kunde | | | | |
| Masecondary | | | | |
| Arrowroot leaves | | | | |
| Other vegetables | (n) | (%) | median | range |

| | | | | |
|---|---|---|---|---|
| Tomatoes | | | | |
| Cabbage | | | | |
| Onions | | | | |
| Egg plant | | | | |
| Beetroots | | | | |
| Cucumber | | | | |
| Courgette | | | | |
| French beans | | | | |
| Green peas | | | | |
| Cereals | (n) | (%) | median | range |
| Maize | | | | |
| Maize flour | | | | |
| Millet | | | | |
| Sorghum | | | | |
| Wheat flour | | | | |
| Rice | | | | |
| Roots and tubers | (n) | (%) | median | range |
| Irish potatoes | | | | |
| Sweet potatoes | | | | |
| Yams | | | | |
| Cassava | | | | |
| Arrowroots | | | | |
| Green bananas | | | | |
| Pumpkins | | | | |
| Carrots | | | | |

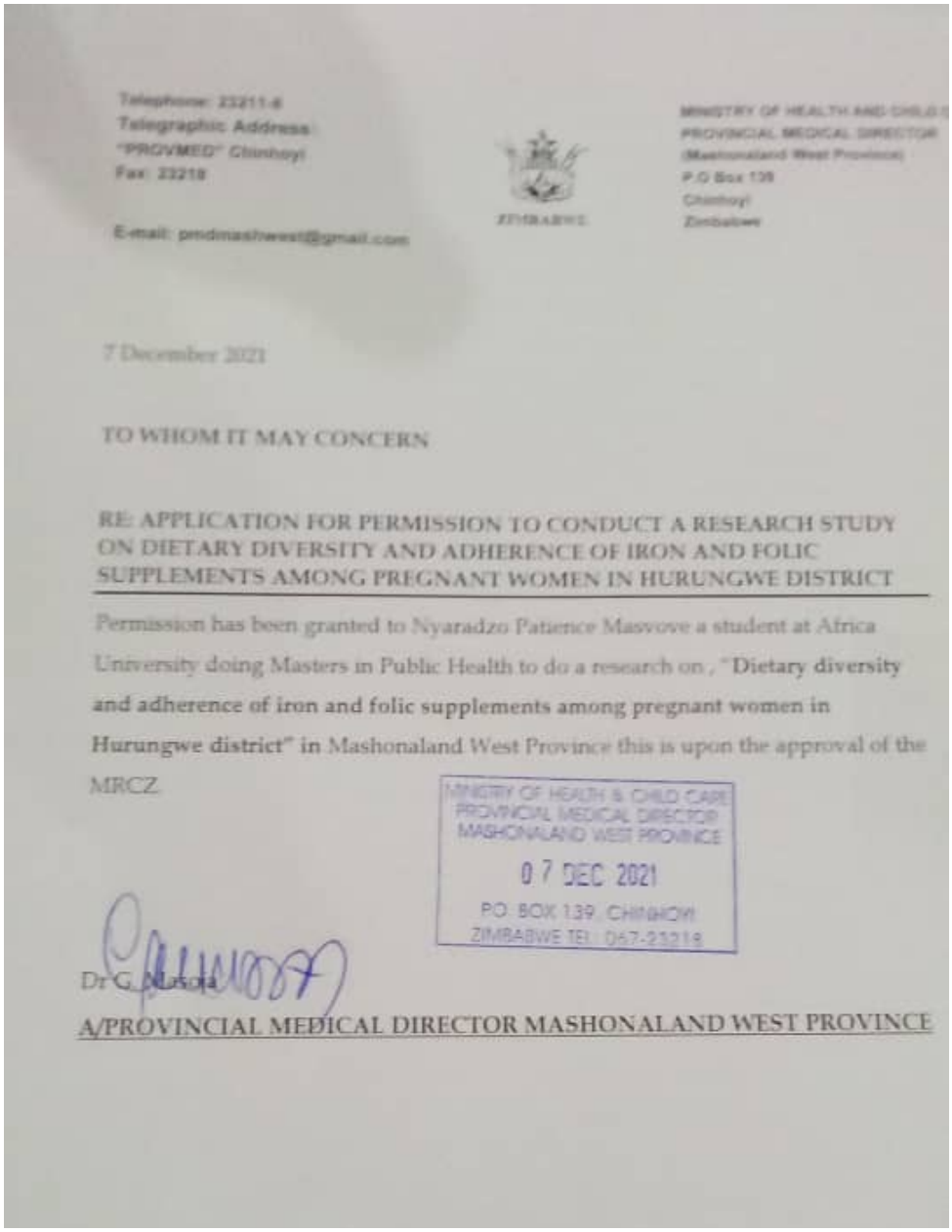
**APPENDIX H: Budget**

| Activity | PI | | AR | | Total |
|---|---|---|---|---|---|
| | Units | Daily fees | Units | Daily fees | |
| Consultancy fees | 20 | 10 | 10 | 5 | 250.00 |
| Travel | 10 | 10 | 0 | 0 | 100.00 |
| Per diems | 8 | 10 | 0 | 0 | 80.00 |
| Stationery and communication | 1 | 60 | 0 | 0 | 60.00 |
| Total evaluation duration | 20 | | 3 | | 490.00 |

## APPENDIX I: Time Line

| ACTIVITIES | Calender (Weeks and Days) 24-28 Jan | 07-11Feb | 14-18 Feb | 7-11 Mar | Total |
|---|---|---|---|---|---|
| Desk review | | | | | 0.5 |
| Training of enumerators | | | | | 2 |
| Pilot testing | | | | | 1 |
| Data Collection | | | | | 15 |
| Presentation of indicative findings | | | | | 2 |
| Data Analysis | | | | | 1 |
| Draft report writing | | | | | 2 |
| Validation meeting | | | | | 0.5 |
| Incorporation of feedback | | | | | 0.5 |
| Presentation of final report and submission | | | | TBA | |
| Total Days | | | | | 24.5 |

**APPENDIX J: Data collection approval letter**:



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ZIMBABWE

MINISTRY OF HEALTH AND CHILD C
PROVINCIAL MEDICAL DIRECTOR
(Mashonaland West Province)
P.O Box 139
Chinhoyi
Zimbabwe

7 December 2021

TO WHOM IT MAY CONCERN

RE: APPLICATION FOR PERMISSION TO CONDUCT A RESEARCH STUDY ON DIETARY DIVERSITY AND ADHERENCE OF IRON AND FOLIC SUPPLEMENTS AMONG PREGNANT WOMEN IN HURUNGWE DISTRICT

Permission has been granted to Nyaradzo Patience Masvove a student at Africa University doing Masters in Public Health to do a research on , "**Dietary diversity and adherence of iron and folic supplements among pregnant women in Hurungwe district**" in Mashonaland West Province this is upon the approval of the MRCZ.

MINISTRY OF HEALTH & CHILD CARE
PROVINCIAL MEDICAL DIRECTOR
MASHONALAND WEST PROVINCE
07 DEC 2021
P.O. BOX 139, CHINHOYI
ZIMBABWE TEL: 067-23218

Dr G. Mutsoti

A/PROVINCIAL MEDICAL DIRECTOR MASHONALAND WEST PROVINCE