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DEPARTMENT OF FOOD SCIENCE AND NUTRITION

**FACTORS ASSOCIATED WITH DIETARY DIVERSITY AMONG WOMEN OF
REPRODUCTIVE AGE IN CHONGWE DISTRICT, ZAMBIA**

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**A RESEARCH DISSERTATION SUBMITTED IN PARTIAL FULFILLMENT OF
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SCIENCE IN HUMAN NUTRITION**

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I, Toose Muzungaile, declare that this dissertation is a result of my own original effort and work, and that to the best of my knowledge, the findings have never been previously presented to the University of Zambia or any other university for the award of any academic qualification. Where assistance was sought, it has been accordingly acknowledged.

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Signed

Date.....

Chiza Kumwenda, PhD (Co- supervisor)

CERTIFICATE OF APPROVAL

We, the undersigned, certify that this dissertation is the result of the author's own work, and that to the best of our knowledge, it has not been submitted for any other academic qualification within the University of Zambia. The dissertation is acceptable in form and content, and that satisfactory knowledge of the field covered by the dissertation was demonstrated by the candidate through oral examination taken on -

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DEDICATION

I dedicate my academic effort to my father, Mr. Robby Muzungaile, My husband Mr. Kennedy Namangolwa and my two children, Musa and Liseli for their ultimate encouragement, patience, and prayers for my good health during this academic journey.

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ABBREVIATIONS AND ACRONYMS

AUC	Area Under the Curve
AOR	Adjusted Odds Ratio
BMI	Body Mass Index
CAAPD	Comprehensive Africa Agriculture Development Programme
CAPI	Computer Assisted Personal Interview
CI	Confidence Interval
CSO	Central Statistics Office
CSO-SUN	Civil Society Scaling Up Nutrition
DACO	District Agricultural Coordinator
DC	District Commissioner
EPHI	Ethiopian Public Health Institute
FANTA	Food And Nutrition Technical Assistance
FAO	Food and Agriculture Organization of the United Nations
FHI	Family Health International
FG	Food Group
FISP	Farmer Input Support Programme
ICF	International classification of Functioning, Disability and Health
IYCF	Infant and Young Child Feeding
LMIC	Low and Middle Income Country
MAIYCN	Maternal Adolescent Infant and Young Child Nutrition
MDD-W	Minimum Dietary Diversity for Women
MICS	Multiple Indicator Cluster Surveys
MoH	Ministry of Health

MS	Microsoft
NFNC	National Food and Nutrition Commission
OB	Open-Based recall
OR	Odds Ratio
ODK	Open Data Kit
SD	Standard Deviation
UNZA	University of Zambia
WASH	Water, Sanitation and Hygiene
WFR	Weighed Food Record
WRA	Women of Reproductive Age
WFP	World Food Programme
UN	United Nations
UNICEF	United Nations Children's Fund
USAID	United States Agency for International Development
UNZA BREC	University of Zambia Biomedical Research Ethics Committee

ABSTRACT

Dietary diversity has continued to gain widespread attention as it has evidently been associated with nutrient adequacy. A diverse diet has been shown to reflect nutrient adequacy since no one food can meet all the nutritional requirements of a person. Women have been considered vulnerable to malnutrition. This is a global concern as poor nutrition status among women of reproductive age (WRA) has an effect on their offspring. To promote dietary diversity, it is important to understand the factors associated with it. This study therefore assessed the factors associated with dietary diversity among WRA in Chongwe district of Lusaka, Zambia. The study was a cross-sectional in nature, consisting of 476 randomly selected WRA. Data was collected using a researcher administered 24-hour dietary recall questionnaire. The study was conducted between October and December 2019.

About 49% of the WRA attained the minimum dietary diversity (MDD-W). Their diets were mainly dominated by foods from the grains, white roots and tubers and plantain food group. Socioeconomic factors (owning a TV and a cellphone), being trained in Water Sanitation and Hygiene (WASH) and Infant and Young Child Feeding (IYCF) were seen to be associated with dietary diversity in this study. It was observed that being from households that had a TV set (P-value: 0.001), and being trained in WASH (P-value: 0.047) were significantly associated with the achievement of MDD-W. WRA who were from households that had a TV set were about 3 times more likely to achieve MDD-W (OR: 3.5) compared to those that were not, and those that owned a cellphone were almost two times more likely to attain MDD-W (OR: 1.70) compared to those that did not own a cellphone. Those that were trained in IYCF were more likely to attain MDD-W (OR: 1.3) compared to those that were not trained.

Strategies and intervention programs targeting the identified factors that are positively associated with MDD-W should therefore be enacted, while the existing ones should be supported and monitored particularly among the WRA. These include training in WASH and IYCF and promotion of women's socioeconomic status. These strategies/programs can be done in a range of areas including revision, adoption and enforcement of legislation that mandates women to have improved socioeconomic status. These can improve the MDD-

W of WRA through various pathways, both nutrition specific and nutrition sensitive. Other studies may be conducted to study behavior aspects of WRA towards dietary diversity.

CHAPTER ONE: INTRODUCTION

1.1 Background to the study

The poor nutritional status of women is of great concern globally, both for the health and well-being of women and their off springs. Women of reproductive age (WRA), those aged between 15 and 49 years are nutritionally vulnerable and their diets frequently fall short of needs, particularly in resource-poor settings (Martin-Prevel et al., 2018). The high prevalence of undernutrition among women could be explained partly by the burden of childbirth, poor quality of women's diets, notably their lack of diversity and social conditions in general (Adubra, Savy, Fortin, Kameli, Kodjo, Fainke, Mahamadou, Le Port, et al., 2019). Undernutrition in WRA, contributes to fetal growth retardation, which in turn increases the risk of neonatal deaths and, for those who survive, their risk of stunting is increased (Sultana et al., 2018). Regrettably, however, poor nutrition is highly prevalent among WRA in low and middle income countries (LMIC), resulting in substantial increases in mortality and overall disease burden (Desta et al., 2019). For instance, in three Asian countries: India, Bangladesh and Pakistan, it was estimated that the proportion of women suffering from chronic energy deficiency stood at about 70%, while in Africa the corresponding proportion ranged from 20% to 40% (Ahmed & Naphtali 2014).

Dietary diversity refers to an increase in the variety of foods across and within food groups capable of ensuring adequate intake of essential nutrients that can promote good health, and physical and mental development (Islam et al., 2023). As there is no single food can provide all the nutrients, the more food groups included in one's daily diet, the greater the likelihood of meeting the nutrient requirements (Custodio, Kayikatire, et al., 2020). Therefore, a diet that is sufficiently diverse may reflect nutrient adequacy (Sultana et al., 2018).

Insufficient dietary intake in WRA poses a huge burden on their overall health worldwide, especially in LMIC where institutional frameworks on agriculture, food, nutrition and health are weak and fragmented (Desta et al., 2019). In such contexts, diets are often monotonous, dominated by starchy staple foods, and unbalanced, and do not provide sufficient micronutrients. Poor nutrition before and during pregnancy and lactation

compromises the health of mothers and their infants (Geta & Gebremedhin, 2022). For these reasons, the first “1000 days” have been targeted in global efforts to improve nutrition for vulnerable groups, and there are also renewed efforts to tackle pre- and periconceptual nutrition for girls and women (Sultana et al., 2018; Islam et al., 2023).

Micronutrient deficiencies, often due to inadequate dietary diversity, constitute a widespread nutrition challenge faced by WRA, particularly those living in resource-poor settings. Apart from affecting the overall health condition of a woman, malnutrition is an intergenerational cycle that inflicts adverse consequences on the unborn child as well (Desta et al., 2019). According to Black et al (2013), maternal stunting and low body mass index (BMI) increase the risk of fetal growth restriction, obstructed labor, and maternal and neonatal death. Malnourished children have delayed cognitive development and are therefore likely to drop out of school, which results in lower economic productivity in adulthood (Custodio, Kayikatire, et al., 2020). The burden of maternal child undernutrition is high, and concentrated in poor communities of under-developed countries that are facing huge burdens of disease and low capacity of human resources (Nachvak et al., 2017).

Nutritional disorders are very frequent in WRA and are far more serious in poorer socioeconomic groups because of the prevalence of possible deficiencies. WRA, especially mothers, play vital role in selecting, preparing, and serving foods to support families (Sultana et al., 2018). Food security research indicates that during periods of reduced food supply, women reduce their own food intakes to secure the food intake of men and children (Adubra, Savy, Fortin, Kameli, Kodjo, Fainke, Mahamadou, Le Port, et al., 2019). Inadequate dietary intake in these women, coupled with infections have been implicated as triggers of malnutrition, which is a complex condition that encompasses severe undernutrition, micronutrient deficiencies, overweight, and obesity (Kiboi et al., 2017).

Zambia, like other LMIC has a myriad of challenges that affect WRA in a disproportionate manner. WRA generally have higher physiological needs which are often not met due to diets that are mainly starch based and of low nutritional value. The situational outlook of malnutrition among WRA in Zambia indicates that about 31% of non-breast feeding/non pregnant women are anaemic, while among the pregnant women, it is at 41% (CSO, MoH,

ICF et al., 2020). Fourteen percent (14%) are vitamin A-deficient (Tanumihardjo et al., 2016), while about 10% and 23% are underweight and overweight or obese respectively (CSO, MoH, ICF et al., 2020). Levels of under nutrition in the country are high and persistent, even among young children (Harris, Grütz, Masi, & Haddad, 2014).

Insufficient nutrient intakes before and during pregnancy as well as during lactation can affect both women and their infants (Kiboi et al., 2017). Child malnutrition is partly due to maternal insufficient dietary intake beginning before the child (female in this case) is born, before pregnancy, during pregnancy and during lactation (Prendergast and Humphrey, 2014). Childhood malnutrition in Zambia is high, and could partially be explained by insufficiency in the diets of WRA. Eleven percent (11%) of children are born with a low birth weight (CSO 2018). This type of malnutrition is a direct reflection of poor nutrition in WRA.

Globally, the MDD-W indicator is currently considered as the best proxy indicator for use in assessing the micronutrient adequacy of women's diets; and has been validated as a proxy indicator for micronutrient adequacy in non-pregnant WRA in low and middle-income countries. Studies have demonstrated that dietary diversity is strongly associated with nutrient adequacy. According to FAO & FHI 360 (2016), the MDD-W is defined as the consumption of at least five (5) out of ten (10) predefined food groups (FGs) over the past 24-hour period. The interpretation is that women consuming foods from five or more of the specified ten FGs have a greater likelihood of meeting micronutrient adequacy. The MDD-W is useful for advocacy, goal setting and policy formulation for programmes aimed at improving diets and nutrition (Hanley-cook et al., 2020).

1.2 Problem Statement

Micronutrient malnutrition is a widespread yet largely neglected nutrition challenge faced by WRA living in the developing world, the consequences of which affect not only the health and survival of women but also their offspring. One of the most important factors responsible for micronutrient deficiency is poor diets lacking diversity, however, accurate information on women's diets and micronutrient intake is lacking (FANTA, 2016).

Previous studies conducted in different regions of Africa have shown a high prevalence of inadequate dietary diversity among pregnant and non-pregnant WRA. A study conducted in Ethiopia recorded that 53% of the WRA had inadequate dietary diversity (Geta & Gebremedhin, 2022). In Zambia, the nutrition situation among WRA is not different from the global picture and it is similar to the statistics from many resource constrained countries. The nutrition status of WRA reflects a poor nutrition in infants and young children, which currently does not look good too, as 9% of children are born with a low birth weight, which is a direct reflection of poor maternal nutrition. Fifty eight percent (58%) of those aged 6-59 months are anaemic, 4% are wasted, 12% are underweight and 35% are stunted while 26% have vitamin A deficiency (CSO et al., 2014; CSO et al., 2018; Tanumihardjo et al., 2016).

Despite the foregoing statistics, not many studies have been conducted to determine dietary diversity among WRA in Zambia. Furthermore, no study has been conducted in Zambia to determine factors that are associated with dietary diversity among WRA. It is against this background that there arose a need to establish the dietary diversity, and the factors associated with it in WRA (15-49 years) in Chongwe district of Zambia. This study is important as there is scarcity of data on diet quality particularly focusing on WRA. For this reason, the current study was conducted to determine the dietary diversity of WRA in Chongwe district, and to identify factors associated with it. The results of this study will add to the existing body of knowledge, and will inform policy makers and other key players concerned with the nutritional status of WRA and children on what factors need to be addressed or strengthened in order to ensure adequate dietary diversity among WRA.

1.3 Justification/Rationale of the study

Dietary diversification has been recommended as one of the best strategies to ensure adequate nutrient intake. It is particularly highly recommended among women as their nutrient intake can have implications on maternal outcomes and as such can perpetuate undernutrition in the lifecycle (Sultana et al., 2018). According to the FAO and FHI (2016), the more food groups included in a person's daily diet, the greater the likelihood of meeting nutrient requirements. Additionally, many studies have demonstrated that dietary diversity

is indeed associated with nutrient adequacy (Hanley-cook et al., 2020; Custodio et al., 2020).

Multiple micronutrient deficiencies remain a major public health concern among WRA, especially those living in low-income and middle-income countries (Desta et al., 2019). The proportion of WRA who reach the minimum dietary diversity in a population can be used as a proxy indicator for higher likelihood of meeting micronutrient adequacy, one important dimension of diet quality (Hanley-cook et al., 2020). According to Morseth et al (2017), adequate nutrient intake necessary for good nutrition among WRA has often been associated with food variety and diet quality of individuals.

The MDD-W indicator has been used to explore linkages between diet and coronary artery disease (Fung et al.,2018), pregnancy-related outcomes (Saaka et al., 2017; Osman et al., 2016), and child growth (Huang et al, 2018), but also to develop new metrics for food biodiversity in diets (25). In Bangladesh, it is now being used for program evaluation, and its applicability to pregnant adolescent girls and women has also been tested (Nguyen et al., 2018). Despite its use as a measure of micronutrient adequacy, very little is known about MDD-W and it's relation to socioeconomic and sociodemographic dimensions (Custodio, Kayikatire, et al., 2020). There is a wide range of policy and programmatic interventions and programs now aiming to improve diets and nutrition of WRA. At the same time, quantitative dietary data remains inadequate for many countries. With the aim of contributing to this emerging literature, data collected by way of the current study will help determine the dietary diversity of WRA in Chongwe district, and identify the factors that it is associated with. The information obtained from this study adds to the existing body of scientific knowledge on the factors associated with dietary diversity in WRA. The study determined the dietary diversity among WRA and demonstrates how dietary diversity among WRA is associated with the socioeconomic and sociodemographic factors. The findings will inform government departments, policy makers, the traditional leadership, development practitioners and other stakeholders involved to make informed decisions on formulation of new policies, and support needed towards existing ones, targeting the variables that have a strong association with dietary diversity. The results will direct focus of community interventions, towards viable interventions that play a key role in the

enhancement of dietary diversity among WRA. Additionally, data from this study will be used for program evaluation including gathering accurate and comparable data on women's diet quality at the subnational level, making it possible to target at-risk populations, track progress, and measure the impact of programs and policies. The study also paves way for further research in determining the impact of dietary diversity on maternal outcomes.

1.4 Purpose of the study

The main purpose of the study was to establish factors associated with dietary diversity in women of reproductive age in Chongwe district of Zambia.

Specific objectives

The specific objectives of the study were:

1. To determine the prevalence of minimum dietary diversity of women of reproductive age in Chongwe district of Zambia
2. To determine the associations between sociodemographic/ socioeconomic characteristics and dietary diversity among women of reproductive age in Chongwe district
3. To establish the predictors of dietary diversity in women of reproductive age in Chongwe district of Zambia

1.5 Hypothesis

H₀₁: There is no association between the socioeconomic status/ sociodemographic characteristics and dietary diversity of women of reproductive age in Chongwe district of Zambia.

1.6 Significance of the study

The study determined dietary diversity among WRA in Chongwe district of Zambia, and established the factors that are associated with it. The results of this study will enable all the key players involved in the nutrition and general wellbeing of women to have tailor-made interventions aimed at ensuring that women meet the MDD. This will ultimately help in the improvement of the nutrition situation of WRA in Chongwe district. To promote

dietary diversity, it is important to understand the factors associated with it. This study assessed the determinants of dietary diversity among WRA in Chongwe district of Lusaka, Zambia. Furthermore, data from this study will inform the need for collaboration among line ministries to ensure the implementation of both nutrition specific interventions (at an individual level) and nutrition sensitive interventions in the fight against all forms of malnutrition among WRA as there is ample evidence that dietary diversity is indeed strongly associated with nutrient adequacy and hence malnutrition. The data will inform policy direction and help stake holders determine the areas in which to channel more financial and human resources. The results from this study generated evidence that can be used for new policies and intervention programmes targeting the factors associated with dietary diversity. The results can also be used for monitoring and evaluation of existing policies and programmes being implemented particularly among the vulnerable populations. Such policies and programmes among WRA will ensure improved dietary diversity and adequate nutrient intake.

1.7 Assumptions

1. The study assumed that women in the study population would be truthful about their health status as well as pregnancy condition.
2. The study assumed that the dietary intake reported on the day of the data collection was not influenced by the presence of the enumerator.
4. It was assumed that all the women consumed food the previous day.

1.8 Limitations

1. The cross-sectional nature of the made it impossible to draw conclusions regarding causality in the relations we found. Longitudinal studies are needed to not only identify temporal sequence of exposure and outcome but also study changes in MDD-W prevalence over time.
2. Data collected on food consumed the previous day was based on what the respondent could remember. This posed a risk of either under reporting or over reporting their consumption and as such had the potential to affect the results of the study.

3. Seasonality may affect dietary diversity. However, this aspect was not taken care of in the current study as it was cross sectional in nature and data was just collected at one point in time.

1.9 Conceptual Framework

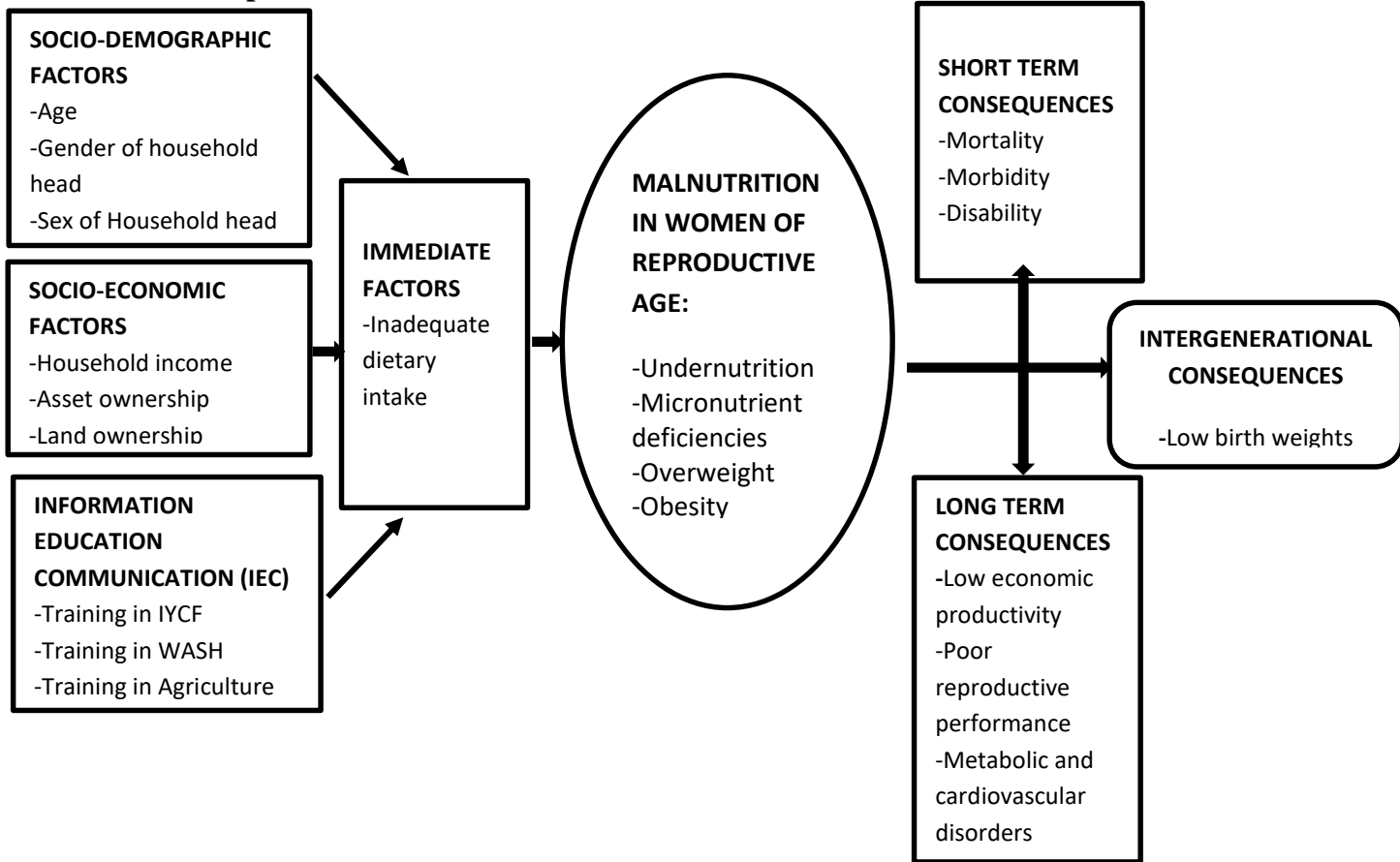


Figure 1: Conceptual framework depicting the various factors associated with dietary diversity

Source: Adapted from Ezeama, Okunna, Ezeama (2022)

CHAPTER TWO: LITERATURE REVIEW

2.1 Overview of Minimum Dietary Diversity

Dietary diversity refers to an increase in the variety of foods across and within food groups capable of ensuring adequate intake of essential nutrients that can promote good health, and physical and mental development (Hanley-cook et al., 2020). As no single food contains all necessary nutrients, diversity in dietary sources is needed to ensure a balanced and healthy diet. It is well documented that in developed countries, dietary diversity at different ages, and represented by different types of scores, is strongly associated with nutrient adequacy and is thus an essential element of diet quality (Girma et al., 2015). There is less evidence showing such associations in developing countries, but the few studies that are available also provide support for the assumption that dietary diversity is a good proxy of the nutrient adequacy of the diet in poor countries (Custodio, Kayikatire, et al., 2020).

Lack of diversity is a particularly severe problem among poor populations in the developing world. The vulnerability is critical in children and pregnant and lactating mothers because they require additional energy and nutritious foods for their physiological and mental development. This lack of diversity mostly translates into micronutrient deficiency. Micronutrient malnutrition is a challenge for WRA, who are particularly vulnerable due to greater micronutrient needs. The MDD-W indicator is a micronutrient adequacy's proxy for those women, but little is known about its relation to other dimensions (Custodio et al., 2020).

Guidelines for measuring women's dietary diversity based on the recommended 10-point food group indicator (MDD-W) were published only recently (Hanley-cook et al., 2020). The MDD-W indicator defined and described in the introduction, is a food group diversity indicator that has been shown to reflect one key dimension of diet quality: micronutrient adequacy (Martin-Prével et al., 2015). Since diet quality is multidimensional, determining dietary diversity is a positive step towards packaging nutrition promotion interventions. Promotion of diverse diets is one of the several approaches to improving micronutrient nutrition for WRA. In addition to micronutrient adequacy, high-quality diets are characterized by balance in intake of protein, carbohydrates and fat (Desta et al., 2019) and

moderation in consumption of certain foods; those low in nutrient density and those associated with increased risks for chronic disease (George et al., 2014).

2.2 Definition and measurement of dietary diversity for women of reproductive age

Dietary diversity can be defined as the number of different foods or food groups that are consumed over a specific reference period (Adubra, Savy, Fortin, Kameli, Kodjo, Fainke, Mahamadou, Le Port, et al., 2019). It can be measured at the household or individual level through observation or the use of a questionnaire. It is often measured by counting the number of food groups and not the food items consumed. The type and number of food groups included in the questionnaire and subsequent analysis may vary depending on the intended purpose and level of measurement. At the household level, dietary diversity is usually considered a measure of access to food, while at the individual level it is an indicator of dietary quality, mainly the micronutrient adequacy of the diet (Hanley-cook et al., 2020). The reference period can vary, but is most often the previous day or week (FAO, 2016).

Some studies have reported MDD-W prevalence values. One of them is a study conducted in the region of Timbuktu in Mali that reported an 8% prevalence of women reaching the MDD-W (Adubra, Savy, Fortin, Kameli, Kodjo, Fainke, Mahamadou, Port, et al., 2019). According to a study conducted in northwest Ethiopia by Girma et al., (2015), only 16.2 % of the study participants had adequate dietary diversity. This compares to the results of a study conducted in Bangladesh which found the mean dietary diversity among WRA to be 2 (Sultana et al., 2018). In a study conducted in Burkina Faso, the mean dietary diversity of WRA was found to be 3.8 food groups (Custodio, Kayikatire, et al., 2020). In a study conducted in rural Mali, only 27% of women reached the MDD-W (Adubra, Savy, Fortin, Kameli, Kodjo, Fainke, Mahamadou, Le Port, et al., 2019).

Studies have shown that there are many factors associated with dietary diversity among women. Although associations between food insecurity and women's dietary diversity are documented in the literature (Weigel et al., 2016), only few studies have examined these associations using the MDD-W. These associations will be discussed in this chapter.

2.3 Social demographic factors

A study conducted in Ethiopia found that the mean age for participants (WRA) was 28.56 ± 0.13 years. Most households comprised of 4-8 people, with the majority (60%) being headed by males (Adubra et al., 2019). In a similar multi country study conducted in Zambia, Cambodia and Ethiopia, the mean age range of the respondents was found to be 36 ± 8 years in Cambodia, while in Zambia it was found to be 29 ± 9 years in Zambia (Adubra et al., 2019). A cross-sectional study conducted in Bangladesh found that the mean age of the respondent WRA was 27.45 ± 9.38 years (Sultana et al., 2018).

Ausen et al., 2015 found that older adults in Botswana consume a low variety of food, with inadequate dairy products, fruits, and vegetables (35.2%, 59.3%, and 22.4% respectively). Another cross-sectional study among elderly respondents in Sharpeville township in Guateng province of South Africa found that married people tend to consume a greater variety of food, perhaps because responsibility for other family members leads to a wider variety of dietary items in the household

2.4 Factors associated with dietary diversity

Socioeconomic status is one of the major determinant of dietary in many countries, and studies have indicated that high socioeconomic status may be associated with overall healthier dietary patterns, diet quality and diversity in low- and middle income countries as well (Morseth et al., 2017). In a review based on data from 33 LMICs, high social economic status and living in urban areas were associated with beneficial dietary patterns such as higher intakes of protein; unsaturated fat; iron; and vitamins A and C, but also increased intake of saturated fat and cholesterol and low intake of fiber (Kiboi et al., 2017).

2.4.1 Level of education

Education level can lead to improved outcomes directly or indirectly through educational benefits, such as increased wealth and earnings. Potential pathways for the impact of education on dietary diversity can be connected to improved access to information, literacy, use of prenatal care, asset wealth, residence location, and intra-household competition for food resources among others (Makate & Nyamuranga, 2023). Studies have been conducted in which researchers have determined factors that are associated with dietary diversity in different settings. Among the identified factors, education level is one of them. Education

has been found to be positively correlated to high dietary diversity. That is, the more educated households are, the more likely they are to attain a high dietary diversity (Nachvak et al., 2017). A study conducted in Ethiopia established that educational level was the strongest predictor of adequate dietary diversity. It was revealed that increasing the level of maternal education was significantly associated with adequate dietary diversity compared to those mothers who had no formal education (Sultana et al., 2018). Similar results were found in a study conducted in Laikipia county of Kenya, which found educational level to be significantly associated ($p < 0.001$) with dietary diversity (Kiboi et al., 2017). Another cross-sectional study conducted in Central Ethiopia revealed that women who had tertiary education (AOR 3.18; 95% CI: 1.8, 6.35) and secondary education (AOR 2.13; 95% CI: 2.32, 8.72) had three times and two times more likely to achieve the adequate dietary diversity, respectively, in comparison to those who had no formal education (Desta et al., 2019). There is need to clearly understand the relationship between education and dietary diversity among young women for purposes of health policy and planning, particularly given growing burden of non-communicable diseases.

2.4.2 Household income

Household wealth is an important predictor of the MDD-W, with an increase in the likelihood of reaching a minimum dietary diversity as households had a better economic status (Usman, 2021). Even without measuring the household food expenditure, the hypothesis is that women in wealthier households benefit from higher income, enabling them to diversify their diet through the purchase of varied foods for consumption (Adubra, Savy, Fortin, Kameli, Kodjo, Fainke, Mahamadou, Le Port, et al., 2019). A study in Central Ethiopia revealed that as the household income increased, the chances of consuming adequate dietary diversity also increased (Sultana et al., 2018). Another study conducted in Ethiopia revealed that as the household income increased, the chances of consuming adequate dietary diversity also increased (Desta et al., 2019). In a study in Burkina Faso, a multi-stage cluster sampling method was used to conduct a study to determine the minimum dietary diversity of WRA. The results revealed that in two of the four clusters, the likelihood of reaching MDD-W increased significantly with higher socioeconomic score (Custodio, Kayikatire, et al., 2020). In a multivariate linear regression analysis of the factors associated with MDD-W, results from a cross sectional study in rural Mali revealed

that household income was significantly associated ($p < 0.001$) with dietary diversity (Adubra, Savy, Fortin, Kameli, Kodjo, Fainke, Mahamadou, Le Port, et al., 2019).

2.4.3 Land ownership and dietary diversity

The nature and security of women's rights to land, trees and other natural resources and their products are critical to ensuring household food security and dietary diversity. Gender differences in the types and relative sizes of productive assets and control of income are critical for food security as evidence from many studies shows that women are more likely to spend their income (from their own production or wage labor) on food, healthcare and education of their children (Meinzen-Dick et al., 2014). A cross-sectional study in Kenya found that land ownership was significantly associated with dietary diversity ($p = 0.040$). Those who reported not owning any piece of land were 0.64 times less likely to attain the minimum diversity as compared to those who reported owning a piece of land (Kiboi et al., 2017).

2.4.4 Women's empowerment

Women empowerment is one of the important pathways to improved diets and nutrition. Women empowerment has an influence on dietary diversity through several ways (Murendo et al., 2018). Empowered women can efficiently allocate their time for child feeding and caring, agricultural work, and household chores so as to improve dietary diversity and nutrition. Women's empowerment impacts dietary diversity through many clear pathways. It is positively and significantly related to the dietary diversity of both children and WRA (Komakech et al., 2019). The positive effects of empowering women are multi-dimensional: her livelihood and nutrition status are improved, as well as those she provides care to. According to Custodio, Thomas, et al., 2020, providing other enablers of improved nutrition may not have sustainable impacts on MDD-W if such actions are not accompanied by women empowerment. A study conducted in Kenya found that women's empowerment was associated with the attainment of MDD-W (Gitagia et al., 2019). The results of a cross-sectional study in Ethiopia revealed that women who had higher monthly income were more likely to have adequate dietary diversity than their counterparts who had lower monthly income (Desta et al., 2019).

2.4.5 Water access

Many studies have focused on the social determinants of dietary diversity, such as educational level, maternal empowerment, and household wealth status. Environmental factors have, however, received little attention (Yaqing Gao, Jie Sheng, Xiaoyi Mi, Mo Zhou, 2022). Access to sufficient and safe water, one of the Sustainable Development Goals (UN,2016), has been found to be consistently associated with a diversified diet. Access to water plays a multifaceted role in improving dietary diversity by supporting agricultural production, hydration, food preparation, nutrient absorption, sanitation, and the production of animal-sourced foods. Ensuring reliable access to clean water is essential for promoting healthier and more diverse diets, particularly in communities where access to food and water resources may be limited(Yaqing Gao, Jie Sheng, Xiaoyi Mi, Mo Zhou, 2022). Better water access has been associated with a higher likelihood of having food that requires a large amount of water for production and preparation, such as fish, fruits, and vegetables in households, which may in turn affect dietary diversity (Hess & Sutcliffe 2018). However, there have been few studies that examined the association between household water access and dietary diversity. A study conducted in India showed that improved water consumption was associated with the consumption of more food groups (Choudhary et al.,2021). Another cross sectional study conducted in china found that unimproved water access was linked to a lower likelihood of achieving dietary diversity (OR = 0.65, 95% CI 0.44 to 0.98, p = 0.039)(Yaqing Gao, Jie Sheng, Xiaoyi Mi, Mo Zhou, 2022). These findings suggest that there is an association between access to water and MDD-W.

2.4.6 Training in nutrition and nutrition related short courses

The potential for low dietary diversity is compounded by a lack of knowledge and information on essential nutrition among WRA. A higher level of nutritional knowledge has been positively and significantly associated with better dietary quality (Murendo et al., 2018). The nutritional messages, information and counseling provided to WRA (regarding their diets and the types of food to be consumed) improved the percentage of mothers who reached adequate micronutrient intake in comparison to those who were not provided these resources. (Ahmed & Salih, 2019). In a study conducted by Getacher et al., 2020, good knowledge of nutrition among WRA predicted the minimum dietary diversity score of

WRA in Ethiopia. WRA who scored above the mean cut off point upon responding to nutrition and food diversity knowledge questions were more than five times more likely to achieve a higher MDD score compared to their counterparts. In other similar studies conducted in three countries (Bangladesh, Vietnam, and Ethiopia) and Uganda, the results were similar; knowledge in nutrition increased the likelihood of attaining MDD-W (Georgina Gómez, Ágatha Nogueira Previdelli et al., 2020). This association maybe because WRA who have increased knowledge about nutrition may know the importance of varieties of foods and have a greater likelihood of taking these varieties of food groups (Getacher et al., 2020).

2.5 Conclusion of literature review

The reviewed literature shows that major factors associated with MDD-W include wider contextual factors such as level of education, household income, land ownership, women's empowerment, access to water, socioeconomic status and knowledge in nutrition. Other studies have identified cultural beliefs, agricultural practices, poverty, and food security to be associated with MDD-W. Inadequate dietary diversity has both short-term consequences, such as mortality, morbidity, and disability, and long-term consequences, such as stunting, impaired cognitive ability, poor economic productivity, poor reproductive performance, increased metabolic and cardiovascular diseases, and intergenerational consequences. Hence, the consequences of micronutrient malnutrition affect not only the health and survival of women but also their children. It is thus important that factors associated with dietary diversity be identified.

CHAPTER THREE: METHODOLOGY

3.1 Research design

A cross sectional study design was utilized to collect data that was used to determine the dietary diversity of WRA and factors associated with it. A cross sectional study design was appropriate for this study because it is quick and relatively inexpensive, allowing the researcher to collect data on many different variables at the same time. This study design was the best way to study associations of multiple exposures (factors) and minimum dietary diversity for WRA.

3.2 Study site

The study was conducted in Chongwe district. Chongwe is one of the six districts of Lusaka Province in Zambia. It is located about 43 kilometers on the eastern side of Lusaka city. Chongwe district is divided into 19 wards with a total population of 313,389 people (ZAMSTATS, 2022). The wards include Chalimbana, Chainda, Chongwe Central, Manyika, Kapwayambale, Chinkuli, Ntandabale, Mwalumina, Lukoshi, Nakatindi, Lwiimba, Kanakantapa, Ngwerere and Kapete. Of these wards, Chalimbana, Chainda and Kanakantapa were randomly selected and included in the study. Two villages were then randomly selected from each of these three wards. The political administration of the district is under the district council and the office of the District Commissioner (DC), assisted by traditional authorities who operate alongside the state administrative structures. Under the customary administrative arrangements, there are four chiefdoms in Chongwe district: Nkomeshya (where the study was conducted), Bunda Bunda, Shikabeta and Mpansha. Except for a few scattered urban settlements, Chongwe district is largely a rural agricultural area dominated by smallholder rain-fed crop farmers (Chitonge, 2017). The region has a tropical climate with three distinct seasons, cool and dry season (April–August), hot and dry season (September–November) and the hot and wet (December–March) (Chidumayo, 2015). The two major livelihood activities for most households in the area are small-scale rain-fed crop and livestock production, with all of the small-scale farmers depending on customary land. The main staple crop that is grown is maize. The residents of Chongwe also grow annual cash crops such as groundnuts, cotton and beans. Vegetables produced in the region include rape (kale), cabbage, tomatoes, cucumber,

eggplant and onions. Some of the vegetable production is done in seasonally waterlogged wetlands found in the region. The most common animals reared include cattle, chickens and goats (Kuntashula and Mungatana, 2015). While most residents of Chongwe practice mixed farming, a few of them have ventured into aquaculture in the recent past. Some households in Chongwe district supplement their diets with food products from nearby forests. These foods include wild mushrooms, edible insects (caterpillar, termites (inswa), wild fruits (e.g. malolo) and wild birds (Chama, Marinda, Kumwenda, 2020).

3.3 Study population

The target population for the study were non-pregnant WRA. Non-pregnant and non-lactating women were targeted because information on their dietary intake would be more representative of WRA in general. Recruiting pregnant and /or lactating women was going to get data that did not represent the dietary patterns of the WRA in general because of the many factors that affect dietary intake during pregnancy and lactation, which include food aversions and pica among others. All of the women that participated in the study met the inclusion criteria described in section 3.4 below. Overall, literacy rates among women in Chongwe district are low. Majority of women do not engage in formal employment. They engage in small scale farming and small businesses for their livelihood.

3.4 Eligibility criteria

3.4.1 Inclusion criteria

To be enrolled in the study, the women had to meet the following inclusion criteria:

- Women of Reproductive Age (15-49 years)
- Non-pregnant and non-lactating
- Voluntarily agree to participate in the research after being fully informed of the research process.

3.4.2 Exclusion criteria

Women with the following characteristics were excluded from the study:

- Women following a specific diet due to a medical condition or personal/religious beliefs were excluded from the study;

- Pregnant and lactating women;
- WRA who did not consent to the study;
- WRA that were sick on the day of the assessment.

3.5 Sampling Technique and Procedure

Simple random sampling procedure was applied in the study. First, a list of all WRA in the randomly selected wards was developed with the help of village headmen and community health workers and volunteers following the eligibility criteria. The sampling frame comprised of 950 WRA from 520 households. Some household had more than one woman who met the eligibility criteria. In such cases, only one eligible woman who usually prepared food from this household was included in the sample. It was made clear to the volunteers that during recruitment, only women who were non-pregnant and non-lactating were to be included. This was further checked by the enumerators during data collection.

Three wards, Chalimabana, Chainda and Kanakantapa were randomly selected to participate in the study. Six villages namely Chishiko, Munkankaulwa, Ndjovu, Mubula section, Mulundu 1, Ndangu and Kanakantapa participated in the study. Simple random sampling was used to arrive at the 476 women. Participants were distributed as follows; 138 from Chishiko village, 20 from Mukankaulwa, 55 from Mukunya, 68 from Njovu, 96 from Ndango, 60 from Mubula section and 39 from Mulundu 1. A replacement list of WRA was drawn from the sampling frame and made available at the start of the study in case of drop-outs. This was to be used in case any of the selected WRA declined to participate in the study for any reason. Figure 2 shows how the study sample was arrived at.

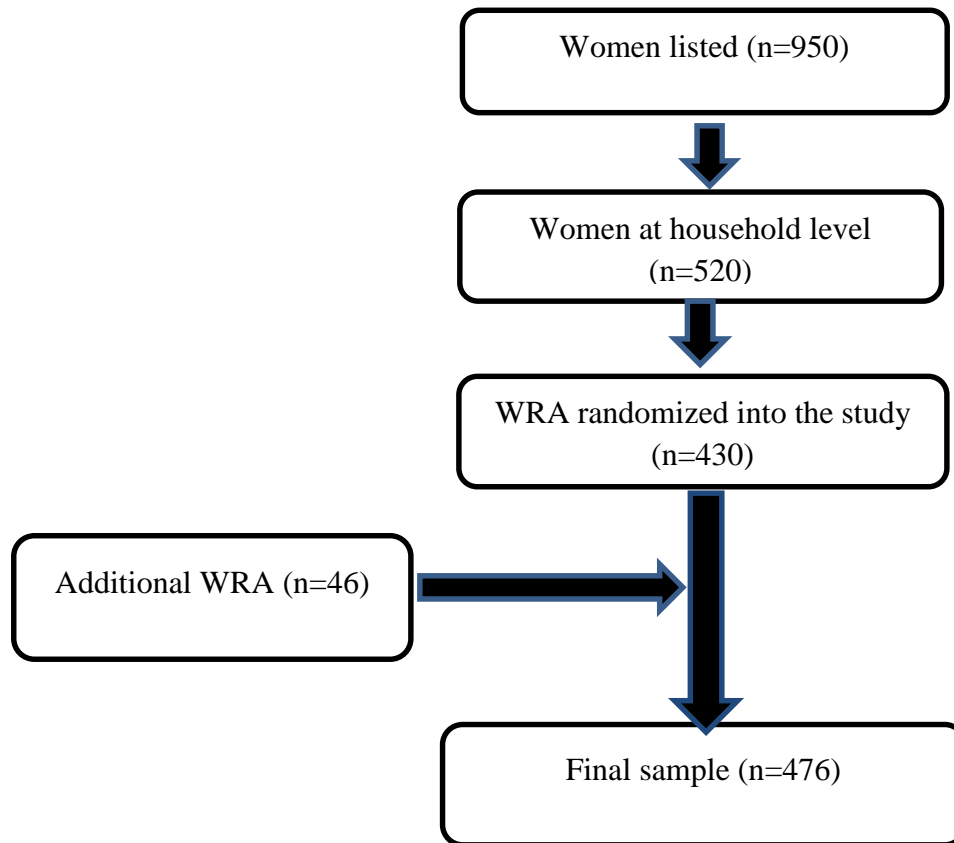


Figure 2: Flow diagram of participant enrolment and inclusion in the MDD-W study

3.6 Sample Size Determination

The sample size of the study was determined using the PASS sample size computer software version 16. The sample-size computations (PASS Sample Size Software 16) indicated that with power $(1-\beta)$ 0.90, α (significance level) 0.05, standard proportion (women reaching MMD-W according to GIZ data), 0.568 (Zambia) and the nuisance parameter (% disagree) 0.10 the sample-size was $n=374$ WRA. By including a 0.15 dropout rate, the final sample size was 430 WRA. However, the drop rate was adjusted to 0.28, a figure that was arrived at based on the pilot study findings as a results of high drop-out rate. With this drop-out rate, the study sample size then came to $n=476$.

3.7 Study Variables and measurements

3.7.1 Dependent Variables

The dependent variable of the study was the minimum dietary diversity. Dietary diversity was coded as 1 for those meeting the minimum dietary diversity and 0 for those not achieving minimum dietary diversity.

Dietary diversity is the number of food groups consumed by WRA out of the ten (10) food groups. These food groups include starchy staples, vitamin A-rich vegetables and fruits; dark green leafy vegetables; other vegetables; other fruits; meat, poultry, and fish; eggs and pulses/legumes; nuts and seeds; and dairy products. Minimum dietary diversity is consumption of five or more food groups of the ten food groups (FAO 2010) used in this study. A list and description of the food groups can be found on Annex 2 of this report. Adequate dietary diversity represents those women meeting the minimum dietary diversity.

3.7.2 Independent Variables

The independent variables were household income, age of house hold head, educational level of household head, educational level of the WRA, household size, parity of WRA, sex of house hold head, training in maternal adolescent infant and young child nutrition (MAIYCN) or not, training in agriculture or not, training in Water Sanitation and Hygiene (WASH) or not, any training received, ownership of basic assets (TV and cell phone), market access (distance to the nearest market), access to health facility (distance to the nearest health facility), distance from urban area, distance from major road, and proximity from water body (distance from river/stream).

3.8 Data Collection Tools and Procedures

The data for this study was collected using a researcher administered semi-structured questionnaire (24-hour recall) specific to the scope of the study objectives. The questionnaire was administered using tablets.

3.8.1 Questionnaire

A semi-structured, researcher administered questionnaire (open based 24-hour recall) was used to collect quantitative data (see Annex 1). The questionnaire comprised both open and

closed ended questions. It was administered to the participating WRA. The WRA were the primary respondents and so they provided the information required. The questionnaire was developed in English and later translated into Nyanja, the local language that is commonly spoken in Chongwe, the study site. It was first developed in MS-word, and afterwards, the contents on the MS-word format questionnaire was changed to the XLS format. The sub-sections of the questionnaire on socio-economic characteristics, and open recall were adapted from the global questionnaire that had been earlier developed by the global research team in consultation with country partners. This questionnaire was then adapted to fit the local context. Some of the adaptations included inclusion of locally consumed food in Zambia, inclusion of variable for wards and villages, among others.

The questionnaire comprised the following sub-sections:

3.8.1.1 Demographic and socio-economic characteristics

Demographic and socio-economic data that was collected included, age of household head, age of the WRA, educational level of household head, educational level of the WRA, household size, parity of WRA, marital status, employment status, residence area, religious affiliation, household income level, type of household, access to water, and access to nutrition training.

3.8.1.2. Dietary diversity data

An open 24-hour recall method was utilized to collect dietary data. Dietary diversity for women was measured using the 10 food groups (FAO, 2010) indicated below:

1. Grains, white roots and tubers, and plantains
2. Pulses (beans, peas and lentils)
3. Nuts and seeds
4. Dairy
5. Meat, poultry and fish
6. Eggs
7. Dark green leafy vegetables
8. Other vitamin A-rich fruits and vegetables

9. Other vegetables
10. Other fruits

The above listed food groups have been described and examples of food falling under each of the food groups have been listed in Annex 2 of this report.

3.8.2 Pre-testing

The data collection tool was pre-tested in Lusaka's Kalingalinga township. The pre-testing was conducted over a period of two days on 24th and 25th August 2019. This was done to ensure validity and reliability of the data collection tools. Research assistants (enumerators) were recruited and oriented before pre-testing the data collection tool. A few enumerators practiced conducting dietary assessment using the open-based 24-hour recall method, with the aim of them familiarizing themselves with the questions and also getting a chance to practice the interviewing technique.

After the pre-testing exercise, the research team discussed methodological and logistical issues that arose during the pretesting exercise that needed to be addressed. The team used this exercise as an opportunity to refine the questionnaire. Some issues raised included clarity of questions, probing techniques when conducting the open recall, reliance on the woman to self-report if she was pregnant or lactating before proceeding with the interview, and how to do further follow-up on food used in mixed dishes.

3.8.3 Data collection procedure

Using a qualitative open-based 24-hour recall questionnaire, the enumerator asked the respondent to describe everything she ate or drank at home or anywhere else the previous day and night. A series of standard probing questions were used by the enumerator to help the respondent recall all foods and beverages consumed. Main ingredients used for composite dishes were also probed and taken note of. In this method the enumerator did not read predefined foods/groups to the respondent hence the notation "open-based". However, for ease of entry of generated information, the enumerator would start by probing whether the respondent consumed any foods at breakfast, followed by mid-morning snack, lunch, afternoon snack, dinner and after dinner snack in that order. At the end the enumerator would then ask if the respondent also consumed anything else other than that

already listed. As the respondent mentioned the foods, the enumerator would list these foods in the spaces provided in the questionnaire on the tablet. Afterwards, the enumerator would then classify the listed foods from the interview into the appropriate MDD-W food groups.

Other information collected during probing was the method of preparation of food items and with this, the enumerator was able to probe further on other ingredients used to prepare the dishes mentioned. During the interview, the enumerator would probe for quantities of ingredients used and using household measures (spoons, cups, etc.) estimate amounts would be determined. Although information on quantities was not recorded, this information was needed to enable the enumerator to determine whether the 15g threshold had been reached. This was particularly for ingredients that are used in small quantities; and also given that at household level, food for all household members is cooked in large quantities, and some ingredients may be added only in small amounts. The enumerator would then determine the quantity of specific ingredients (e.g. tomatoes, onions, carrots, green pepper, etc.) consumed by the respondent especially for foods drawn from a “family pot”. This would provide an estimate of what the respondent consumed and hence determine whether they met the 15g threshold for that food group or not.

3.9 Data Analysis

The data was subjected to the Shapiro Wilk normality test. The Shapiro-Wilk test is a normality test which is based on the correlation between the data and the corresponding normal scores and provides better power than the Kolmogorov-Smirnov test (Heumann & Schomaker, 2016). These tests were done in STATA and aided in determining which statistical test to use to analyze the data.

Data was analyzed using Stata version 15 (StataCorp, 2015) Software. Descriptive statistics such as means, medians, standard deviations, percentages and frequencies were calculated for ordinal and continuous variables and were used to describe the study population demographic and socioeconomic data and other characteristics such as training in MIYCF, WASH, food preparation and irrigation. To determine minimum dietary diversity for

women, the total number of food groups consumed over a 24-hour period were added and dietary diversity determined.

The dietary diversity score variable was dichotomized as category 1 for those WRA meeting the minimum diversity (consumed at least five out of ten defined food groups the previous day or night) and 0 for those not meeting the minimum dietary diversity. The analyses were based on the recommended ten food groups for determining MDD-W. To determine factors associated with dietary diversity for WRA, univariate and multivariate logistic regressions were carried out. A univariate analysis was performed in order to determine the strength of association between MDD and the independent variables. All variables both significant and not significant were entered into a weighted logistic regression analysis in order to control for confounders. Variables with a p-value < 0.05 were used as statistically significant factors.

In the best fit model, all variables that were found to be significant in the multivariate analysis at p-value < 0.05 were entered in order to ultimately come up with the factors associated with meeting MDD-W.

3.10 Ethical Considerations

Ethical approval was obtained from the University of Zambia Biomedical Research Ethics Committee (UNZABREC). Approval reference Ref. No 304-2019. Permission to conduct the study was sought from the District offices in Chongwe. These offices included the District Commissioners office, District Agricultural Office and the District Health office. Further permission was sought from the local authority in Chongwe, Senior Chieftainess Nkomeshya Mukamambo II of Nkomeshya Chiefdom in Chongwe District. Meetings were held with community leaders, men and WRA to explain the purpose of the study. Informed consent was obtained from the respondents. Before commencement of the study the enumerators explained to each respondent the purpose of the study and that participation in the study was on voluntary basis. The information on consent was read out to all respondents and verbal consent was obtained from those who agreed to participate. A template of the consent form is provided in the annex.

Prior informed consent was obtained by the interviewer from the WRA, who are the primary respondents in the study. Interviewers signed their initials to confirm they had obtained consent at the start of the interview. No respondent was forced to participate by a family member or a village leader or anyone.

CHAPTER FOUR: RESULTS

4.1 Sociodemographic characteristic

The study was conducted between 21st October and 14th December 2019. Four hundred and seventy-six (476) WRA participated in the study. The sociodemographic characteristics of the participants are presented in Table 4.1. For the women, the sociodemographic factors included age, educational level, occupation, religion, and marital status. For the household, factors included the sex of the head of household and the size of the household.

The mean age of the study participants was 28.8 ± 9.1 years. Sixty-one percent (292/476) of the study participants were married, and forty-seven percent (223/476) had attained primary level of education. The sampled households were mostly headed by men (72.5%). Almost all of the respondents were Christians (98%). In terms of occupation, 35% of the study participants were housewives, 17% were farmers and 17% were traders. Majority of WRA reported to have been trained on maternal nutrition (81.9%) as well as in water, sanitation and hygiene (78.1%). Table 4.1 has the details.

Table 4.1: Socio-demographic characteristics of the study participants (n=476) *

Variable		n=476	Percent (%)
Age (years)	(years)	No or mean \pm SD	
	15-24	191	40.1
	25-34	143	30.0
	35-44	109	22.9
	45-49	33	6.9
	Mean age \pm SD	28.8 \pm 9.1	
Religion	Christian	467	98
	Muslim	1	0.2
	African	5	1.05
	Others	3	0.6
Marital status	Widowed	14	2.9
	Married	292	61.3
	Unmarried	170	35.8
Education level	No formal education	32	6.7
	Primary	223	46.9
	Secondary	214	44.6
	Tertiary	9	1.9
Occupation	Trader	79	16.6
	Housewife	165	34.7
	Student	54	11.3
	Farmer	81	17.0
	Daily labourer	46	9.7
	Others	51	10.7
Household size	1-5	252	52.9
	6-10	202	42.4
	11-15	20	4.2
	>15	2	0.4
Household head	Mother/woman	131	27.5
	Father/man	345	72.5
Training	Maternal nutrition	390	81.9
	Water, sanitation and hygiene	372	78.1
	Food preparation and cooking demonstrations	131	27.5%

*Values are presented as number of subjects (percentage) or mean \pm SD

4.2 Proportion of WRA consuming from each of the ten (10) MDD-W food groups

Results for the proportion of women consuming food items from each of the ten MDD-W food groups are graphically presented in Figure 3. The results show that the most consumed foods were those of grains roots and tubers food group. All women (100%) consumed foods from the grains, white roots and tubers and plantain group. The next most widely consumed foods were from the other vegetables (96%) followed by foods from the dark green leafy vegetables (72%). Foods from the nuts and seeds, and dairy groups were the least consumed. Ten percent (10%) of the WRA consumed food from the nuts and seeds group, while six percent (6%) consumed from the dairy food group. The proportions of WRA consuming foods from the rest of the food groups ranged between thirty-five percent (35%) and forty-seven percent (47%).

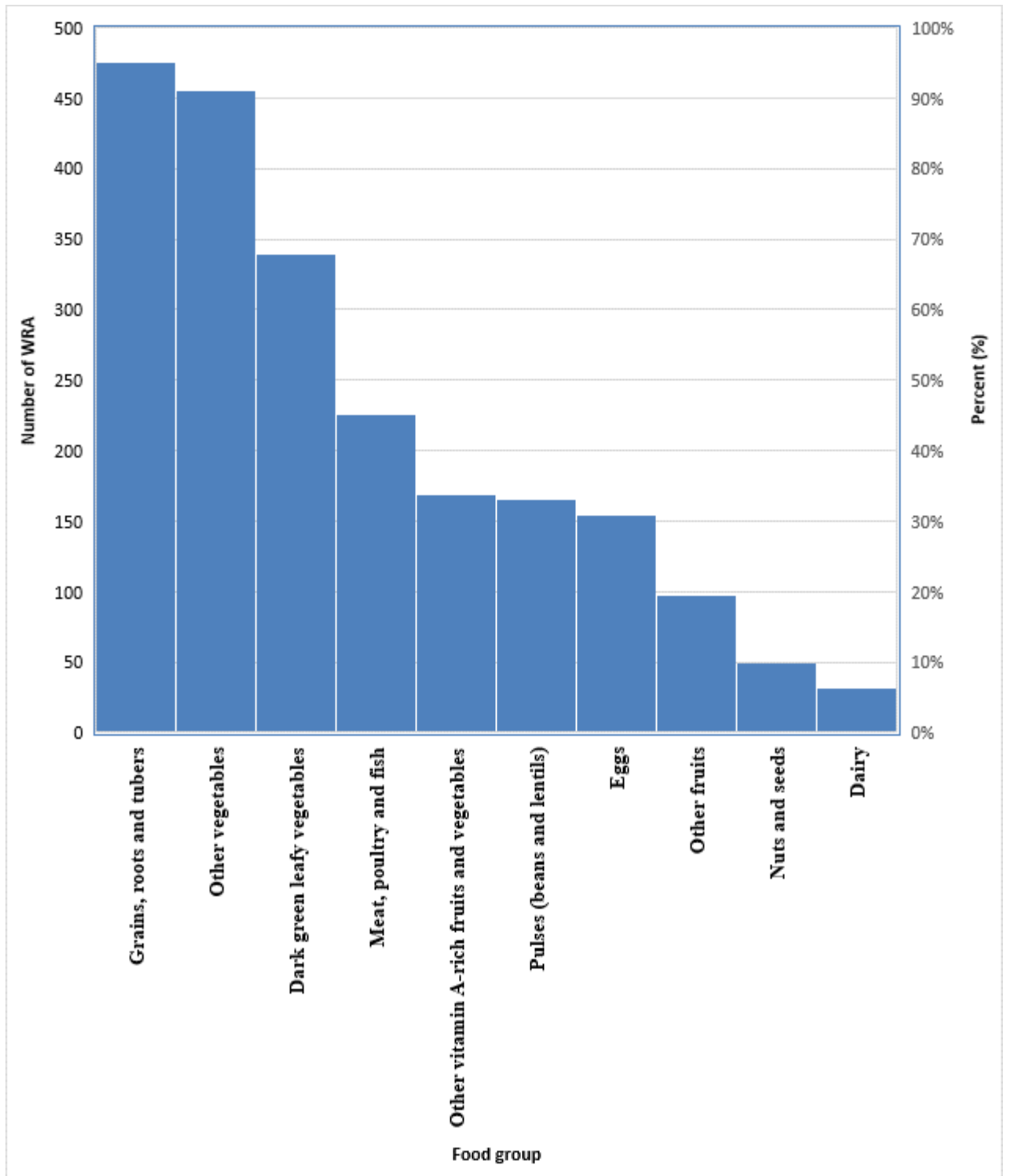


Figure 3: Proportions of women who consumed foods from each of the food groups

4.4 Minimum dietary diversity

The study revealed that 49% (232/476) of WRA in Chongwe district met the minimum dietary diversity (consumed food from at least five food groups), while 51% (244/476) did not meet the minimum dietary diversity. These results are graphically presented in figure 4.

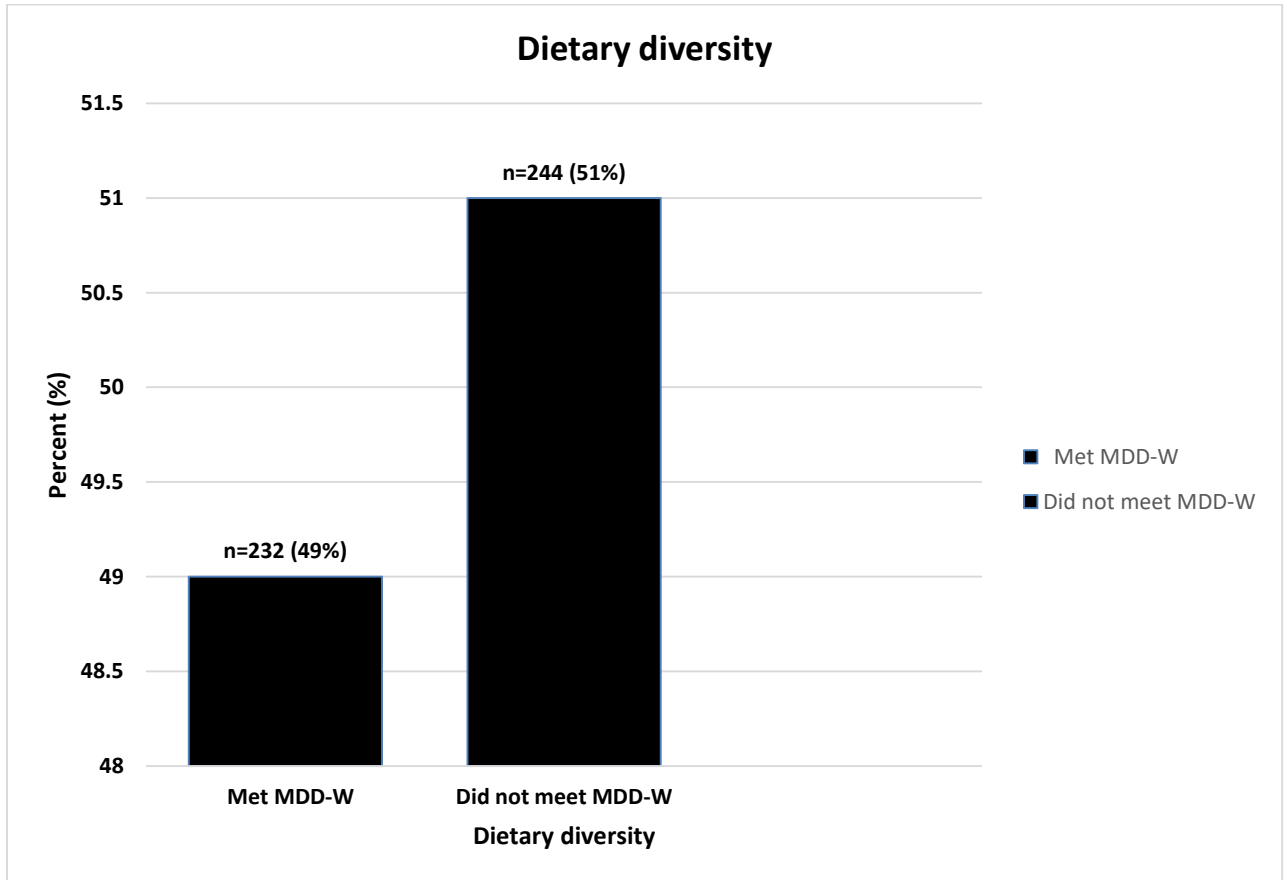


Figure 4: Minimum dietary diversity of WRA in Chongwe district

4.5 Proportion of women consuming particular number of food groups

The results in figure 5 indicate the proportion of WRA who consumed particular number of food groups out of the 10 MDD-W food groups. All the WRA reported consuming food from at least two (2) to eight (8) MDD-W food groups. None of the WRA reported consuming foods from only one food group, or from all the ten food groups. The majority (38%) of the WRA reported consuming food from 4 food groups.

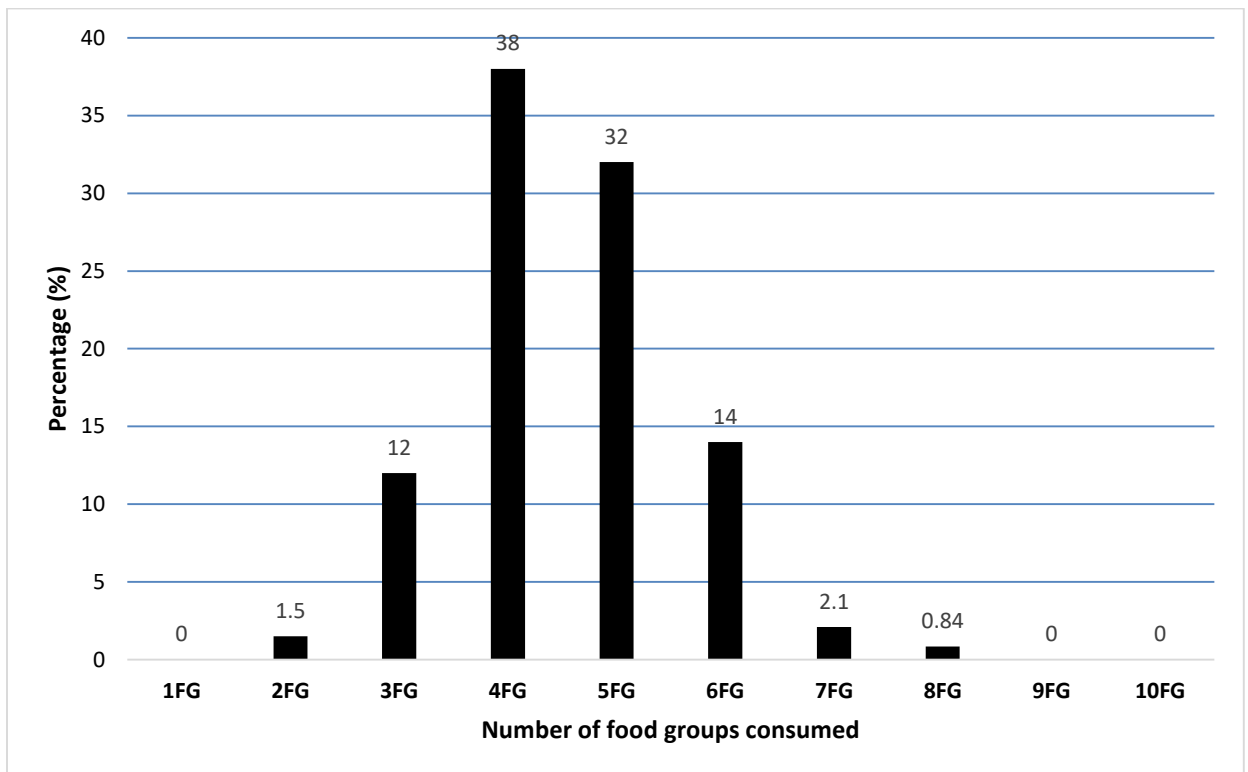


Figure 5: Proportion of women consuming particular number of food groups out of the 10 MDD-W food groups

4.6 Association between Socioeconomic/sociodemographic characteristics and MDD-W

The results for the association between various socioeconomic characteristics of WRA and MDD-W are presented in table 4.2. The results indicate that none of the socioeconomic factors had statistically significant associations with dietary diversity ($P>0.05$).

Table 4.2: Correlation between sociodemographic/sociodemographic factors and dietary diversity of women of reproductive age in Chongwe district

Variable	category	Dietary diversity				P-value
		Adequate		Not Adequate		
		N=476	Percent (%)	N=476	Percent (%)	
Age of household head	15yrs – 25yrs	104	21.8	104	21.8	0.276
	26yrs – 35yrs	73	15.3	74	15.5	
	36yrs – 49yrs	55	11.5	66	13.8	
Marital status of respondent	Single	75	15.7	64	13.4	0.640
	Married	135	28.3	157	32.9	
	Divorced	8	1.6	10	2.1	
	Separated	7	1.4	6	1.2	
	Widowed	7	1.4	7	1.4	
Occupational status	House wife	74	15.5	91	19.1	0.738
	Farmer	41	8.6	40	8.4	
	Student	27	5.6	27	5.6	
	Daily labourer	26	5.4	20	4.2	
	Formal Employment	2	0.4	3	0.6	
	Business	42	8.8	37	7.7	
	Others	20	4.2	26	5.4	
Educational levels	No formal	14	2.9	18	3.7	0.261
	Primary	104	21.8	119	25	
	Secondary	107	22.4	105	22	
	College	7	1.4	2	0.4	
Literacy levels	Able to read	151	31.7	149	31.3	0.364
	Illiterate	81	17.0	95	19.9	
Sex of household head	Male	156	34.6	180	37.8	0.518
	Female	67	14.1	64	13.4	
Household size	1-5	115	24.1	137	28.7	0.229
	6-10	106	22.2	96	20.1	
	11-15	11	2.3	9	1.8	
	>15	0	0	2	0.4	

4.7 Association between community training and MDD-W

The associations between obtaining training and dietary diversity among WRA of Chongwe was determined by running chi square tests. It was observed that obtaining a training in WASH had a statistically significant association ($p=0.047$) with the achievement of minimum dietary diversity among WRA in Chongwe district. Associations between obtaining training in other fields and attainment of MDD-W were not statistically significant.

Table 4.3: Correlation between community trainings and dietary diversity of women of reproductive age in Chongwe district

Variable	Category	Dietary diversity				p-value
		Adequate		Not adequate		
		N=476	Percent (%)	N=476	Percent (%)	
Training in Agriculture	Yes	131	27.5	118	24.7	0.077
	No	101	21.2	126	26.4	
Training in IYCF	Yes	111	23.3	20	4.2	0.169
	No	92	19.3	26	5.4	
Training in maternal Nutrition	Yes	108	22.6	23	4.8	0.824
	No	96	20.1	22	4.6	
Training in WASH	Yes	110	23.1	21	4.4	0.047
	No	87	18.2	31	6.5	
Training in food preparations	Yes	73	15.3	58	12.1	0.974
	No	66	13.8	52	10.9	
Beneficiary of special seed	Yes	32	6.7	99	20.7	0.856
	No	30	6.3	88	18.4	
Training in irrigation	Yes	18	3.7	113	23.7	0.734
	No	18	3.7	100	21	
Other training	Yes	14	2.9	117	24.5	0.894
	No	12	2.5	106	22.2	

~P-value is χ^2 p-value

*Other trainings category included PMTCT, catering, cervical cancer, conservation farming, crafts, HIV/AIDS, land preparation, mushroom growing entrepreneurship and financial literacy

4.8 Association between asset ownership and MDD-W

Table 4.4 presents results for ownership of assets that were assessed for association with dietary diversity of WRA in Chongwe district. The assets ownership included assets owned by the WRA and those owned by the households of the WRA. Owning a TV set was statistically significantly associated with the achievement of MDD-W (P=0.001).

Table 4.4: Asset ownership and correlation with minimum dietary diversity of women of reproductive age in Chongwe district

Category Asset ownership		Dietary diversity				P- Value
		Adequate		Not adequate		
		N=476	Percent (%)	N=476	Percent (%)	
Fridge	Yes	28	5.8	18	3.7	0.083
	No	204	42.8	226	47.4	
Television	Yes	188	24.7	87	18.2	0.001
	No	114	23.9	157	32.9	
Radio	Yes	134	28	137	28.7	0.723
	No	98	20.5	107	22.4	
Sofas	Yes	150	31.5	141	29.6	0.124
	No	82	17.2	103	21.6	
Mobile phone	Yes	190	39.9	183	38.4	0.068
	No	42	8.8	61	12.8	
Landline	Yes	6	1.2	7	1.4	0.850
	No	226	47.4	237	49.7	
Plot of land (title deed)	Yes	70	14.7	59	12.3	0.142
	No	162	34	185	38.8	
Farm land	Yes	129	27.1	121	25.4	0.189
	No	103	21.6	123	25.8	
Livestock	Yes	105	22	106	22.2	0.690
	No	127	26.6	138	28.9	
A vehicle	Yes	23	4.8	13	2.7	0.059
	No	209	43.9	231	48.5	

4.9 Association between source of drinking water, energy for cooking and MDD-W

Multivariate logistic regression analysis was done to determine associations between source of water and attainment of MDD-W. The results indicated that source of water was not a significant predictor of MDD-W among WRA in Chongwe district (Table 4.5).

Table 4.5: Source of drinking water and correlation with minimum dietary diversity of women of reproductive age in Chongwe district

Source of water	Dietary Diversity				P-value
	Adequate		Not adequate		
	N=476	Percent (%)	N=476	Percent(%)	
Tap water	46	9.6	36	7.5	0.583
Borehole	177	37.1	193	40.5	
Protected well	2	0.4	3	0.6	
Unprotected well	3	0.6	4	0.8	
River/Stream	0	0	1	0.2	
Other	4	0.8	7	1.4	

Multivariate logistic regression analysis was done to determine associations between source of energy for cooking and attainment of MDD-W. The analysis indicated that source of energy for cooking was not a significant predictor of MDD-W among WRA in Chongwe district (Table 4.6).

Table 4.6: Source of energy and correlation with minimum dietary diversity of women of reproductive age in Chongwe district

Source of energy	Dietary Diversity				P-value
	Adequate		Not adequate		
	N=476	Percent (%)	N=476	Percent(%)	
Electricity	4	0.8	2	0.4	
Wood	129	27.0	133	27.9	
Charcoal	99	20.7	109	22.8	
Other	114	23.9	157	32.9	

4.10 Logistic regression results of the factors associated with MDD-W

The factors whose P-values were $P < 0.25$ in the linear regression were picked for further analyses using logistic regression to establish their effects on the odds of achieving dietary diversity. The results are as presented in Table 4.7. The logistic regression results indicated that those WRA in Chongwe district who were from HH that had a television set in were about 3 times more likely to achieve MDD-W (OR: 3.5) compared to those that did not own a television set. WRA that owned a cellphone were almost 2 times more likely to achieve MDD-W (OR:1.70) compared to those that did not, and WRA that had training in IYCF were 1.3 times more likely to achieve MDD-W (OR: 1.3) compared to those that were not trained in IYCF.

Table 4.7: Logistic regression of the factors associated with MDD-W

Dietary diversity	Odds Ratio	P> z 	95% Conf. Interval	
Training in IYCF	1.278	0.575	0.541	3.013
No. of people in household	1.007	0.916	0.883	1.148
Ownership of a TV	3.452	0.001	1.620	7.355
Ownership of a fridge	0.452	0.175	0.143	1.425
Ownership of sofas	0.606	0.179	0.292	1.258
Ownership of a mobile phone	1.703	0.166	0.801	3.617
Ownership of a plot of land	1.164	0.660	0.591	2.296
Ownership of farm land	1.248	0.497	0.659	2.362
Ownership of a vehicle	0.833	0.772	0.241	2.873

CHAPTER FIVE: DISCUSSION

The main objective of this study was to establish factors associated with dietary diversity among WRA in Chongwe district. The study established that 49% (232/476) of all the study participants achieved the MDD-W, which is relatively low. The low MDD-W could likely be explained by the season in which the study was conducted. The study was conducted from October to December, the season which is generally a lean period when most households have depleted their food stores and looking forward to the green harvest. In October, some households were still experiencing food shortages arising from the drought that had affected agricultural productivity in Chongwe and other parts of the country in the 2018/2019 cropping season. In November, with the onset of the rains, households had access to wild fruits, a variety of vegetables, insects, mushrooms, and mangoes. These foods were available mainly in December. The prevalence of MDD-W observed in this study was similar to that found in rural areas in Burkina Faso where MDD-W was also found to be at (49%) in Sanguie and (30%) in Sourou (30%) (Custodio, Kayikatire, et al., 2020). This finding is, however, contrary to the findings of a study conducted in Ethiopia, which found that fifty-three percent (53%) of all women had adequate dietary diversity (Geta & Gebremedhin, 2022). A similar study conducted in Mali found that only 27% of the WRA were meeting MDD-W (Adubra, Savy, Fortin, Kameli, Kodjo, Fainke, Mahamadou, Le Port, et al., 2019). These findings are similar to the current study in that MDD-W was also low. In another study conducted in Bangladesh, a similar picture of results to the current study was found, where only 40.3% of the study subjects were found to consume adequately diversified diets. Starchy staples, and other vegetables were most commonly consumed, while, dairy products, eggs were reported only by few participants (Islam et al., 2023).

Not surprisingly, it was found that women's diets were largely dominated by starchy staples, as the most consumed foods were from the grains, roots and tubers group, with 100% (476/476) of the WRA consuming from this group. This is the group that consists of maize (the most widely consumed staple food in the study area), rice, and cassava among other foods. These goods, particularly maize, is largely consumed as it is the main staple and so this explains why all the WRA consumed food from this food group. The consumption of food from the grains, roots and tubers group was followed by the

consumption of foods from the other vegetables group with 95% (452/476) and then consumption from dark green leafy vegetables group at 71.43% (340/476). This picture is comparable to the results of the study conducted in Burkina Faso which found that the most frequently consumed food groups were all starchy, vitamin A rich dark green leafy vegetables and other vegetables (Custodio, Kayikatire, et al., 2020). Mostly, the diets of people living in rural and peri-urban settings are dominated by starchy staples due to their abundance and they are eaten as the main staple food. These are usually eaten with vegetables that are grown locally or sourced at a relatively low cost compared to relish from the other food groups. The least consumed foods were foods from the dairy group, with only 6.75% (32/476) of the WRA reporting consumption of foods from this group. The consumption of food among the WRA ranged from two (2) to eight (8) food groups. These results could be explained by the fact that the study was conducted during the lean period, when most foods are off season, as well as the monotonous nature of the diets which has become a norm in most settings. The low consumption of eggs among WRA is most likely because in most rural areas, eggs are primarily for children and for hatching, rather than for consumption by adults.

None of the socio-demographic variables showed significant association with MDD-W ($P > 0.05$). Although WRA in households headed by younger household heads were more likely to meet the MDD-W than their counterparts headed by older household heads, this association was not statistically significant. A combination of factors such as changing dietary preferences, access to information and education, economic stability, cultural influences, and health consciousness may contribute to WRA from households headed by younger household heads being more likely to have diversified diets compared to those from households headed by older household heads. A similar study found that among the sociodemographic variables, only the age of the head of the household was inversely related to MDD-W: the older the head of the household, the less likely were the women to consume at least five FGs, the association being significant only in one of the two sites where the study was conducted (Custodio, Kayikatire, et al., 2020). The other variables did not show significant associations with MDD-W. Contrary to the results of the current study,

however, associations between dietary diversity and demographic factors have been reported in other studies (Morseth et al., 2017).

Associations between training and MDD-W were also assessed (training in IYCF, agriculture, WASH or any other training). WRA who obtained training in various aspects were more likely to achieve MDD-W compared to those that did not obtain training. This study only found statistically significant association between MDD-W and training in WASH ($P=0.047$). Associations with the other trainings were not statistically significant ($P>0.05$). Not many studies have determined the associations between training and MDD-W. The results from this study could be explained by the fact that various nutrition messages, for example, healthy eating and dietary diversification, and disseminated through various training platforms such as community trainings. WASH training programs sometimes include components related to nutrition education and awareness. The possible explanation for training in WASH being associated with MDD-W is that individuals who receive WASH training may be more knowledgeable about the importance of a diverse diet overall health and well-being. This awareness can motivate individuals to seek out and consume a variety of foods from different food groups, leading to greater dietary diversity. Overall, being trained in WASH promotes behaviors and practices that support safe food handling, access to clean water, proper sanitation, and nutrition education, all of which contribute to greater dietary diversity and improved nutritional outcomes. A study conducted by Kuchenbecker et al. (2017), who found positive associations between nutrition education (10 sessions conducted by a facilitator) and minimum dietary diversity. These findings are similar to findings that were documented by Kiboi et al in Kenya (Kiboi et al., 2017), where training in WASH was found to be associated with the attainment of MDD-W.

Owning a television (TV) in the household was the strongest predictor of adequate dietary diversity among the social economic factors and all the selected possible predictors of dietary diversity in the current study, with a P-value of 0.001. It was revealed that WRA who were from households that owned a TV set were more likely to achieve adequate dietary diversity compared to those WRA who were from households that had no TV set. This finding is likely due to the economic power associated with owning a TV set. The

other reason could be that those who own TV sets have access to knowledge and information presented on various TV programs about healthy diets.

In addition, results of the current study indicated that educational level was not statistically associated with dietary diversity. Although WRA who have attained an education were more likely to attain MDD-W compared to those that had no education, the difference was not significant. WRA who had attained an education did not have a statistically significant greater chance of attaining MDD-W compared to those that did not have an education. This finding is supported by a study that was conducted in Iran which found that there was no significant association between educational and dietary diversity (Nachvak et al., 2017). The results are contrary to what was found in a study conducted in Bangladesh where the educational level of WRA was significantly related to their dietary diversity. The odds of having adequate diversified diets were higher among those WRA who had at least secondary education compared to those who never attended school (Islam et al., 2023). The explanation for such seemingly controversial results is that general education focusing only on the WRA may not lead to improved dietary diversity if other community members have not received education. Focus should not only be on the WRA but also other family and community members in order to create a supportive environment for facilitating behavior change. Boedecker et al, (2019) indicates that effective education for behavior change in line with dietary diversity is interpersonal communication delivered through the existing health care system.

Being from a household that owned a TV set was significantly associated with MDD-W ($P=0.001$). It was found to be the strongest predictor of achieving MDD-W. This was followed by owning a mobile phone, training in IYCF and owning land. It was revealed that increasing the ownership of TV sets, mobile phones, training in IYCF and land ownership significantly increased the odds of achieving MDD-W. This finding is in line with a study done in Ethiopia which found owning a TV set to be positively associated with MDD-W (Abduhalik et al., 2019). Another study conducted by in Mali found household wealth index to be a strong predictor of MDD-W, with women in the wealthiest households having greater odds of reaching the MDD-W (Adubra, Savy, Fortin, Kameli, Kodjo, Fainke, Mahamadou, Le Port, et al., 2019). The result in the study conducted in

Mali resonates with the results in the current study, in that when women have a high wealth index, they can afford to own a TV set, a mobile phone and land (predictors found in the current study).

CHAPTER SIX: CONCLUSION

6.1 Conclusion

This study has shown that the overall consumption of adequate dietary diversity of WRA was found to be relatively low, with 49% (232/476) WRA meeting the minimum dietary diversity. Being trained in WASH, coming from a household that had a TV and owning a cell phone were positively associated with the adequate dietary diversity. The predictors of MDD-W were found to be ownership of a cell phone, TV ownership, and being trained in IYCF.

In light of these findings, there is a need to support existing programs and come up with new policies targeting these variables. More trainings in IYCF need to be conducted as nutrition messages are delivered through these trainings and as such can have an impact on the improvement of dietary diversity of WRA. Expanding nutrition sensitive interventions such as trainings in WASH also need to be supported. Despite not being directly related to dietary diversity, WASH trainings were seen as being linked to MDD-W and such need to be enhanced. The training package for WASH should be tailored in order to include messages on the promotion of dietary diversity. Furthermore, empowering women to have improved socioeconomic status is recommended in order to improve women's dietary diversity. These variables increase dietary diversity through various pathways (both nutrition sensitive and nutrition specific). Further studies should be done on the knowledge-related and behavioral factors of dietary diversity.

6.2 Strengths

The strength of this study is that it is the first to investigate the associations between minimum dietary diversity and multiple factors in WRA of Chongwe district. Studies have been conducted focusing on the minimum dietary diversity in terms of prevalence, but in the present study, focus was on factors associated with minimum dietary diversity as well as determining the predictors of MDD-W among WRA in Chongwe district.

6.3 Limitations

As mentioned previously, seasonality is known to influence dietary consumption, especially in rural and peri-urban settings in which households rely on their own agricultural production. However, the cross-sectional nature of this study, in which data

was collected during a limited period of time, did not enable the exploration of the possible effect of seasonality on the associations found. Finally, the cross-sectional nature of the data made it impossible to draw conclusions regarding causality in the relations found as it is difficult to know which one precedes, the exposures or outcomes in a study of a cross-sectional nature as the current study. Longitudinal studies are needed to not only identify temporal sequence of exposure and outcome but also study changes in MDD-W prevalence over time. Hence the study is unable to generalize to the population because of seasonality which might affect the results of this study. In addition, this study might not give the exact figure of the dietary diversity practice due to a recall bias and being self-reported. Beyond this, this study did not address the barriers to market access and dietary diversity.

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Annex 1: Questionnaire

**STUDY TITLE: FACTORS ASSOCIATED WITH DIETARY DIVERSITY
AMONG
WOMEN OF REPRODUCTIVE AGE IN CHONGWE
DISTRICT,
ZAMBIA**

A. Module 1- Household information

(To access these questions, open the ODK app in your tablet and click fill blank form to launch the MDDW weighed food record form)

B. Section 1.1: General Information (GI)

Table: General information

Questions	Response	Condition
		Always
	Interviewer: Is this your name? ODK will display the name of the enumerator associated with the tablet's serial number. Check that the name is yours. If this name is correct, continue. If it is not, select "NO" and enter the correct name on the	[NAME]
GI1	Interviewer: Is there an eligible woman (15-49 years) who usually prepares or buy foods present in this house? ODK will generate pop up warning If no, continue to the next selected household The eligible woman for all modules is women of reproductive age group (15 to 49 years) who usually prepares or buys foods and non-pregnant	1= Yes 0= No Always
GI2	Date and start time of interview ODK will automatically display the current date and start time of interview	Always
GI3	District	1= Chongwe

GI4	Ward	1= Chainda 2= Chalimbana	Always
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GI5	<p>village code ODK will allow interviewer to select one after selecting the right Ward</p>	<p>For Chainda: 1 = Mukunya 2 = Ndjovu 3 = Ndango 4= Kanakantapa</p> <p>For Chalimban a 1 =Chishiko 2 =Mukankaulwa 3 = NISTICOL 4. NIST</p>	Always
GI6	<p>Structure number Interviewer: Record the three-digit structure number from the household listing form and it is the number used to identify each houses/buildin</p>		

	<p>Unique household ID</p> <p>ODK will automatically generate this unique number taking the combination of District (first digit), Ward (second digit), village (third and fourth digit) and structure number (the last three digit).</p> <p>(Interviewer: to be copied to consent form and associated</p>	<p>Automatically generated</p> <p>District/Ward/village/structure number</p>	
GI7	<p>What is the name of the head of this house?</p>		

	<p>Write the name of the head of household in the space provided. This name will be shared with the open and list based data collectors.</p>		
GI8	<p>Sex</p> <p>This is the sex of head of the household</p>	<p>1= Male</p>	
GI9	<p>Please tell me the full name of the woman who usually prepares and buys foods and is not-pregnant</p> <p>Write the name of respondent in the space provided</p> <p>Note: This is the woman of reproductive age (15-</p>		
	<p>Is respondent name present to be interviewed today?</p> <p>If no, take appointment given and go to next household</p>	<p>0=No</p> <p>1= Yes</p>	

GI0	<p>Does respondent name usually live here? (at least for 3 months)</p> <p>For the purposes of this survey a household members are those who have lived in the household for at least 3 of the past 12 months, and may include resident workers or servants</p>	<p>0=No 1= Yes</p>	
GI11	<p>Ask the respondent her physiological status</p> <p>If she is either pregnant or both pregnant and lactating end the interview, And continue to the next selected household</p>	<p>1= neither pregnant nor lactating 2= Pregnant 3= Lactating 4= Both</p>	
GI12	<p>Are you fasting today?</p> <p>Will you be abstaining from eating any food or drink the whole day?</p>	<p>0= No 1= Yes</p>	
GI13	<p>Is today a special day?</p>	<p>0= No 1= Yes</p>	

	<p>Ask the respondent if there is festivity, celebration or wedding party in the house?</p>		
	<p>Read the consent form and obtain approval to participate in the study. Answer any questions. If consent is refused, end the interview and continue to the next selected household.</p> <p>End interview if consent 'refused' or 'Appointment'</p>	<p>1= Accepted 2= Refused 3=Appointment given</p>	

Section 1.2: Socio-demographic information (SD)
Table: Socio-demographic information

Question		Response
SD1	<p>Relationship of respondent name with HH head</p> <p>Write the woman's relationship to the household head.</p>	<p>1= Mother</p> <p>2= Wife</p> <p>3= Child</p> <p>4= Mother-in-law</p> <p>5=Grandchild</p> <p>6=Grandparent</p> <p>7=Sibling</p> <p>8=Aunt</p> <p>9= Self</p>
SD2	<p>Age Enter in complete years</p>	
SD3	<p>Religion</p>	<p>1= Christian</p> <p>2= Muslim</p> <p>3=African religion</p> <p>4 = Hindu</p>
SD4	<p>Marital status</p>	<p>1=Single</p> <p>2=Married</p> <p>3= Living with unmarried partner</p> <p>4=Divorced</p> <p>5=Separated</p> <p>6=Widowed</p>

SD5	Occupational status	1=Housewife 2=Farmer 3=Student 4=Daily laborer 5= Gov't employee
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SD6	Educational status Educational status related to completed years of schooling which refers to the number of successfully completed years of schooling and excludes years repeated in a class. For example if a respondent attended grades 1 – 5, but they repeated 4th grade and then only	1= No schooling 2= Primary School (grade 1 – 7) 3=Secondary School (Grade 8 – 12) 4=University and technical college
SD7	SD7 Have you ever received a training by Community Health Worker or Agriculture	0=No 1=Yes
	SD8_1 IYCF	0=No 1= Yes
	SD8_2 if yes when?	1= less than 1 year
	SD8_3 Maternal Nutrition	0=No 1= Yes
	SD8_4 if yes when?	1= less than 1 year 2= Between one and two years 3=Greater than two years
	SD8_5 Wash	0=No 1= Yes
	SD8_6 When?	1= less than 1 year 2= Between one and two ear 3=Greater than two years
	SD8_7 Food preparation or cooking demonstration	0=No 1= Yes

		- 3=Greater than two years
	SD8_8 if yes, when?	1= less than 1 year
	SD8_11 Irrigation	0=No 1=Yes 2= Between one and two year 3=Greater than two years
	SD8_12 if yes when?	1= less than 1 year
	SD8_9 Benefit of special seeds?	0=No 1=Yes 2= Between one and two year
	SD8_10 if yes, when?	1= less than 1 year 2= Between one and two year 3=Greater than two years
	SD8_13 Other	0=No - 1= Yes 2= Between one and two year
		1= Yes
	SD8_14 Specify	Type answer here
	SD8_15 When?	1= less than 1 year 2= Between one and two year 3=Greater than two years

Section 1.3 Socio-economic status (SE)

This section is targeted at the respondent. Next you will be asked about your socioeconomic status, for example, the type of house you live in and what things you have in the house

Table: Social Economic Status determinants

S/N	Question	Response
SE1	How many people including yourself, live in your household (with intention to live there	
SE2	How many rooms are in your house (excluding bathrooms and toilet)	
SE3	Do you own or rent the house?	1= Own 2= Rent 3= other
SE4	Do you have a separate room for sleeping	0=No 1= Yes
SE5	Do you have a separate room for cooking	0=No 1= Yes
SE6	If yes for SE5, is it separate from the living room?	0=No 1= Yes
SE7	What fuel do you use for cooking most of the time?	0=No 1= Yes
	Do you own the following at home?	1 =Electricity 2 =Gas 3 =Manure 4 = Firewood 5 = Charcoal

SE8_1	Do you own a T.V?	0=No 1= Yes
SE8_2	Do you own a Stove with oven?	0=No 1= Yes

SE8_3	Do you own a Fridge?	0=No 1= Yes
SE8_4	Do you own a Radio?	0=No 1= Yes
SE8_5	Do you own Sofas?	0=No 1= Yes
SE8_6	Do you own Computer(s)?	0=No 1= Yes
SE8_7	Do you own Cell phone(s)?	0=No 1= Yes
SE8_8	Do you own Landline?	0=No 1= Yes
SE8_9	Do you own Plot of land (title deed)?	0=No 1= Yes
SE8_10	Do you own Farm Land?	0=No 1= Yes
SE8_11	Do you own Livestock?	0=No 1= Yes
SE8_12	Do you own Vehicle?	0=No 1= Yes Please specify type: 1. - 2. Family car 3. Tourist van 4. Truck 5. Tractor 6. Other, Please specify
SE9	What is your main source of water? _____	1= Tap water 2= Protected source 3= Unprotect source
SE10	Time to get water source	
SE10M	How long does it take for you to go from your house to the nearest water source? (in minutes)	
SE11	What type of toilet is in your household?	1= Flush Toilet 2= Pit latrine 3= Do not have Toilet
SE12	Is the toilet shared with another family?	0=No 1= Yes

Annex 2: Description of the 10 food groups

GROUP 1 – Grains, white roots and tubers and plantains

This group is sometimes also called starchy staples. These foods provide energy, varying amounts of micronutrients (e.g. certain B vitamins provided by grains) and varying amounts of anti-nutrients, such as phytates. When grains are consumed whole, they also provide dietary fibre. White roots and tubers include non-coloured and non-grain-based starchy staples that mainly provide carbohydrates. These include any staple dishes/casseroles and pastes made from roots, tubers and plantains.

Commonly consumed examples include:

-Foods made from grains include all products and staple dishes derived from cereal crops and flours made from these crops, such as all types of breads, buns, fritters, rolls

-Stiff porridges of maize, cornmeal, wheat, sorghum, millet or cassava (e.g. nshima, maize, samp, meal rice, jungle oats, rice);

-Noodles, pasta (macaroni and spaghetti)

-White roots and tubers or plantains include irish potatoes, white-fleshed sweet potatoes, white yams, white-fleshed bananas

-Plantains/white-fleshed banana (a fruit) and cooking bananas are included in this group because they share a similar nutrient profile to some roots and tubers and play the same role in diets as a starchy staple food. These are different from the sweet ripe bananas that might be called dessert bananas, which are placed in the “Other fruits” group.

This group does not include sweet biscuits and cakes, which are classified under “Sweets”, and instant noodle packets, classified under “Fried and salty foods”.

GROUP 2 – Pulses (beans, peas and lentils)

This group includes members of the plant family Fabaceae (alternate name Leguminosae), such as beans, peas and lentils. The seeds are harvested at maturity and dried and used as food or processed into a variety of food products. The group is high in protein and B vitamins, although the protein is not complete and certain amino acids must be supplied by other foods. Pulses represent a very important protein source in plant-based diets and among populations where animal-source foods are largely unaffordable. The fat content of pulses is generally low, with the exception of soybean. However, pulses also contain varying amounts of anti-nutrients that inhibit absorption of certain nutrients.

Commonly consumed pulses include:

-Mature seeds (beans), common beans (black, kidney), chickpea, pigeon pea, cowpea, lentil and soybeans, sprouted pulses, legumes and processed/prepared products, such as soymilk

This group excludes:

-Plants harvested green or immature and eaten fresh from the pod – these are included in the “Other vegetables” group.

-Groundnuts (peanuts) because, while groundnuts are in the Fabaceae family, both its high fat content and most common culinary uses make them different from other legumes and more similar to tree nuts. Groundnuts are included in the “Nuts and seeds” group.

GROUP 3 – Nuts and seeds

This group comprises mostly tree nuts but also includes groundnuts (peanuts) and may include certain seeds when consumed in substantial quantities. Nuts and seeds butters, such as pounded groundnut/peanut butter and cashew butter, are also included when consumed in substantial amounts (more than 15 g) and not merely added to flavor mixed dishes. Nuts and certain seeds are rich in unsaturated fatty acids, vegetable protein, fibre, minerals, tocopherols, phytosterols and phenolic compounds. They may have unique health benefits with the exception of chestnuts, they generally have a very high fat content. Common tropical tree nuts include: cashew, macadamia and Brazil nut; common nuts grown in broader temperate zones include almond, chestnut, hazelnut, pecan, pistachio and walnut. Commonly consumed seeds include: sunflower seeds and pumpkin seeds.

GROUP 4 – Milk and milk products Milk and milk products

Foods in this group are also known as dairy foods. They are important sources of high-quality protein, potassium and calcium, as well as vitamin B12 (available only from animal-source foods) and other micronutrients. Items in this group include almost all liquid and solid dairy products from cows, goats, buffalo, sheep or camels, drunk or consumed as such (this list is not exhaustive):

-Fresh whole, low-fat and skim milk;

-Reconstituted powdered or evaporated milk or ultra-high temperature (UHT) milk consumed as such;

-Hard cheese (e.g. cheddar, Swiss, parmesan), soft cheese (e.g. ricotta, cottage, mozzarella, paneer);

-Sour milk (mabisi), yoghurt/curd.

This group does not include:

-Poorer-quality milk products (which are usually most frequently consumed) as they do not contain substantial amounts of milk:

-Butter, cream and sour cream are classified with “Fats and oils” because of their high fat content and their typical culinary uses.

-Ice cream and sweetened condensed milk are classified under “Sweets”. If condensed milk is diluted and consumed as a beverage, classify under “Sugar sweetened beverages”.

-Commercially processed/packaged yoghurt drinks are classified under “Sugar sweetened beverages”, because these are usually high in sugar and low in dairy content.

-Cocoa drinks with milk: Classify with “Sugar-sweetened beverages”.

-Non-dairy products such as: soya milk and soya yogurts in particular, but also coconut milk and almond milk.

GROUP 5 – Meat, poultry and fish

This group is sometimes referred to as flesh foods, as it includes all fresh, dried and processed meats, organ meats, poultry and other wild birds and mammals (bush meat), snakes, frogs and other reptiles and amphibians and seafood/shellfish. All flesh foods are important sources of high-quality protein and bioavailable micronutrients, notably iron, zinc and vitamin B12 (the last is available only from animal-source foods).

On the MDD-W questionnaire, this group can be subdivided into (1) Organ meats, (2) Red flesh mammal’s meats, (3) Processed meats, (4) Poultry and other white meats, and (5) Fish and seafood.

Organ meats; this group includes different types of red organ meats that are usually rich in iron.

-Blood sausage and other blood products are also included because of their high iron content

-Gizzard, heart, kidney, liver;

-Blood sausage, other blood products.

Excluded from organ meats: Pale organ meats, such as tripe, because of their much lower iron content.

These are classified with “Poultry and other white meats”

Foods in this group include:

Red flesh mammal’s meats; All flesh meats from mammals:

-Beef, goat, lamb, mutton, pork, rabbit, deer, antelope, buffalo or other large wild (bush meat) or domesticated mammals;

-Mice, guinea pig, rat, kalulu or other small wild (bush meat) or domesticated mammals

Processed meats;

-Processed meats are smoked, cured, or salt or chemical preservatives are added. Some examples include:

-Salami, polony, bacon, hot dogs, luncheon meat, pepperoni;

-Sausages such as frankfurters and chorizo, corned beef, and all types of ham

Poultry and other white meats Birds, reptiles and amphibians are included:

-Chicken, duck, goose, guinea fowl, turkey, pigeon or other wild or domesticated birds;

-Tripe or other pale organ meats;

- Crocodile, frog, snake and other reptiles and amphibians

Fish and seafood Fish and seafood from both marine and freshwater sources, such as:

- Fresh, frozen or dried fish, large or small, all species;

- Canned fish (e.g. Kapenta, tuna and sardines);

- Clams, mussels, oysters and scallops (bivalves);

- Shrimp, lobster, crayfish and crabs (crustaceans);

- Edible sea urchins and sea cucumbers (echinoderms);

- Octopus, squid, cuttlefish;

- Shark, whale

Fish roe and snails are not included here and are classified under the optional food group “Insects and other small protein foods”.

GROUP 6 – Eggs

This group includes eggs from any type of bird (domesticated poultry and wild birds). As with other animal-source foods, eggs are a good source of protein and contain vitamin B12 and a range of bioavailable micronutrients.

-Chicken eggs

-Duck eggs

-Guinea fowl eggs

-Quail eggs

This group excludes: fish eggs (fish roe), which are classified under “Insects and other small protein foods.”

GROUP 7 – Dark green leafy vegetables

Essentially all medium-to-dark green leafy vegetables are vitamin A-rich. In addition to being rich in vitamin A, many green leafy vegetables are rich in folate and several other micronutrients.

Commonly consumed leaves included in this group:

-Medium green leaves, such as Chinese cabbage, rape (kale), okra (lady's fingers), wild okra leaves, lettuce, along with darker greens such as spinach, as well as the green leaves from other food crops such as from, cassava, bean, pumpkin, amaranth. Leaves consumed may vary widely by country and region, and include both cultivated and wild and foraged species. In the absence of information regarding their nutrient content, wild/foraged leaves that are medium-to-dark green can be assumed to be vitamin A-rich and placed in this group.

Excluded from this group: pale green leaves, such as iceberg lettuce.

GROUP 8 – Other vitamin A-rich fruits and vegetables

This group includes both vitamin A-rich fruits and a small but diverse group of vitamin A-rich vegetables other than leafy greens. These foods may also be good sources of vitamin C and/ or folate and/or other micronutrients. While “Other vitamin A-rich fruits and vegetables” comprise one of the ten distinct food groups in the indicator, fruits are listed separately from vegetables on the questionnaire, as this may be more intuitive for enumerators.

Most common vitamin A-rich fruits included in this group are ripe mango and ripe papaya. Others include red palm fruit/pulp, passion fruit, apricot and several types of melon. Certain varieties of ripe, deep yellow-fleshed or orange-fleshed bananas are also rich in vitamin A, but white/cream-fleshed bananas are not. Deep yellow-fleshed and orange fleshed bananas may be classified with vitamin A-rich fruits when:

- Their Vitamin A content is known to be high;
- It is considered feasible to distinguish bananas by color during fieldwork on the questionnaire.

Other vitamin A-rich vegetables included in this group are:

- Orange-fleshed sweet potato, carrot, papaya, pumpkin and deep yellow- or orange-fleshed squash

Notable fruits excluded from this group and classified as “Other fruits include:”

- Green (unripe), mango and papaya -because they are not rich in vitamin A
- All bananas except those mentioned above;
- Citrus oranges (although orange-colored, are not rich in vitamin A)

GROUP 9 – Other vegetables

This group includes vegetables that have not been counted as dark green leafy vegetables or as other vitamin A-rich vegetables. Diets rich in fruits and vegetables are associated with positive health outcomes. This may be because a range of bioactive compounds found in fruits and vegetables are

consumed, including phenolics, flavonoids and fibre, and not just because of their commonly recognized role as sources of micronutrients

Similar to other food groups, the “Other vegetables” group uses the culinary definition for a vegetable, not the botanical. The group includes stems, fruits and flowers of plants when generally consumed in savoury dishes and considered as vegetables in culinary systems. This group includes legumes when the fresh/green pod is consumed (as in fresh peas, snow peas, snap peas or green beans); cucumber, tomato and okra (all fruits in botanical terms).

This group excludes high-carbohydrate starchy roots and tubers, such as white potatoes, white yams, cassava and cocoyam, because their nutrient contributions differ, even though they are considered vegetables in a few culinary definitions. The exclusion of roots and tubers is consistent with how the WHO defines which vegetables count towards the recommended consumption of fruits and vegetables. As with dark green leafy vegetables, commonly consumed vegetables vary widely with geography and can include foraged as well as cultivated foods.

GROUP 10 – Other fruits

This group includes most fruits, excluding vitamin A-rich fruits. The health effects of diets rich in fruits and vegetables were noted above. As explained under “Other vegetables”, this group follows the culinary definition of fruits – not including tomatoes, etc. Fruits are usually easily recognized and classified as such. Note that plantains and cooking bananas are classified with starchy staples (Group 1, above), but sweet white bananas are classified with fruits. The ten food groups. As with vegetables, commonly consumed fruits vary widely with geography and can include foraged as well as cultivated fruits.

Examples include avocado, bananas, mabuyu (baobab fruit), apples, coconut, etc

*Adapted from FAO, 2021

Annex 3: Time Schedule

Activity	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov
Submission of topic	■									
Literature review	■	■								
Submission of first draft of proposal		■								
Presentation of proposal		■								
Submission of final copy of proposal			■							
Ethical Clearance				■						
Pretesting of data collection tools				■						
Data collection					■					
Data analysis						■				
Presentation of findings							■			
Report writing							■	■	■	
Submission of report										■

Annex 4: Total research cost

CATEGORY	SUB-TOTAL (K)
Stationary	600
Travel expenses	12,000
Ethical clearance	2,500
Equipment	3,000
Data Collection	25,000
Miscellaneous	1,500
Contingency (10%)	3,660
GRAND TOTAL	48,260