EFFECT OF PARTICIPATION IN ORANGE FLESHED SWEETPOTATO FOCUSED NUTRITION EDUCATION INTERVENTION ON NUTRITION KNOWLEDGE, INFANT AND YOUNG CHILD FEEDING PRACTICES, AND WOMEN DIETARY DIVERSITY IN ZOMBA, MULANJE AND CHIKWAWA.

MSC (AGRICULTURAL AND APPLIED ECONOMICS) THESIS

FLORA ULAYA

SUBMITTED TO

DEPARTMENT OF AGRICULTURAL AND APPLIED ECONOMICS
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BUNDA CAMPUS

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BUNDA CAMPUS

JULY, 2021

DECLARATION

I **Flora Ulaya**, declare that this thesis 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 Lilongwe University of Agriculture and Natural Resources or elsewhere for the award of any academic qualification. Where assistance was sought, it has been acknowledged accordingly.

Flora Ulaya

Signature: _____

Date: _____

CERTIFICATE OF APPROVAL

We, the undersigned, certify that this thesis is a result of the author's own work, and that to the best of our knowledge, it has not been submitted for academic qualification within Lilongwe University of Agriculture and Natural Resources or elsewhere.

Major Supervisor: Dr. S. Katengeza

Signature: ……

Date:……..

Supervisor: Prof. H. Mangisoni

Signature: ……

Date:……

DEDICATION

To my mother, Getrued Maliko, you are my role model and I love you. Thank you for your motivation and encouragement. May the almighty God bless you always.

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ABSTRACT

Nutrition education not only positively affects nutrition knowledge but also contributes to the development of behaviors that can promote healthy families and societies. Hence good nutrition knowledge of mothers and caregiver's Implies good nutrition for the whole family. However, less rigorous research has been done in Malawi to analyze the impact of nutrition education. Hence the study aimed at analyzing the impact of OFSP focused nutrition education intervention on nutrition knowledge, infant and young child feeding practices, dietary diversity, and consumption of Vitamin A rich food. The study collected data from 363 households from Chikwawa, Mulanje and Zomba districts. Poisson regression, difference in difference and propensity score matching were used to analyze the objectives. The results show that nutrition education affects nutrition knowledge but not infant and young child feeding practices. This means that the nutrition knowledge acquired did not transition to changes in feeding practices. In addition, participating in OFSP project has an impact on dietary diversity of women of reproductive age. Participants diversified with 1.07 more food groups that non-participants. However, overall, the study population had a low dietary diversity level as shown by a score of 3.88 and only 35% of the women consumed 5 out of 10 food groups. Lastly, propensity score matching results show that participating in OFSP project has a positive and significant impact on both children and caregiver consumption of vitamin A food rich food. It is therefore recommended that OFSP focused nutrition intervention be scaled up to other regions in Malawi. It is also recommended nutrition education intervention focus not only on knowledge but also change in attitude and practices. Lastly intervention must encourage farmers to grow different food groups to ensure dietary diversity.

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LIST OF ACRONYMS

CADECOM	Catholic Development Commission in Malawi
CGIAR	Consultative Group on International Agricultural Research
CIP	International Potato Centre
DAPP	Development Aid from People to People
DDS-W	Dietary Diversity for Women or reproductive age
DID	Difference in Difference
FANTA	Food and Nutrition Technical Assistant
FAO	Food and Agriculture Organisation
GoM	Government of Malawi
IFPRI	International Food Policy Research Institute
IYCFP	Infant and Young Child Feeding Practices
JLIFAD	International Fund for Agricultural Development
MBT	Mother baby Trials
MND	Micronutrient Deficiency
NGO	Non-Governmental Organisation
OFSP	Orange Fleshed Sweet Potatoes
PSM	Propensity Score Matchin
ROH	Rooting Out Hunger
RTC	Root and Tuber Crop
SSA	Sub Saharan Africa
USAID	United States Agent for International Development
UNICEF	United Nations Children's Fund

VAD	Vitamin A Deficiency
WHO	World Health Organisation

CHAPTER ONE

1.0.INTRODUCTION

1.1.Background Information

Micronutrient's deficiency (MND) also known as the hidden hunger problem is a major concern in sub-Saharan Africa (SSA). According GAIN et al (2020), under five children and women are more susceptible to poor health outcomes resulting from micronutrient deficiencies. One common micronutrient deficiency is Vitamin A deficiency (VAD). VAD is high in low-income countries affecting approximately 190 million under five children and 190 million women. The consequences of poor nutritional status can include poor eyesight, cognitive underdevelopment and mortality from diarrhea and measles in under five children (Dhillon, 2010). For women of reproductive age, VAD, increases the risk of mortality during child delivery and increases the risk of micronutrient deficiency in newborn infants.

Nevertheless, for under five children, appropriate infant and young child feeding practices are equally essential for growth and development. According to WHO, the first two years of a human life are very critical, as a child this age is vulnerable to malnutrition and deaths due to inappropriate feeding practices (GAIN *et al* 2020). The World Health Organisation (WHO) and United Nations Children Fund (UNICEF) developed the infant- and young child-feeding strategy guide which recommends early initial breastfeeding within an hour, exclusive breastfeeding for the first six months of life, continual breastfeeding for two years, dietary diversification and age-appropriate complementary feeding starting at six months. Vitamin A in breast milk is adequate to supply infants with Vitamin A needs for the first 6 months of life. However, in low-income countries breast milk volume and vitamin A content are suboptimal and not sufficient for infants to maintain adequate vitamin A levels although exclusively breastfed. Although there has been substantial

improvement in VAD (60% to 4%), VAD still remains an underlying cause of early childhood deaths.

Adverse effects of MND and undernutrition can be prevented through timely introduction of nutrition intervention (Menon et al., 2018). Correspondingly, improving nutrition status for the population has been the goal for both the public and private sectors in Malawi (Maru, 2017). There are several strategies that can be used to ensure that household members obtain adequate amounts of micronutrients; supplementation, industrial fortification, and diversification of diets are some of them (Dhillon, 2010). However, high cost of funding an effective nation-wide supplementation outreach program makes supplementation approach costly and unproductive. In additional, in the case of Vitamin A Deficiency, high-dose supplementation alone is not sufficient to eliminate VAD, as it needs to be accompanied by nutrition and health intervention programs such as increase consumption of micronutrient dense food and dietary diversification (Bhutta et al, 2013).

To improve vitamin A deficiency and undernutrition in Malawi government and non-governmental organizations have supported the development and dissemination of OFSP varieties since 2009 to date. Mainly focusing on under five children and women of childbearing age (caregivers) in smallholder farm households. Non-Governmental Organizations (NGOs) include International Potato Center (CIP), USAID, Irish Aid, Concern Worldwide and Catholic Development Commission in Malawi (CADECOM) just to mention a few. These have been working with farmers, mothers and caregivers to improve the nutrition status of households in Malawi through Orange Fleshed Sweetpotato production (OFSP) (Mwanga & Ssemakula, 2011). The increasing importance of sweetpotato is largely emphasized due to its high productivity across different environments, its short cropping season, and flexible planting and harvesting schedules (Low *et*

al., 2000). In nutritional terms, sweetpotatoes, particularly orange fleshed are good sources of Vitamin A (Caeiro &Vicente, 2015). This is basically what differentiate OFSP from other types of sweetpotatoes. OFSP contain beta carotene which is converted to Vitamin A in the body after consumption (CIP & CGIAR, 2018).

1.1.1 OFSP intervention

CIP in particular partners with the government, Non-Governmental organizations, Smallholder farmers and Districts Agricultural Development Offices, to improve nutrition security and Vitamin A deficiency through OFSP production and consumption. In detail, CIP in partnership with other organizations, supply high quality OFSP vines and agricultural-nutritional education to smallholder farmers, mothers, and caregivers. This approach aims as at increasing the production and consumption OFSP, improve farmer income and improve child and maternal nutrition.

There has been a total of six OFSP projects over the years. Depending on the project objectives, care groups, farmers groups or associations, youth clubs, women groups, school feeding programs, and other extension approaches have been used as a platform for disseminating agricultural nutrition education. In additional for improvement in OFSP production, CIP, developed mother baby trial clubs (MBT) where varietal performance and recommended agronomic practices are taught and encouraged. Messages on the nutritional benefits of OFSP are also disseminated via the MBT (Gatto et al 2021)

However, this thesis focused on the Root and Tuber Crop Project (RTC-ACTION) Project, which builds on the predecessor Rooting Out Hunger (ROH). RTC-action project has over the last six years targeted households in Southern Malawi with interventions that include: vine dissemination, agronomic training, nutrition education and counselling, nutrition sensitization, market linkages and value chains for some of the nutritious staples. Basically, vine dissemination and agronomic

training is aimed at ensuring that cheaper source of Vitamin A is widely available and accessible to vulnerable households from own farms. Nutrition education and counselling is aimed at helping families adopt a food-basket approach that promotes dietary diversification as well as households that adopt optimal feeding practices. Lastly, market linkages and value chain development aim at improving household incomes and access to nutritious and diverse market-traded foods.

However, since the inception of the (RTC) in Malawi, literature remains blurred on whether OFSP interventions have nutrition impact on the targeted population. Hence, this study intends to contribute to the orange fleshed sweetpotato research industry by analyzing the impact of participating in OFSP focused nutrition education on nutrition knowledge, infant and young child feeding practices, dietary diversity and consumption of Vitamin A rich food.

Table 1.1.: OFSP project

No	Project	Start	End	Region
1	SUSTAIN I	2014	2017	North, central, south
2	SUSTAIN II	2018	2019	North Central
3	MISST	2015	2019	Central, South
4	Routing out of hunger	2009	2016	Central, South
5	Diversify	2017	2020	South
6	RTC-action	2016	2021	South

1.2.Problem Statement

Adequate and balanced nutrition is important for a healthy society, as a strong and healthy people help in developing the society both economically and social. It is believed that nutrition education for Mothers and caregivers not only positively affects their nutrition knowledge but also contributes to the development of behaviors that can promote healthy families and societies. Hence good nutrition knowledge of mothers and caregiver's Implies optimal feeding practices for the whole family.

However, there are mixed results on impact of nutrition education. Empirical evidence on this subject matter from countries other than Malawi provide mixed results on the correlation between agriculture nutrition intervention and dietary diversity, infant and young child feeding practices, nutrition knowledge and consumption of Vitamin A rich food (see. Shikuku *et al.,* 2019; Grant, *et al,* 2019; Kwikiriza *et al.,* 2015; Manikyamba *et al.,* 2015). In Malawi, however, an empirical question is whether such nutrition education intervention can significantly enhance nutrition outcomes and how is it impacting on dietary diversity and IYCF among the beneficiary households. There is little evidence in the country on the same mainly because orange fleshed sweetpotato is a developing crop and less rigorous research has been conducted.

In Tanzania, Grant *et al.* (2019), reported that the intervention has a positive impact on production and consumption of OFSP. Otieno *et al.* (2019) also found positive relationship between nutrition education and Vitamin A retention. Similarly, Manikyamba *et al.* (2015) found positive relationship between nutrition education and dietary diversity. However, while nutrition education enhanced adoption of OFSP in Mozambique and Uganda, nutrition knowledge seemed to be insignificant. Conversely, Kwikiriza *et al.* (2015) reported that although the campaigns

significantly increased knowledge of OFSP as a Vitamin A source, it did not have any impact on food security and dietary diversity.

Given inconsistent evidence from other countries and lack of empirical evidence in Malawi, it is irrational to make conclusions about Malawi based on the results from other countries. In view of this, it is important to conduct the study of the impact of OFSP focused nutrition education intervention on nutrition knowledge, dietary diversity, infant and young child feeding practices and consumption of Vitamin A rich food in Malawi. In addition, Abidin *et al.* (2017) reported that sweetpotato is an "orphaned" crop, one that has been given little research attention hence more research has to be done in this field to increase its production and consumption levels.

1.3.Research Objectives.

1.3.1. Main Objective

The main objective of this M.Sc. thesis research is to assess the effect of OFSP focused nutrition education interventions on nutrition knowledge, infant and young child feeding (IYCF) practices, dietary diversity, and consumption of Vitamin A rich food.

1.3.2. Specific objectives

i) To analyse the effect of OFSP-focused nutrition education project on nutrition knowledge.

ii) To analyse the effect of OFSP focused nutrition education on number of recommended infant and young child feeding practices

iii) To analyse the impact of participation in OFSP-project on dietary diversity of women of Reproductive age.

iv) To analyse the impact of OFSP-project on caregiver and child consumption of Vitamin A rich food.

1.4.Research Questions

The study will address the following research questions:

i) Does participation in OFSP-focused nutrition education affect nutrition knowledge?

ii) Does OFSP focused nutrition education effect the application of optimal infant and young child feeding practices by mothers?

iii) Does participating in OFSP-project have an impact on dietary diversity of women of reproductive age.

iv) Does participating in OFSP-project have an impact on caregiver and child consumption of Vitamin A rich food?

1.5.Justification

Optimal Infant and Young Child Feeding (IYCF) in the first year could prevent almost one fifth of deaths in children under five years of age, saving the lives of over 8 million children by optimal breastfeeding alone. However, the global IYCF indicators are still at suboptimal level. Previous research has established the importance of nutrition education to improve maternal knowledge about IYCF practices and consequently nutritional status of infants and young children. Since the introduction of OFSP focused nutrition education in Malawi, less rigours research has been done on the subject matter. Henceforth, it is important to analyse if participating in OFSP project is an effective strategy for improvement in infant and young child feeding practices in Malawi. In addition, Vitamin A deficiency and undernutrition are the cause of 10% death in under five children hence there is need to assess the consumption of vitamin A rich food and dietary diversification patterns in Malawi to come up with better strategies of improving undernutrition in Malawi.

The findings will provide literature for subsequent research in the orange fleshed sweetpotatoes industry not only in Malawi, but also in other sweetpotato producing regions around the world (Abidin *et al,* 2017). Furthermore, the study will fill in the gap in literature. Finally, it is important to conduct the study of impact of participating in OFSP project on nutrition knowledge, IFYCP, dietary diversity and consumption of Vitamin A rich foods in Malawi in order to understand if the OFSP interventions are making transformations in the country like they have done in other countries such as Kenya and Tanzania. This will help in assessing whether scaling up or replicating the project in other parts of the country is feasible.

1.6.Thesis Organization

This thesis has been organized into six chapters. Chapter one presents an introduction background which highlights the problem statement, objectives and justification of the study. Chapter two presents literature review on IYCF, Nutrition knowledge, dietary diversity, and consumption of vitamin A rich food. The chapter highlights terminologies used in this study as well as the research gaps in the nexus of OFSP interventions and IYCF and dietary diversity. Chapter three describes the methodology employed in this study. The chapter focuses on conceptual framework, theoretical framework, empirical framework, data sources, and analytical technics. Chapter five presents the results and discussion and finally chapter six presents conclusion and recommendations.

CHAPTER TWO

2.0.LITERATURE REVIEW

2.1.Micronutrient Deficiency

Undernutrition is a major contributor of global morbidity and mortality in children. Children who are poorly fed in early years of life are at an increased risk of being malnourished (WHO, 2009). Primarily, undernutrition is caused by poor diversity of diets which is a major problem in Africa. Following Koppmair et al., (2016), in many sub-Saharan African countries only less than one-quarter of infants are reported to have better dietary diversity levels.

Similarly, in Malawi, malnutrition rates among infants and young children have consistently remained high, more especially in the southern region (Gerosomo, 2017). people lack adequate knowledge of food choices, childcare, and optimal feeding practices (Kalima 2019). In 2015‑2016, the prevalence of under nutrition was so high indicating that under nutrition is a chronic public health problem. Equally, National Statistical Office, 2017, revealed that only 25% of breastfed children had an adequately diverse diet and 29% had been fed the minimum number of times appropriate for their age. These percentages are low indicating the need to improve infant and young child feeding practices in Malawi.

2.2.Infant and Young Child Feeding Practices

Improving infant and young child feeding practices in children between 0–23 months of age is critical to improved nutrition and health (WHO, 2008). Optimal Infant and Young Child Feeding practices in the first year of life could save approximately 8millions preschool children through breastfeeding alone. There are eight core indicators of infant and young child feeding practices these are (i) Early initiation of breastfeeding, (ii)Exclusive breastfeeding for 6 months,

(iii)Continued breastfeeding at 1 year, (iv) Complementary feeding, (v) Minimum dietary diversity, (vi)Minimum meal frequency, (vii) Minimum acceptable diet, (viii) Consumption of iron-rich or iron-fortified foods (WHO, 2010)

Early initiation of breastfeeding is Proportion of children born in the last 24 months who were put to the breast within one hour of birth. Exclusive breastfeeding for 6 months is the Proportion of infants 0–6 months of age who are fed exclusively with breast milk. Continued breastfeeding at 1 year is the Proportion of children 12–15 months of age who are fed breast milk (WHO, 2009). Complementary feeding is the Proportion of infants 6–8 months of age who receive solid, semi-solid or soft foods.

Minimum meal frequency is defined as being fed solid or semisolid foods the minimum number of times per day based on a child's age. For breastfed children, this is twice for 6–8 months, three times for 9 to 23 months; non breastfed children should be fed four or more times per day. Minimum dietary diversity is defined as being fed 4 or more food groups per day (WHO, 2009). Diet Diversity (DD) assesses the number of different food groups consumed by a person or group of people over a given period of time day. Thus, the diversity of an individual's diet reflects their economic ability to access a varied diet. last but not least, a minimally acceptable diet is met for breastfed children if they were fed three or more food groups and were fed the age-specific minimum number of times per day (≥2 for children 6–8 months ≥ 3 for children ages 9–23 months). Lastly, Consumption of iron-rich or iron-fortified foods is proportion of children consuming iron rich foods (WHO, 2009).

It has been noted that that children who do not practice these 8 core indicators of infant and young child feeding become stunted, develop micronutrient deficiencies, and have common childhood illnesses. However, globally IYCF indicators are still at suboptimal level, with less than half being

exclusively breastfed and less than quarter achieving the dietary diversity level and practicing age-appropriate feeding (Kohli and Chadha, 2017). Malawi is no different, only 59.4% of infants 0-5 months are exclusively breastfed. In addition, age-appropriate feeding and dietary diversity is low with only14.3% and 24.5% respectively, practicing the two (WHO, 2017; UNICEF, 2020)). Nevertheless, according to Walsh, Dannhauser & Joubert, 2003, poor knowledge of optimal nutrition practices is one of the causes of poor feeding practices, inadequate food intake, unhygienic dietary diversity in households. However, following AFIKEPO, 2020, only 42% of women have high knowledge score toward infant feeding. nutrition knowledge has a major bearing on decisions related to agriculture and nutrition that are made within households by affecting decisions around food production, purchase, and consumption. These decisions may enhance positive outcomes for both the agriculture and nutrition sectors while avoiding negative impacts (Pauw, ecker & Verduzco-Gallo, 2018)

2.3.Orange Fleshed Sweetpotato Production

Sweetpotato (Ipomoea batatas) also known as potato is one of the high yielding crops with total production per unit area greater than other staple food crops such as maize, millet and rice **(**Mukras et al., 2013). Sweetpotato originated from tropical Central America. Because of its tropical origin, sweet potatoes adapt well to warm climates and well-drained sandy loam soil. The optimum temperature to achieve the best growth of sweetpotatoes is between 21 and 29 0C, although they can tolerate temperatures as low as 18 0C and as high as 35 0C (Department of Agriculture, Forestry and Fisheries South Africa, 2011). In addition, sweetpotatoes are less labor intensive than most other staple crops such as maize. Sweetpotato is a root and tuber crop as such vines are used when planting rather than seeds (Low et al., 2007).

Sweetpotato (Ipomoea batatas (L.) Lam.), known as Mbatata in Malawi is mainly consumed unprocessed. Sweet potato has a short production cycle (3-4 months) depending on the type of sweet potato. In Malawi sweetpotatoes have two growing seasons. One for rain fed and another through irrigation. The main growing season is November to March then for irrigation is from July to September. Its roots and vines can be used for both human and animal consumption. The roots (Mbatata) are consumed mostly through boiling and mainly for breakfast. While the leaves are consumed as relish (kholowa).

For the past decade, most varieties in Africa were white flesh, however this type lack beta-carotene which contains high Vitamin A (Hotz et al., 2013). In order to improve this situation a biofortified crop known as orange fleshed sweetpotato was introduced so as to reduce micronutrient deficiencies (Low et al, 2007). Orange-fleshed sweetpotatoes are rich in beta-carotene which is an organic, red-orange pigment abundant in plants and fruits. Beta-carotene is what gives OFSP an orange color and is converted to Vitamin A in the body after consumption to provide additional nutritional benefits (maru, 2017)

Research efforts are ongoing to disseminate early maturing, high-yielding, Vitamin A–rich sweetpotato varieties to ensure improvement in food and nutrition needs of the growing population. One of the main NGOs facilitating the interventions of orange flesh sweetpotatoes is the International Potato Centre (CIP). The main goal is to increase adoption of OFSP and consumption of Vitamin-A-rich foods (Hagenimana & Low, 2000). To achieve this, CIP implements nutrition education and provides high quality vines to rural areas. The main OFSP varieties are Chipika, Kadyaubwerere, Kaphulira, Mathuthu, Anaakwanire, and Zondeni varieties. Mainly, the project is focused in southern Malawi, where there is high sweet potato production.

2.4.Impact of Orange Fleshed Sweetpotato Interventions

There have been several studies analyzing the impact of OFSP intervention across Africa. The results however, have shown different conclusion on the impact of OFSP interventions. Following, Makama et al, (2014), production of OFSP has an impact on food security and poverty elevation. This is because households earn money though production OFSP which improves their livelihood situations. This is in conjunction with Grant, et al, (2019), who reported that the intervention has a positive impact on production and consumption of OFSP as well as on caregiver's nutrition knowledge. Hence, the project significantly improved both food security and dietary diversity among beneficiary households.

Shikuku et al., (2019), on the other hand, found that OFSP interventions have a positive impact on food security but not dietary diversity. Meaning that, indeed households that received training had better food security levels than those that did not. However, this did not translate to improvement in their diet choices and nutrition status. This is in agreement with Kwikiriza et al., (2015), who found that nutrition education increases nutrition knowledge but does not have an impact on food security and dietary diversity. Hence more studies need to be done in these areas.

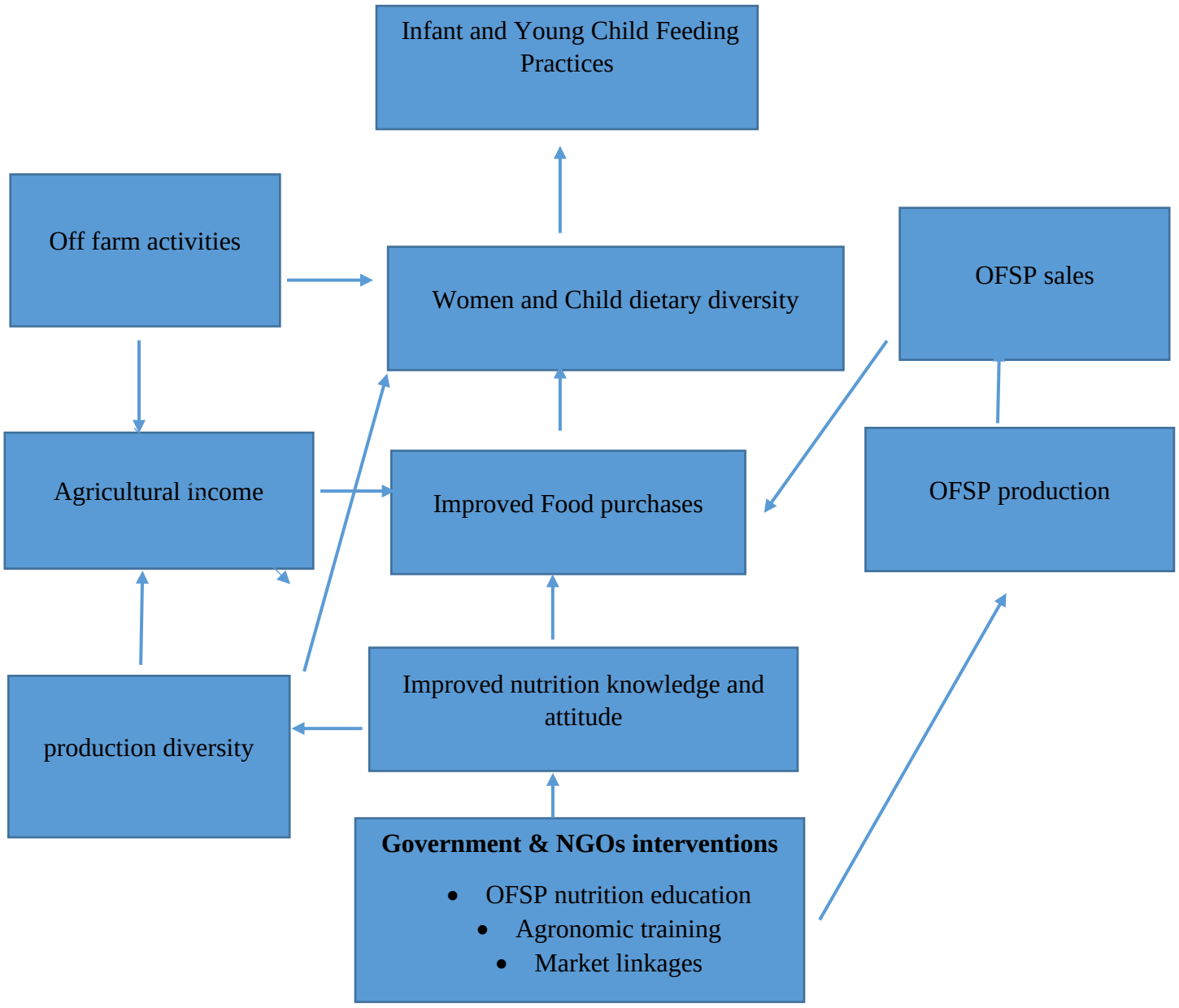
CHAPTER THREE

3.0.METHODOLOGY

3.1.Nutrition Security and Food Security Conceptual Framework

The study uses the agriculture to nutrition pathway to explain how to measure impact of agricultural nutrition intervention. According to Kadiyala *et al.,* (2014), merely producing more food does not ensure food security or improved nutrition and diet diversity. Pathway from agriculture to Nutrition Recognizes that growing more food is necessary but not sufficient to achieve good nutrition and health security as such there are other factors that influence the achievement of good nutrition by a household.

The logic behind agriculture to nutrition pathways is that agriculture can influence nutrition and health through multiple pathways (direct and indirect). Thus, agriculture can affect nutrition through access to adequate food (food security), food diversity, and improved infant and young child feeding practices. Figure 1 below illustrates the agriculture to nutrition pathways.



Source: Author

Figure 3.1: Agriculture to nutrition pathways

In this study we conceptualize that participating in OFSP nutrition education would lead to improved dietary diversity and infant and young child feeding practices directly and indirectly. Indirectly, OFSP intervention will ensure that farmers have positive attitude and knowledge towards nutrition. This would have an impact on crop production choices. According to Sibhatu (2015), production diversity has an impact on dietary diversity. Hence in the long run the intervention will have an impact on women and child dietary diversity which leads to improve maternal infant and young child practices. Following Eyenew (2017) production diversity significantly increases dietary diversity. This is because, most smallholder farmers consume a larger proportion of food produced at the farm. On the other hand, the intervention will directly improve dietary diversity through improved nutrition knowledge which will lead to improved food purchases which will eventually improve dietary diversity and infant and young child feeding practices (Manikyamba *et al*, 2015; Muthee, 2018). The intervention will also improve production of OFSP which will increase income generated by OFSP producers (Epeju & Rukundo, 2017). This will enable farmers afford other diverse nutritious foods.

In summary, agriculture to nutrition pathways in this study can be understood in terms of impact of agriculture intervention on (1) food for own consumption, (2) nutrition knowledge (3) Production diversity 4) dietary diversity 5) infant and young child feeding practices.

3.2.Theoretical Framework.

3.2.1. Random utility theory

The study borrows the random utility theory to understand the impact of OFSP nutrition education intervention on dietary diversity, nutrition knowledge and infant and young child feeding practices. The theory states that the preference of an individual among the available alternatives is described by a utility function. As such an individual chooses the alternative with the highest utility. In the

case of orange fleshed sweetpotato nutrition education intervention, the farmers' decision to participate depends on the utility they will obtain from participating. A farmer *i*, making decision about OFSP intervention earns a utility function:

$\mu\_ij = X\text{^}' \beta\_ij + \varepsilon\_ij$……1

A farmer is assumed to be a rational being hence will decide to participate in OFSP education nutrition intervention if their expected utility obtained from participating exceeds the utility of not participating. (Greene 2003).

$\mu\text{^} * = \mu\_i1 - \mu_{i0}$……...2

Where

μ^* is the farmers expected utility,

$\mu_{i1}$is the utility obtained from participating in orange fleshed sweetpotato nutrition education

μ_{i0} is the utility obtained from not participating in orange fleshed sweetpotato nutrition education

The utility motivating farmer's decision to participate in sweetpotato nutrition education is that it will improve the dietary diversity and maternal infant and young child feeding practices.

3.3.Model Specification

3.3.1. First objective: Effect of nutrition education on nutrition knowledge

In this study, knowledge was defined as an individual's understanding of nutrition, including the intellectual ability to remember and recall food and nutrition related terminology, specific pieces of information and facts. A structured nutrition knowledge questionnaire was developed to assess the impact of the intervention on nutrition related knowledge. The questionnaire included a series of questions that captured participant's knowledge and practices taught during the nutrition education interventions. The main key indicators of nutrition knowledge in this study were classified as familiarity with: ,1) basic food groups knowledge, 2)Importance of Vitamin A knowledge, 3) Introduction of water to infants knowledge, 4) Introduction of solid and semi-

solid Food to infants Knowledge 5) introduction of sweetpotato to infant's knowledge, 6) when to stop breastfeeding knowledge, 7) food rich in Vitamin A knowledge, 8) meal frequency baby knowledge, 9) meal frequency six to eight months child knowledge, 10) meal frequency nine to 23 three months child knowledge, 11) pregnant woman consumption rate knowledge, 12) heard of Vitamin A, 13) importance of first breast milk knowledge and 14) healthy food knowledge.

Respondent was given a score of 1 if she knows the correct answer to a question regarding nutrition facts and 0 otherwise. Thus, number of correct answers by each respondent was tallied. Poisson regression method was used to examine the effect of project participation on knowledge whereby number of correct nutrition answers given by each respondent was the dependent variable and participating in OFSP nutrition education was the independent variable.

The poisson probability mass function of Y_i given x_i is given by

$$P\{y_i = y|x_i\} = \frac{exp\{-\lambda_i\}\lambda_i^y}{y!}, \qquad y = 0,1,2, \ldots, \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots 3$$

The Poisson regression is expressed as follows (Yang& Berdine, 2015):

$$E(Y_i|X_i, \mathcal{E}) = exp(a + X'B + \varepsilon)\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots 4$$

Where

Y_i is the dependent variable representing Nutrition Knowledge.

X_i is a vector of independent variable representing caregroup participation, age of head, ender of head, age of woman, Education of woman, Education of head, nutrition information sources, ownership of phone, ownership of TV, ownership of radio, ownership of bicycle, distance to farm groups, distance to market and distance to health facilities

β is the coefficient of the independent variables, α is the constant, λ is the mean and ε is the error term

Poisson regression was chosen because the dependent variable is a continuous and non-negative count variable. The study tested whether the (conditional) mean of the dependent variable is equal to the (conditional) variance hence the choice of either using negative binomial or Poisson distribution was made.

The Poisson distribution automatically implies that the conditional variance of y_i is also equal to mean (λ_i) as shown in equation

$$V\{y_i|x_i\} = \lambda_i = exp\{x'_i\beta\} \quad \text{..... 5}$$

3.3.2. Second Objective: Effect of OFSP focused nutrition education on infant and young child feeding practices

The study used a 24-h recall data to construct World Health Organization indicators for IYCF, namely:(i) Early initiation of breastfeeding, (ii) exclusive breastfeeding for 6 months, (iii) continued breastfeeding at 1 year, (iv) introduction of solid, semi-solid or soft foods, (v) minimum dietary diversity, (vi) minimum meal frequency, (vii) minimum acceptable diet, (viii) consumption of iron-rich or iron-fortified foods (WHO, 2010). Number of IYCF for each child was calculated. Poisson regression was used to understand the effect of nutrition education on number of recommended infant and young child feeding practices. The dependent variable is the number of IYCF practices and participation in nutrition education will be the independent variable

The study also determined the relationship between production (crop and animals) diversity and infant and young child feeding practices. The number of crops grown and animals raised by the household was calculated and used to determine the relationship between production diversity and

infant and young child feeding practices. A common indicator of production diversity on a farm is a simple count of the different species produced (Sibhatu et al., 2015). However, since the study is focusing on nutrition, production diversity score was calculated by counting the number of food groups produced by the household (Sibhatu &Qaim, 2016). Hence, if a farmer produces several species that belong to the same food groups, the production diversity score was one and zero was given to nonfood crops. Twelve food groups were adopted since the study is looking at production diversity of the household. The twelve groups were adopted from household dietary diversity.

Finally, the study also analysed the effect of off farm income on infant and young child feeding. Rural off-farm activities represent an income stream which might affect infant and young child feeding practices.

The Poisson regression is expressed as follows

$$E(Y_i|X_i, \mathcal{E})=exp(a + X'B + \varepsilon) \quad \text{.....6}$$

Where

Y_i is the dependent variable representing number of recommended infant and young child feeding practices.

X_i is a vector of independent variable representing caregroup participation, nutrition knowledge, production diversity, off farm income, age of head, gender of head, age of woman, Education of woman, Education of head, nutrition information sources, ownership of phone, ownership of TV, ownership of radio, ownership of bicycle, distance to farm groups, distance to market and distance to health facilities

β is the coefficient of the independent variables, α is the constant, λ is the mean and ε is the error term

3.3.3. Third Objective: Impact of OFSP project participation on dietary diversity of women of reproductive age.

Dietary diversity indicator for women of reproductive age was measured using 24hr recall period approach. The DDS-W measures women micronutrient intake hence assessing the adequacy of micronutrient intakes (FAO&FHI 360, 2016). The following 10 food groups were used to calculate the DDS-W indicator.

Table 3.1: DDS-W Food Groups

Description	Food group	Score
A	Grain, Roots and tubers	0, 1
B	Pulses (beans, peas and lentils)	0, 1
C	Nuts and seeds	0.1
D	Dairy	0.1
E	Meat, poultry& fish, organic meat)	0, 1
F	Eggs	0, 1
G	Vitamin A rich vegetables& fruits	0, 1
H	Dark green leafy vegetables	0,1
I	Other vegetables	0,1
J	Other fruits	0,1

Source: FAO & FHI 360, 2016

Each food group was assigned a score of 1 (if consumed) or 0 (if not consumed). The score ranges from 0 to 10. Zero meaning did not consume any of the food groups and ten meaning the women consumed all food groups. The Dietary Diversity indicator for women of reproductive age was calculated as follows (Swidale & Bilinsky, 2006):

$$\mathrm{DDS}-\mathrm{W}\ =\mathrm{SUM}(\mathrm{A}+\mathrm{B}+\mathrm{C}+\mathrm{D}+\mathrm{E}+\mathrm{F}+\mathrm{G}+\mathrm{H}+\mathrm{I}+\mathrm{J}) \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots 7$$

$$\text{Average DDS}-\mathrm{W}=\frac{\text{Total DDS}-\text{W for the population}}{\text{Total number of women}} \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots 8$$

A threshold of 5 out of 10 food groups is applied for dietary intake of women. If the aggregate dietary diversity score is equal to, or greater than, 5, then the DDS-W=1. If the DDS-W < 5, then the DDS-W=0. DDS-W scores of 1 and 0 indicate adequate and inadequate micronutrient intake, respectively (FAO&FHI 360, 2016). Hence the DDS-W was categories as follows:

Table 3.2:DDS-W Classifications

Classification	**Score**	**DDS-W**
Inadequate micronutrient intake	0-4	0
adequate micronutrient intake	5-10	1

Source: FAO&FHI 360, 2016

To analyse the impact of the intervention on dietary diversity difference in difference method was used. Where by the treatment group was compared against the control group to analyse if there is a difference in dietary diversity levels**.**

Impact of the OFSP agricultural nutrition interventions on dietary diversity was analysed as follows (Heckman et al., 1999):

$DID = (\grave{Y}_{T,2} - \grave{Y}_{T,1}) - (\grave{Y}_{C,2} - \grave{Y}_{C,1})$……9

Where

DID is the difference in differences between the treated and the control in terms of dietary diversity.

$\grave{Y}_{T,1}$ Dietary diversity levels of the treatment group in 2017 before intervention

$\grave{Y}_{T,2}$ Dietary diversity levels of the treatment group in 2020 after intervention

$\grave{Y}_{C,1}$ Dietary diversity levels of the control group in 2017 before intervention

$\grave{Y}_{C,2}$ Dietary diversity levels of the control group in 2020 after intervention

Table 3.3: Difference in Difference Approach

Year	Treatment group	Control group	DID
2020	Dietary diversity 1	Dietary diversity1	?
2017	Dietary diversity 2	Dietary diversity 2	?
DID	?	?	?

$Y_i = \beta_0 + \beta_1 TRT_i + \beta_2 AFT_i + \beta_3 TRT_i * AFT_i + \varepsilon_i$……10

Where

TRT = 1 if in treatment group, = 0 if in control group …….11

AFT = 1 if after intervention, = 0 if before intervention ……..12

TRT*AFT= interaction term of intervention group and either before and after intervention…13

ε_i= Error term……..14

3.3.4. Fourth objective: Impact on Child and Caregiver consumption of Vitamin A rich food

Hellen Keller frequency method was used to calculate Vitamin A rich food consumption. The method uses a 7day recall question about child and caregiver's consumption. Vitamin rich food are categorised into dark green vegetables, dark yellow or orange fruits, dark yellow or orange vegetables animal sources of food and foods fortified with vitamin A. The following food were used to understand consumption of vitamin A rich food

Table 3.4: Vitamin A rich food

Description	Item	Score
1	Any dark green leafy vegetables	1,0
2	Red palm oil	1,0
3	Carrots	1,0
4	Ripe mango	1,0
5	Pumpkin	1,0
6	Ripe papaw,	1,0
7	OFSP or Yellow-fleshed Sweetpotato	1,0

8	Eggs with Yolk	1,0
9	Fresh fish	1,0
10	Liver	1,0
11	Butter	1,0
12	Cod liver oil	1,0
13	Passion fruit	1,0
14	Vitamin A fortified margarine	1,0
15	Fortified Weaning food with vitamin A	1,0

Each food group was assigned a score of 1 (if consumed) or 0 (if not consumed). Vitamin A deficiency was calculated as follows (Keller, 2006):

Animal sources score = eggs + fish + liver + butter + cod liver oil + fortified weaning food + fortified margarin……15

Plant sources score = dark green vegetables + ripe mango + ripe pawpaw + carrot + Pumpkin + yellow or orange sweet potatoes + red palm oil + apricots……..16

Total score = Animal source score + $\frac{\text{plant source}}{6}$……17

Whether a study population is Vitamin A deficiency is determined by the following threshold: consumed less than or equal to 4 days per week for animal sources of vitamin A or consumed less than or equal to 6 days per week for total score.

Finally, to analyse the impact of the intervention on Consumption of vitamin A rich food Propensity score matching was used. ATT will be applied to measure the effect of OFSP project on consumption of Vitamin A rich food. ATT is given by:

$$ATT_{PSM} = E_{P(X)|D=1}\{E[Y_1|D=1, P(X)] - E[Y_0|D=0, P(X)]\} \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots 18$$

Where Y_1 and Y_0 are total vitamin A scores (outcome variable) for participants and non-participants, respectively. D denotes OFSP project participation, and it represents 1 for participants and 0 for non-participants, X is a set of covariates expected to affect participation. $E_{P(X)|D=1}$ is the expected probability with regards to the calculated propensity scores. Therefore, ATT_{PSM} gives the effect of participation on the outcome variable o on the control and treatment group subject to the given set of covariates.

According to Caliendo & Bonn (2008) implementation of PSM recommends the following steps to be followed, (i)estimating propensity scores, (ii)choosing a good matching algorithm, (iii) checking for overlap/common support, (iv) matching quality/effect estimation, and (v) sensitivity analysis. Hence below describes the analysis results for each step of propensity score matching. Hence the study applies the process for both child and caregivers.

3.4.Description of Variables

Table 3.5: Description of Variables used in the study

Variable	Description	Measurement	Sign
Nutrition knowledge	Number of Nutrition facts correctly stated out of 14 indicators	Count	+

IYCFP	Number of recommended maternal Infant and young child feeding practices (MIYCFP) followed out of 9 practices	Count	+
DDS-W	Number of food groups consumed by a woman of reproductive age(15-45yrs) out of the possible 10 food groups	Score	+
Farmer specific variables			
Age of woman	Age of respondent (woman)	Years	+/
Age head	Age of head	Years	+
Age Child	Age of child	Months	+
Gender head	Gender of the household head	Dummy 1= Male, 0= Female	+
Education woman	Number of years of formal education of mother	Years	+
Education head	Number of years of formal education of head of household	Years	+
Off farm income	Non-farm related income	Kwacha	+
Nutrition information sources	Where household get nutrition information	1=radio, 2=open days 3=community health surveillance, 4=government extension workers, 5=Ngo extension workers 6=family and friends	+
Ownership of phone	Whether there is a phone in the household	1=yes, 0=no	+
Ownership of radio	Whether there is a radio in the household	1=yes, 0=no	+

Ownership of Television	Whether there is a television in the household	1=yes, 0=no	+
Ownership of bicycle	Whether there is a bicycle in the household	1=yes, 0=no	+
Farm factors			
Production diversity	Number of food groups grown by the household out of possible 12 from HDDS	Score	+
Nutrition factors			
DDS-W threshold	Dummy variable for whether a woman of reproductive age consumed 5 out of 10 food groups	1=yes, 0=no	+
MDD	Number of food groups consumed by a child aged 6-23 months out of the possible 8 food groups	Score	+
Infant and you child feeding practices indicator			
MDD threshold	Whether a child has consumed 4 out possible 7food groups	1=yes, 0=no	+
Early Initial Breastfeeding	Whether children born in the last 24 months who were put to the breast within one hour of birth	1=Yes, 0=No	+
Exclusive Breast Feeding	Whether infants 0–6 months of age were fed exclusively with breast milk.	1=Yes, 0=No	+
Continued Breastfeeding at I year old	Whether children 12–15 months of age were fed breast milk	1=Yes, 0=No	+

Introduction of Solid and semisolid Food	Whether Infants 6–8 months of age received solid, semi-solid or soft foods.	1=Yes, 0=No	+
Minimum Meal Frequency-six_8months	Whether breastfed children 6-8 months were fed solid or semisolid foods the minimum number of times per day based on a child's age.	1=Yes, 0=No	+
Minimum Meal Frequency-nine_23	Whether breastfed children 9-23 months were fed solid or semisolid foods the minimum number of times per day based on a child's age.	1=Yes, 0=No	+
Minimum Meal Frequency-6_23nonbreastfed	Whether no breastfed children 6-23 months were fed solid or semisolid foods the minimum number of times per day based on a child's age.	1=Yes, 0=No	
Minimum Mealfrequency6 -23	Whether children 6-23 months were fed solid or semisolid foods the minimum number of times per day based on a child's age.	1=Yes, 0=No	
Minimum Acceptable Diet	Whether Children 6-23months were fed three or more food groups and were fed the age-specific minimum number of times per day	1=Yes, 0=No	+
Consumption of iron rich food	Whether children 6-23 consumed iron rich foods	1=Yes, 0=No	+

Nutrition knowledge Indicators			
Basic food groups knowledge	Whether the woman know any food groups	1=Yes, 0=No	+
Importance of vitamin A Knowledge	Whether the woman know the importance of Vitamin A	1=Yes, 0=No	+
First time introduction of Water Knowledge	Whether the woman know when to introduce water to infants	1=Yes, 0=No	+
Introduction solid semisolid knowledge	Whether the woman know when to introduce solid and semi solid food to children	1=Yes, 0=No	+
Sweetpotato first time knowledge	Whether the woman know when to introduce consumption of Sweetpotato to children	1=Yes, 0=No	+
Stop breastfeeding Knowledge	Whether the woman know when to stop breastfeeding	1=Yes, 0=No	+
Food with vitamin A knowledge	Whether the woman know food that contain Vitamin A	1=Yes, 0=No	+
Meal frequency baby	Whether the woman know meal frequency for a child less than six months	1=Yes, 0=No	+
Meal frequency six_eight months	Whether the woman know meal frequency for a child six to nine months	1=Yes, 0=No	+
mealfrequency_nine_23months	Whether the woman know meal frequency for a child nine to twenty-three months	1=Yes, 0=No	+
Pregnant women eat less or more Knowledge	Whether the woman know whether to eat more of less when pregnant	1=Yes, 0=No	+
Heard of Vitamin A Knowledge	Whether the woman has ever heard of Vitamin A	1=Yes, 0=No	+

Heathier between bread and Sweetpotato knowledge	Whether the woman know which one is heathy between bread and Sweetpotato	1=Yes, 0=No	+
First breastmilk is good or bad knowledge	Whether the woman know if its good or bad to give a baby the first breastmilk	1=Yes, 0=No	+
Institutional factors			
Project participation	Dummy for Participation in OFSP project	1=Yes, 0=No	+
Care group participation	Dummy for Membership of care group	1=Yes, 0=No	+
Distance to market	Distance in Kilometer to market	Kilometers	+
Distance to farm group	Distance in Kilometer to farm group	Kilometers	+
Distance to health facility	Distance in minutes to health care facility	Minutes	+

3.5.Study Area and Focus

The study was conducted in Southern Malawi, specifically Zomba, Mulanje and Chikwawa Districts. These are some of the Districts where RTC-ACTION project has been implementing its activities with and without partners in nutrition intervention. Panel data was collected in all the three districts while crosection data was collected in Zomba and Mulanje this is because in Chikwawa had no caregroups.

3.6.Data Collection and Sources

The study used both primary and secondary data. The secondary data was collected in 2017 by International Potato Center under the Root and Tuber Crop (RTC) for agricultural transformation

in Malawi Project. The secondary data was used as baseline for panel analysis. The survey used the purposive sampling method to select three districts of Zomba, Mulanje and Chikwawa in Malawi. The baseline data contains information on farmers who received participate in the project and those that are not in the project.

Primary data was collected using a semi-structured questionnaire comprising both quantitative and qualitative questions. Thus, the study targeted households that received nutrition training and those that did not receive training. Receiving training was categorized into (i)participating in caregroup as a proxy for nutrition education, and (ii) participating in OFSP project. Participation in OFSP project was defined as household and/or caregiver: i) receiving vines of OFSP varieties, ii) taking part in nutrition education through mother baby trials. and iii) participation in value chain linkage activities. The treatment group were those that were in caregroup and a those that participated in OFSP project. The control group were those that did not participate in caregroup and OFSP project. Two sets of data were collected, one set from caregroup participants and non-participants and another group from OFSP project participants and non-participants.

3.7.Sample Size and Sampling Technique

Data used in this study was collected through a household survey of 360 randomly selected households stratified by participation in the RTC-ACTION project. That is, the respondents were drawn from households that have participated in the project and those which have not, and their outcomes compared. Data was collected using personal interviews (subject to the COVID-19 situation) and were at caregiver and household levels. 130 households were interviewed for panel data set and also 230 households for new data set.

Table 3.6: sample size

District	EPA	care groups (cross-sectional)	Care group control farmers (cross-sectional)	Panel group farmers	Panel Control group farmers	Total
Zomba	❖ Likangala ❖ Thondwe	60	30	40	20	**150**
Mulanje	❖ Thuchila ❖ Msikawanjala	60	30	40	20	**150**
Chikwawa	❖ Livunzu ❖ Mitole	-		40	20	**60**
TOTAL		**120**	**60**	**120**	**60**	***360***

Simple random sampling was used to selected households for interviews. In Zomba district, 150 farmers were interviewed, in Mulanje, also 150 farmers were interviewed while in Chikwawa 60 participants were interviewed making a total of 360 households. Each district had two EPAs hence the sample size was shared equally for each EPA in each district. In Zomba, the study was conducted in Thondwe and Likangala EPAs, while in Mulanje the study was conducted in Msikawanjala and Thuchila EPAs. Finally, in Chikwawa the study was conducted in Livunzu and Mitole EPAs.

3.8.Analytical Methods

STATA and excel were used to analyze the data. Difference in difference method, Poisson regression and propensity score matching was used to answer the objectives. The data was checked for multicollinearity, and unobserved heterogeneity.

CHAPTER FOUR

4.0. RESULTS AND DISCUSSIONS

4.1. Introduction

This chapter presents results from the study conducted on Impact of participating in orange fleshed sweetpotato project on nutrition knowledge, infant and young child feeding practices, dietary diversity of women of reproductive age and consumption of Vitamin A rich food. The chapter is segregated into five sections. The first section discusses the descriptive results on the characteristics of households in this study. The descriptive results are intended to assist in understanding the social, economic characteristics of households by OFSP-project participation and Caregroup participation. The second section focused on effect of OFSP focused nutrition education on nutrition Knowledge. The third section focused on effect of OFSP focused nutrition education on Infant and Young Child Feeding Practices. The fourth section focuses on impact of OFSP project on Dietary diversity of Women of Reproductive Age. Lastly, section five focuses on the impact of OFSP project on consumption of Vitamin A rich food.

4.2. Descriptive Statistics

4.2.1. Socio-economic and demographic characteristics for continuous values

This section presents key demographic and socio-economic characteristics of the study population separated into OFSP- project participation and caregroup participation. The results in table 4.1 show that, overall, on average the head of household had 36.58 years of age with 7.77 years of schooling. On the other hand, the respondent(woman), on average had 32.27 years with 6.67 years of schooling. Age and Education are important in explaining decisions taken by individuals. According to Debelo, 2015, education and age can determine the adoption of agricultural practices by improving consciousness to handle and use relevant information wisely.

Results further show that, overall, on average household size was 5.38 members per household which is slightly higher than the national average of 4.4 members as per the 2018 National Census results. In addition, the study population had production diversity of 4.32 food groups out of 12 food groups, and earned on average MK136,307.8 from off farm activities. Furthermore, in terms of distance, on average, the distance to the nearest village market was 2.62km, distance to farm group was 9.10 km and it takes on average 71.67 minutes to reach the health center.

On the other hand, statistically, participants and non-participants were different in regarding to age of head, education of women, off-farm income, production diversity, distance to the nearest village market and distance to heathy center. In terms of OFSP-project, on average the participants diversified more than non-participants as shown by a production diversity of 4.66 and 4.03 food groups, respectively. The results further show that on average OFSP project participants stayed 0.92 km close to the village market as compared to non- participating.

Likewise, in terms of Caregroup, the mean age of head for non-participants was higher than for participants as shown by 37.81 and 35.18 years, respectively. Inaddition, the women in caregroup were 1.66 years more educated than those not in caregroup. The results further show that, on average caregroup participants diversified more than non-participants as shown by the production diversity of 4.5 and 4.16, respectively. caregroup participants earn MK 51,694.8 more from off farm activities as compared to non-participants. Lastly, table 4.1. further shows that statistically it takes on average 14.45 minutes less for caregroup participants to reach the health center than non-caregroup participants.

Table 4.1: Summary of socio-economic and demographic characteristics for continuous values

		OFSP PROJECT		*CAREGROUP*	
Variable	Overall (n=363)	Non-participants (n=167)	Participants (n=196)	Non-Participants (n=193)	Participants (n=170)
Age W	32.27 (9.06)	31.88(9.90)	32.72(9.06)	32.83(10.46)	31.63(7.14)
Age Head	36.58(10.17)	36.38(10.70)	36.81(9.54)	37.81(11.48) **	35.18(8.26) **
Education Level W	6.67(3.42)	6.70(3.78)	6.65(2.96)	5.89(3.41) ***	7.55(3.23) ***
Education level head	7.77(3.50)	7.72(2.83)	7.83(4.16)	7.65(2.87)	7.91(4.10)
HH size	5.38(1.74)	5.31(1.77)	5.46(1.77)	5.32(1.82)	5.45(1.67)
Off farm income	136307.8(228074.1)	118459.6(139229.2)	157255.4(228074.1)	112098.1(128990) **	163792.9(301812.4) **
Production diversity	4.32(1.33)	4.03(1.40) ***	4.66(1.33) ***	4.16(1.32) **	4.5(1.32) **
Dist-market	2.62(2.63)	3.05(2.87) ***	2.13(2.23) ***	2.71(2.74)	2.52(2.50)
Dist-farmer group	9.10(36.9)	8.43(26.51)	9.90(46.37)	10.63(45.70)	7.38(23.36)
Dist-health center	71.67(51.50)	73.74(49.38)	69.24(53.93)	78.41(49.90) ***	63.96(52.36) ***

Parentheses denotes Std. Dev. for continuous variables; * indicate t-test * Significant at 10% (p<0.1), ** significant at 5% (p<0.05), and *** significant at 1% (p<0.01)

A total of 363 households participated in this study. Looking at table 4.2, overall, 26.45% of the households were female headed households. According to Boogaard *et al.*, 2015 gender of the head plays a significant role in household decision making and household resource allocation. The results further shows that 69.15% owned a phone, 57.02% owned a bicycle, 39.12% of the households owned a radio and only 4.68% owned a TV. This is in line with NSO, 2018 result on the national household means of communication as the main telecommunication equipment owned by household is the phone and the least owned is the television, especially in rural areas. Moreover, with the current generation, owning a TV, radio and phone are some of the common indicators of household access to nutrition information (Grandhi, 2013). This is because, media act as a medium that ensures household access relevant agricultural nutrition information to literate and illiterate farmers within a short time (Gunya, 2017).

However, the success and effectiveness of media in agriculture also depends on the nature and choice of the source used. looking at the results, that the main source of nutrition information used by households in this survey were the radio and government extension workers, NGO extension workers, community health surveillance, family and friends and lastly open days. However, the main common source of nutrition information used by households in this study were the radio and the extension workers.

Table 4.2: Summary of socio-economic and demographic characteristics for categorical values

			OFSP PROJECT		*CAREGROUP*	
Variable	Categorical value	Overall (n=363)	Non-participants (n=167)	Participants (n=196)	Non-Participants (n=193)	Participants (n=170)
Gender head%	0=female	96(26.45)	56(28.57)	40(23.95)	52(26.94)	44(25.88)
Radio Ownership (%)	1=yes	142(39.12)	74(37.76)	68(40.72)	68(35.23)	74(43.53)
Tv Ownership (%)	1=Yes	17(4.68)	8(4.08)	9(5.39)	6(3.11)	11(6.47)
Bicycle Ownership (%)	1=Yes	207(57.02)	107(54.59)	100(59.88)	100(51.81) **	107(62.94) **
Phone Ownership (%)	1=yes	251(69.15)	132(67.35)	119(71.26)	127(65.80)	124(72.92)
Nutrition Information Sources	No source	219((60.33)	138(70.41) ***	81(48.50) ***	133(68.91) ***	86(50.59) ***
	1=radio	48(13.22)	127(13.78) ***	21(12.57) ***	18(9.33) ***	30(17.65) ***
	2= open days	2(0.55)	0 ****	2(1.20) ***	0 ***	2(1.18) ***
	3=community heathy surveillance	22(6.06)	7(3.57) ***	15(8.98) ***	5(2.59) ***	17(10.00) ***
	4=Extension worker	42(11.57)	10(5.10) ***	32(19.16) ***	23(11.92) ***	19(11.18) ***
	5=NGO extension worker	21(5.79)	9(4.59) ***	12(7.19) ***	9(4.66) ***	12(7.06) ***
	6= friends & family	9(2.48)	5(2.55) ***	4(2.40) ***	5(2.59) ***	4(2.35) ***

Parentheses consist of figures in percentages; * indicate chi-square test * Significant at 10% (p<0.1), ** significant at 5% (p<0.05), and *** significant at 1% (p<0.01)

Looking at OFSP project and caregroup, statistically, participants and non-participants were different in regarding to ownership of bicycle and information sources. The results show that for OFSP project, most participants obtain nutrition information from government extension workers (19.16%) while most non-participants obtain nutrition information from the radio (12%). As for caregroup it was the opposite, most participants obtain nutrition information from radio (17.65) and non-participants obtain information from government extension workers (11.92). Lastly, in terms of ownership of bicycle, more caregroup participants (62.94%) owned bicycles than non-participants (51.81%)

4.3. Nutrition Knowledge

In this study nutrition knowledge was computed as a count variable generated form 14 nutrition questions each having a score of 0 and 1. Correct answers were scored with 1 point and wrong or "don't know" answers and missing data were scored with 0 points. Looking at the figure 4.1 below, overall, the mean nutrition knowledge score was 9.65. This implies that on average the study population was able to answer approximately 10 questions about nutrition correctly. In terms of OFSP project, the results show a significant difference between participants and non-participants.

The results show that participants were more knowledgeable than non-participant as shown by the mean score of 9.84 for participants and 9.49 for non-participants (p-value =0.0564) Likewise, in terms of caregroup, the results show that statistically, participants were more knowledgeable than non-participants as shown by the mean score of 9.96 and 9.38, respectively (p-value = 0.0013). This shows that participating in both OFSP project and caregroup affects nutrition Knowledge. However, those in care groups had a higher mean score than those participating in OFSP project.

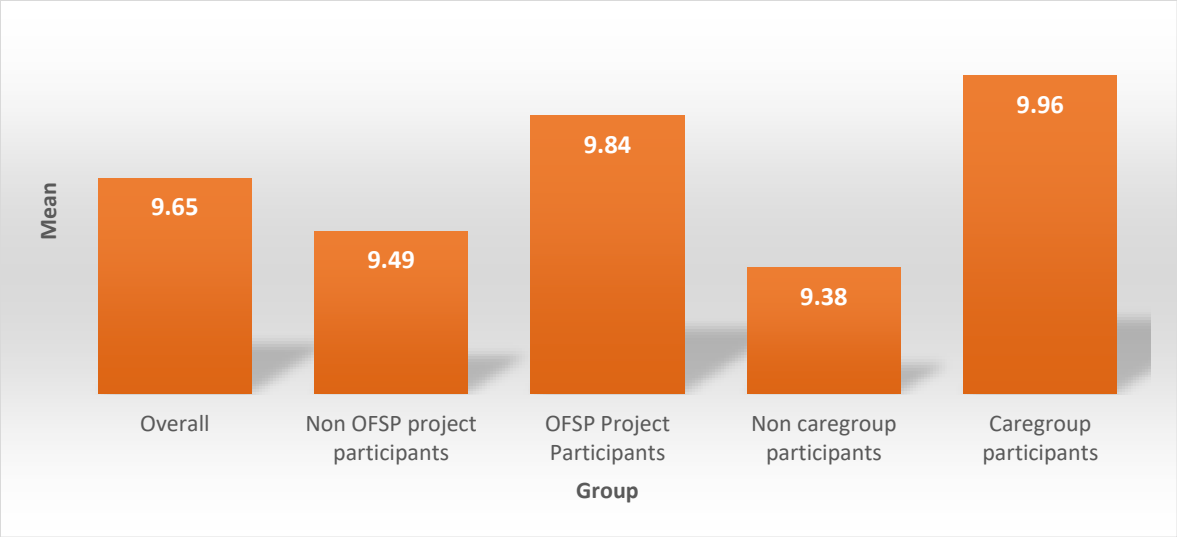


*Figure 1***Figure 4.1: Nutrition Knowledge Mean Score**

Nutrition Knowledge as a count variable was generate from 14 indicators namely,1) basic food groups knowledge, 2)Importance of Vitamin A knowledge, 3) Introduction of water to infants knowledge, 4) Introduction of solid and semi-solid Food to infants Knowledge 5) introduction of sweetpotato to infant's knowledge, 6) when to stop breastfeeding knowledge, 7) food rich in Vitamin A knowledge, 8) meal frequency baby knowledge, 9) meal frequency six to eight months child knowledge, 10) meal frequency nine to 23 three months child knowledge, 11) pregnant woman consumption rate knowledge, 12) heard of Vitamin A, 13) importance of first breast milk knowledge and 14) healthy food knowledge. Looking at the results in table 4.3 below, overall, 78.24% of the households knew at least one food group, with the common food group mentioned being energy giving. When asked about Vitamin A, 90.91% have ever heard of vitamin A and knew the importance of Vitamin A to the body with the common answers being prevents diseases, and for good eyesight. 80.17% knew at least one food that contained Vitamin A with the common answers being dark green vegetables, ripe pawpaw, ripe mango, and eggs.

Inaddition, 88.71% knew that the recommended age to stop breastfeeding a child was 2 years, and 60.88% knew that a pregnant woman should consume more food than a non-pregnant woman. 95.87% knew that sweetpotatoes are healthier than bread. In terms of fist time introduction of food, 86.78% and 91.18% respectively knew that water and solid and semisolid foods are be introduced to a baby at 6 months old (WHO, 2009). However surprisingly, only 28.65% knew that sweet potatoes can also be introduce to a child at 6 months of age. Majority felt that sweetpotatoes are to be introduce to a child at least not less one year of age.

Furthermore, caregivers had little knowledge on meal frequency for infants and young children. Looking at the results only 47.66% of the caregivers knew that child aged six to eight months is to be fed 2-3 times a day, and 34.16% knew that a child aged nine to twenty-three months old is to be fed 3-4 times a day (USAID, 2011; WHO, 2003).

Table4.3: Nutrition Knowledge Indicators

		OFSP PROJECT		*CAREGROUP*	
Variable	Pooled (n=363)	Non-participants(n=167)	Participants (n=196)	Non-participants (n=193)	Participants (n=170)
Basic food groups knowledge	265(78.24)	144(73.47)	121(72.46)	127(65.80) ***	138(81.18) ***
Importance Vitamin A Knowledge	330(90.91)	177(90.31)	153(91.62)	169(87.56) **	161(94.71) **
Introduction to Water Knowledge	315(86.78)	165(84.18)	150(89.82)	164(84.97)	151(88.82)
Introduction to solid semisolid food knowledge	331(91.18)	174(88.78) *	157(94.01) *	173(89.64)	158(92.94)
Sweetpotato first time consumption knowledge	102(28.65)	53(27.04)	51(30.54)	49(25.39)	55(32.35)
Stopping breastfeeding Knowledge	322(88.71)	170(86.73)	152(91.02)	163(84.46) **	159(93.53) **
Food with vitamin A knowledge	291(80.17)	152(77.55)	139(83.23)	148(76.68) *	143(84.12) *
Meal frequency baby knowledge	7(1.93)	5(2.55)	2(1.20)	5(2.59)	2(1.18)

Meal frequency six_eight months knowledge	173(47.66)	91(46.43)	82(49.10)	92(47.67)	81(47.65)
mealfrequency_nine_23months knowledge	124(34.16)	66(33.67)	58(34.73)	76(39.38) **	48(28.24) **
Pregnant women consumption Knowledge	221(60.88)	117(59.69)	104(62.28)	116(60.10)	105(61.76)
Heard of Vitamin A Knowledge	330(90.91)	177(90.31)	153(91.62)	169(87.56) **	161(94.71) **
First breast milk knowledge	343(94.49)	186(94.90)	157(94.01)	176(91.19) ***	167(98.24) ***
Heathy food knowledge	348(95.87)	184(93.88) **	164(98.20) **	184(95.34)	164(96.47)

Parentheses consist of figures in percentages; *indicate chi-square test* Significant at 10% ($p<0.1$), ** significant at 5% ($p<0.05$), and *** significant at 1% ($p<0.10$

In terms of OFSP Project, participants and non-participants were statistically significantly different in knowledge in regarding to when to introduce solid and semi solid food to infants and whether sweetpotato is heathier than bread. Looking at the results in table 4.3, 94.01% of the participants and 88.87% of non-participants knew that solid and semi solid foods are be introduced to infants at the age of 6 months (p-value=0.079). Regarding to knowledge on whether bread is healthier than sweetpotato, 98.20% of the participants and 93.88% of non-participants knew that sweetpotato is healthier than bread (p-value= 0.039).

Likewise in terms of Care groups, participants were statistically more knowledgeable than non-participants in most nutrition knowledge questions. Looking at the results, 81.18% of the participants and 65.80% of non-participants knew at least one basic food group (p-value= 0.001). When asked about Vitamin A, 96.47% of participants and 87.56% of non-participants have ever heard of Vitamin A with the main source of knowledge being the radio and government extension workers (p-value= 0.018), 91.71% of the participants and 87.56% of non-participants knew the importance of vitamin A to the body. The common answer, "being it prevents diseases" (p-value= 0.018). When asked to mention food that contain Vitamin A, 84.12% of participants and 76.68% of non-participants could mention at least one food that contained Vitamin A (P-value=0.076). The common answer being dark green vegetables. Similarly, when asked about the recommended age to stop breastfeeding a child,93.53% of the participants and 84.46% of non-participants knew that that the recommended age to stop breast feeding is not less than two years (p-value=0.006) (USAID, 2011).

When asked about first breast milk, 98.28% of caregroup participants and 91.19 of non-participants knew that first breast milk is good for the infant (p-value =0.003). Lastly, Caregivers in both groups had great difficulty answering questions about meal frequency. Only, 39.38% of participants and 28.24% of non-participants knew that a child nine to twenty-three months is to be fed 3-4 times a day (p-value=0.025) (WHO, 2003).

4.3.1. Effect of participating in OFSP-focused nutrition education on nutrition knowledge

Poisson regression and Negative binomial regression were the most preferred method for this study as nutrition knowledge was computed as a count variable. Test for equal variance and mean was performed to select between Poisson regression and Negative binomial. The significant alpha coefficient given by chi bar-square test accepts the null hypothesis that there is equal conditional

variance and mean. This implies that there is no over dispersion or under dispersion in the data and Poisson model is a good fit (Cameron & Trivedi , 1998). test of goodness of fit was with a prob>chi2 of 1.00, shows that we accept that poisson is a good fit.

Multicollinearity test was also done to test if the independent variables are correlated. Hence, no multicollinearity was found.

4.3.4. Results on effect on nutrition knowledge

The null hypothesis for this objective state that OFSP focused nutrition has no effect on nutrition knowledge.

Table 4.4: Poisson coefficient and Incident Rate Ratios on effect of participation in OFSP-focused nutrition education project on nutrition knowledge

Variable	Coefficient	Robust SE	IRR	Robust SE
Caregroup Participation	0.04*	0.02	1.04*	0.02
information sources				
Radio programs	0.07***	0.03	1.07***	0.03
Open days	0.03	0.03	1.03	0.03
Community health surveillance	0.05	0.03	1.05	0.03
GOV-extension workers	0.12***	0.02	1.12***	0.02
NGO extension Workers	0.09**	0.04	1.09**	0.05
Family & friends	0.03	0.03	1.03	0.03
Personal Characteristics				
Log-age	-0.01	0.03	0.99	0.03
Education level-Woman	0.002	0.003	1.00	0.00
Gender-head	0.02	0.02	1.02	0.02
Radio-ownership	-0.01	0.02	0.99	0.02
Phone-ownership	0.06***	0.02	1.06***	0.02
Bicycle-ownership	-0.02	0.02	0.98	0.18
TV-ownership	0.08**	0.04	1.08**	0.04

Institutional Variables				
Log-distance-farmer-group	0.01*	0.01	1.01*	0.01
Log-distance-health-center	-0.01	0.01	0.99	0.01
District				
Mulanje	0.03	0.03	1.03	0.03
Zomba	0.02	0.03	1.02	0.03
Cons	0.97***	0.74	9.07***	1.02
Wald x^2		79.90		
Number of observations		363		
Pseudo Rsquared		0.0098		
P-value		0.0000***		
Prob>chibar2		1.00		

*****, ** and * represent significance at 1%, 5% and 10% respectively**

The results are presented in Table 5.2 shows that the overall model was significant at the 1% level. The significant variables were caregroup participation, acquiring nutrition information from radios, government extension workers and NGOs extension workers, ownership of phone, ownership of TV and lastly distance to farmer groups.

The results in Table 4.5 show that caregroup participation was significant (0.059) at 10% and positively affect nutrition knowledge. This implies that participating in caregroup increases the nutrition knowledge levels of households. Precisely, participating in caregroup increases nutrition knowledge by 0.04. This is because in caregroup, participants are taught different nutrition terminologies. These findings concur with findings by Kajjura et al, 2019 who found that nutrition education improves knowledge of mothers. Likewise. D'Alimonte et al, 2003 also found that caregroup in Malawi have an impact on caregiver's nutrition knowledge.

Furthermore, apart from getting information from caregroup, the results in table 4.5 shows that getting nutrition information from the radio, government extension workers and NGOs extension workers also has a positive and significant effect on caregiver nutrition Knowledge. Following Grandhi et al, 2013, woman access to nutrition knowledge leads to improved health of the whole family which in turn leads to a healthy and productive nation. Precisely, the results show that getting nutrition information from radio increase nutrition knowledge by 0.07 and its significant at 1% (p-value = 0.005). Similarly, getting nutrition information from government extension workers increases nutrition knowledge by 0.12 and it is significant at 1% (p-value = 0.000). lastly getting nutrition knowledge from NGOs extension workers increases nutrition knowledge by 0.09 at its significant at 5% (p-value =0.045). Looking at the results, women who got information from radio and government and NGO extension workers were able to remember and answer questions correctly. This may be because extension workers interact more often with farmers hence their messages are trusted and easily remembered.

To add on this, currently in Malawi about 51. 7 percent of household have mobile phones (NSO, 2018) and worldwide mobile phones are seen as an important technology for enhancing economic development in all sectors. As for the agricultural sector, ownership of mobile phones is very much appreciated as mobile phones are easy, fast and convenient in communicating relevant information (chhachhar & Hassan, 2013). Looking at the results 4.5 above, ownership of a phone has a significant and positive effect on nutrition knowledge. This means owning a phone increases nutrition knowledge by 0.06 and its significant at 1% (p-value = 0.003). This may be because currently there are so many nutrition programs that use mobile phones messages to improve child and farmer nutrition. Furthermore, although only few people in rural areas own television as compared to radios. The results above also show that ownership of television has a significant and

positive effect on nutrition knowledge. This implies that receiving information from the television affects nutrition knowledge positively as compared to other sources of information. Results show that owning a television increases nutrition knowledge by 0.08 and its significant at 5% (p-value = 0.026). This is in line with the study by Grandhi et al, 2013 which stated that Television is one of the main sources of health and nutrition for rural women. This may be so because nowadays there are so many nutrition programs and dramas that are done on television making it easy and faster for mothers to obtain information.

Lastly, the results in table 4.5 further show that distance to farm group has a positive and significant effect on nutrition knowledge. Precisely, 1km increase in distance to farm groups increases nutrition knowledge by 0.01. This is contrary to literature as distance has a negative impact on nutrition Knowledge. This is because, as distance increases it becomes difficult for people to travel and participate in groups hence the longer the distance to farm groups the less the motivation to participate in the groups hence the low the nutrition knowledge.

In conclusion, we reject the null hypothesis that OFSP focused nutrition education has no effect on nutrition knowledge hence conclude that OFSP focused nutrition education has an effect on nutrition knowledge (p-value=0.000).

4.4. Infant and Young Child Feeding Practices

Practicing IYCFP is one of the most effective ways of improving child nutrition and combating morbidity and mortality in children. In this study IYCFP was as computed as a count variable generated from 8 core indicators namely: 1) Early initial breastfeeding, 2) continued breastfeeding at one year old, 3) introduction of solid and semi solid food, 4) exclusive breastfeeding 5) Minimum acceptable diet, 6) Consumption of iron rich food, 7) Minimum dietary diversity and 8) Minimum meal frequency for a child six to twenty- three months (WHO,2009).

Looking at figure 4.2, overall, the mean IYCFP was 2.48. Meaning that overall households only practices 2 out of 8 core infant and young child feeding practices. This implies that many infants and young children in the study area do not receive optimal feeding. This is in line with study by international food policy research institute, 2016, who stated that IYCFP are still a challenge especially in low-income countries like Malawi. In terms of OFSP project and caregroup, the results show that non-participants on average followed more practices than participants as shown by the 2.5 and 2.45 mean score for OFSP project and 2.5 and 2.46 mean score for Caregroup, respectively. However, the results were not statistically significant.

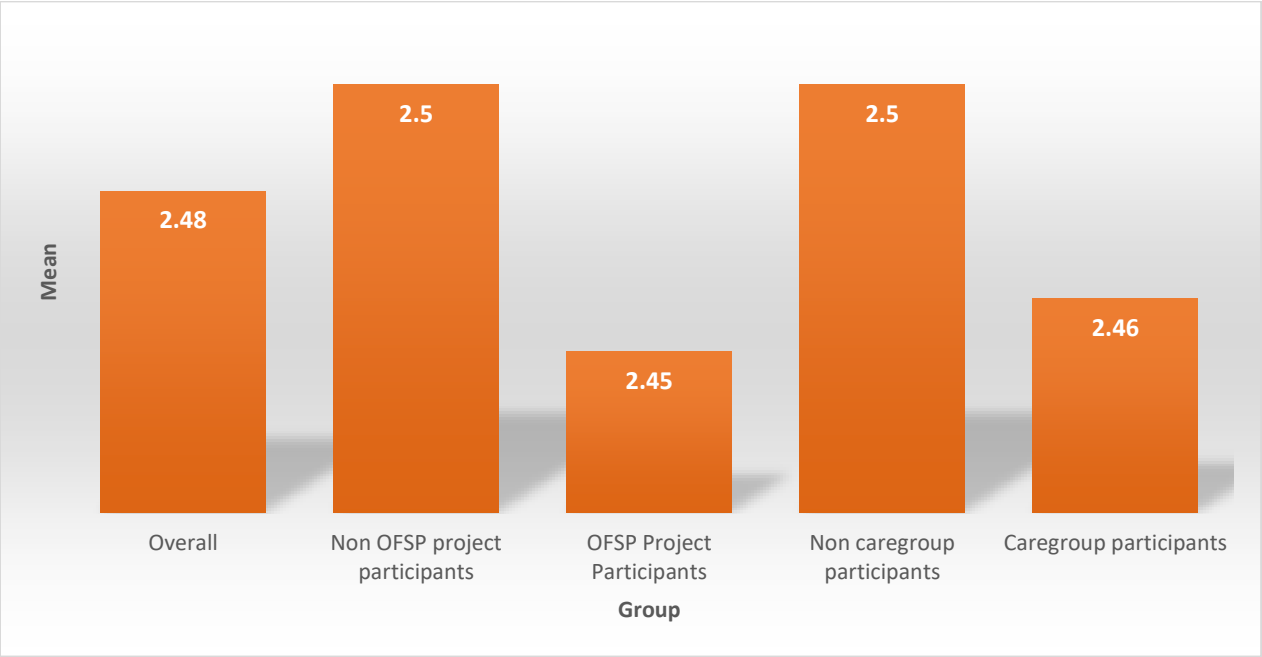


Figure 4.2: Mean Score for Infant and Young Child Feeding Practices.

Looking at the results in table 4.5 below, overall, the commonly followed feeding practice is the consumption of iron rich food (78.14%) and early initial breastfeeding (69.18%), while the least applied practice is the provision of a minimum acceptable amount of food (only 17.60%). Thus, feeding their children six to twenty-three months old at least 4 food groups and acceptable number of times per day (2-3 times per day for children aged six to eight months; 3-4 times /day for age nine to 23 months) (WHO 2009;). This is in line with UNICEF 2020, which also found that minimum acceptable diet is the least practiced as shown by only 14.3% of Malawians practicing it. The high iron consumption may be attributed to the fact that iron rich foods are readily available and easy to access in Malawi during the process of data collection. Similarly, according Mwende et al, 2018 high level of early initial breastfeeding may be attributed to strong government campaigns that encourage mothers to deliver in health facilities where they are assisted in breastfeeding the baby soon after birth.

Furthermore, looking at the results in table 4.6, 35.56% of the caregivers continued breastfeeding

their children over one year old, 56.25% introduced solid and semi solid food to their children at 6 months old and 68% of children 0-5 months exclusively breastfed their children. 43.20% fed their children six to twenty-three months diverse food groups. Hence, feeding children six to twenty-three months old 4 out of 7 food groups (WHO, 2009). 36% fed their children the minimum number of times per day according to age of child. Therefore, feeding children aged six to twenty-three months, two or more food groups per day for breastfed children and three or more food groups for non-breastfed children (NSO & ICF-international 2016).

Furthermore, looking at the table below, OFSP project participants and non-participants were not statistically different in terms of the infant and young child feeding practices followed. However, for Caregroup the results show that participants and non-participants were statistically different in terms of consumption of iron rich food. The results show that, participants consumed iron rich food more than non-participants.

Table 4.5. Infant and Young Child Feeding Practices.

		OFSP PROJECT		*CAREGROUP*	
Variable	*Overall (n=363)*	*Non-participants (n=167)*	*Participants (n=196)*	*Non-Participants (n=193)*	*Participants (n=170)*
Early Initial Breastfeeding	101(69.18)	51(64.56)	50(74.63)	50(71.43)	51(67.11)
Continued Breastfeeding at one year old	16(35.56)	10(37.04)	6(33.33)	10(40)	6(30)
Introduction of Solid and semisolid Food	9(56.25)	6(66.67)	3(42.86)	4(44.44)	5(71.43)
Exclusive Breast Feeding	17(68)	11(64.71)	6(75)	11(73.33)	6(60)
Minimum Acceptable Diet	22(17.60)	15(22.73)	7(11.86)	12(20.34)	10(15.15)

Consumption of iron rich food	98(78.40)	48(72.73)	50(84.75)	40(67.80) ***	58(87.88) ***
MDD threshold	54(43.20)	31(46.97)	23(38.98)	25(42.37)	29(43.94)
Minimum meal frequency (six -twenty-three months)	45(36)	26(39.39)	19(32.20)	23(38.98)	22(33.33)

Parentheses consist of figures in percentages; * indicate chi-square test* Significant at 10% (p<0.1), ** significant at 5% (p<0.05), and *** significant at 1% (p<0.01)

4.4.1. Effect on Infant and Young Child Feeding practices

Since IYCFP was computed as a count variable Poisson regression and negative binomial regression were the most preferred method for this study. Hence, a test for equal variance and mean was performed to select between Poisson and negative binomial. Looking at alpha coefficient given by chi bar-square test in table 4.6, we accept the null hypothesis that there is equal conditional variance and mean. This implies that there is no over dispersion or under dispersion in the data and Poisson model is a good fit (Cameron & Trivedi , 1998). Test of goodness of fit also backed the chi bar- test and with a p-value of 0.99 the null hypothesis that poison is a good fit was accepted.

Table 4.6. Poisson coefficients and Incident Rate Ratio on Effect of participation in OFSP-focused nutrition education project on infant and young child feeding practices

Variable	Coefficient	Robust SE	IRR	Robust SE
Nutrition Knowledge	-0.02	0.03	1.04	0.13
Caregroup Participation	0.03	0.10	0.98	0.03
Information sources				
Radio programs	-0.25	0.17	0.78	0.16
Open days	-0.22	0.14	0.80	0.58
Community Health Surveillance Assistants	0.09	0.14	1.09	0.25
GOV-extension workers	0.08	0.13	1.09	0.29
NGO extension Workers	0.43**	0.20	1.54**	0.33
Family & friends	0.30	0.24	1.35	0.48
Personal Characteristics				
Production diversity	-0.04	0.04	0.96	0.04
Log-Off farm income	-0.01	0.03	0.99	0.04
Log-age	0.05	0.15	1.05	0.21
Educ-level-W	0.003	0.01	1.00	0.02
Gender-head	0.39***	0.11	1.48***	0.22
Radio Ownership	0.10	0.10	1.11	0.14
Phone Ownership	0.11	0.10	1.11	0.15
Bicycle Ownership	-0.25**	0.10	0.78*	0.10
TV Ownership	0.11	0.17	1.12	0.29
HH-size	0.002	0.03	1.00	0.03
Log-distance-farmer group	0.001	0.03	1.00	0.05
Log-distance-health-center	0.02	0.04	1.02	0.07

Log-distance-village-market	-0.14*	0.07	0.87	0.08
District				
Mulanje	-0.33**	0.15	0.72*	0.13
Zomba	-0.22	0.14	0.80	0.14
Cons	1.11*	0.60	3.04	2.63
Wald x^2				
/Inalpha	-27.63747			
Alpha	9.94			
Number of observations	145			
Pseudo Rsquared	0.0533			
P-value	0.2834			

*****, ** and * represent significance at 1%, 5% and 10% respectively**

The results presented in Table 4.6 above, shows that overall, the model was not significant at all levels. Hence, we accept the null hypothesis and conclude that participating in caregroup has no effect on infant and young child feeding practice. This is contrary to literature (D'Alimonte et al 2019), who found that nutrition focused education such as caregroup have an impact on Infant and young child feeding practices. In addition, following kajjura et al, 2019 acquiring knowledge from nutrition education allows mothers to internalize the information resulting in behavior change. However, this was not the case for this study. Although caregroup participation resulted in changes in nutrition knowledge, the knowledge gained did not lead to changes in feeding practices.

4.5. Minimum Dietary Diversity for Women of Reproductive Age (15- 45 years old)

Poor dietary diversity can lead to malnutrition, especially for vulnerable individuals such as mothers and infants. In this study, minimum dietary diversity of women of reproductive age was computed as a score from 10 food groups, with the highest score being 10 and the lowest score being 0 (FAO&FHI, 2016). Looking at the results below, Overall, the mean DDS-W was 3.88.

This means that on average the households consumed approximately 4 out of 10 food groups. This is in line with the study by Ahern et al, 2021, who also found that in Malawi the mean MDDS-W is four food groups. This implies that, overall, the study population had a low dietary diversity and low micronutrient adequacy as the minimum threshold of MDD-W is the consumption of 5 out 10 food groups (FA0&FHI, 2016). In addition, only 35.25% of the respondents achieved the minimum threshold, indicating that dietary diversity was a problem for the whole population as less than half of the women diversified with 5 out of 10 food groups.

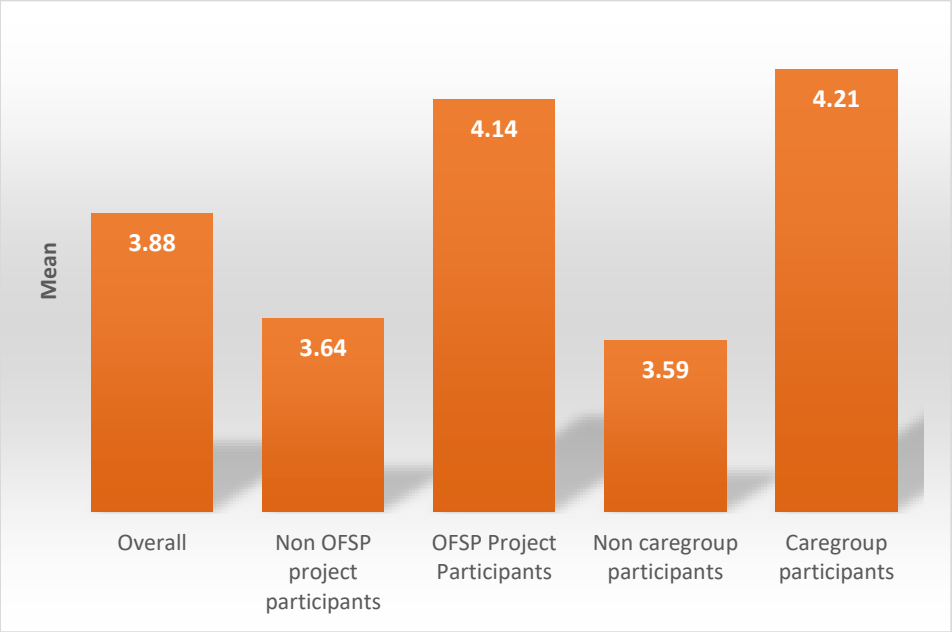


Figure 4.3: Mean Score Dietary Diversity for Women of Reproductive age

In terms of OFSP project, the results shows that participants were statistically different from non-participants. The results show that, the dietary diversity for participants was higher than for non-participants as shown by the dietary diversity level of 4.14 and 3.64, respectively (p-value= 0.0079). However, the results indicate that both groups have a low dietary diversity as only 40.58% and 30.57 of participants and non-participants, respectively achieved the minimum threshold of 5

out of 10 food groups. This in in line with the study by Gatto et al., 2021, which found that in OFSP project area the mean dietary diversity of women of reproductive ae is 4.18.

Similarly, for care groups, participants statistically had a higher mean score than non-participants as shown by the 4.21 and 3.59 mean score, respectively (p-value=0.0009). For care groups, only 45.26% of caregroup participants and 27.58% of non caregroup participants attained the minimum required threshold of consuming at least 5 out of 10 food groups during the day preceding the survey

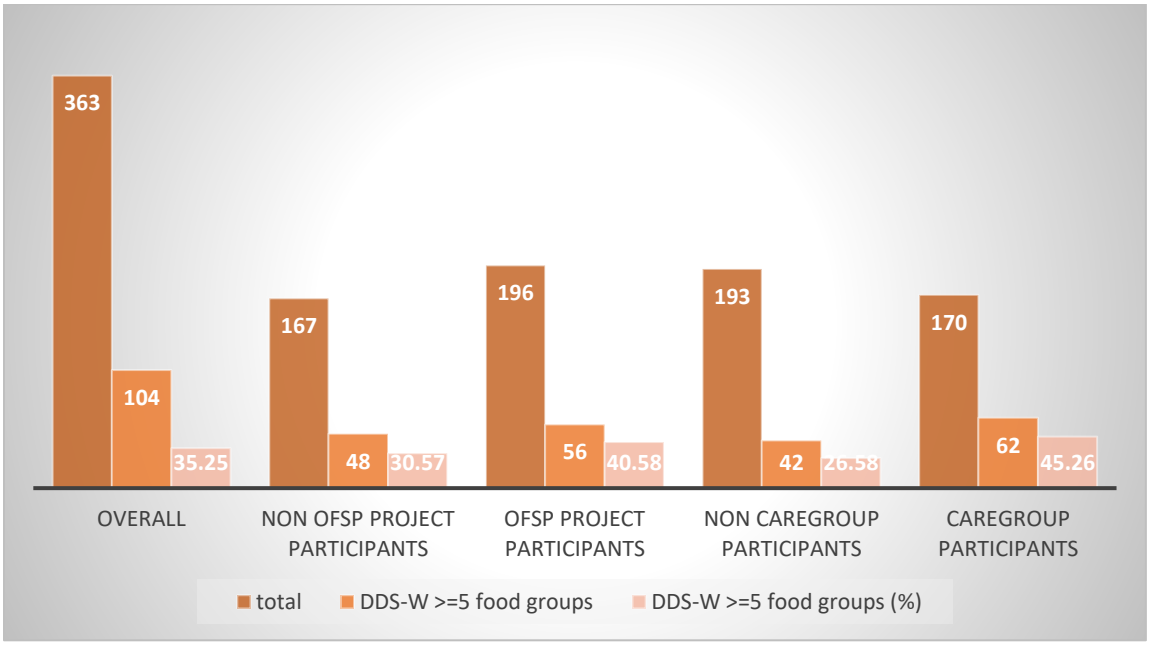


Figure 4.4: percentage of women who consumed 5 out of 10 food groups

4.5.1. Food groups consumed by women of reproductive age

Table 4.7. below indicates that overall, almost all women consumed grain (99.66%), and more than half of the women consumed dark green vegetables (61.02%), Vitamin A rich fruits & vegetables (68.81%), meat, poultry & fish (50.17%) and other vegetables (55.59%). However, less than half of the study women consumed, eggs, milk, other fruits, legumes, and nuts &seed.

Looking at the results the least consumed food was milk and milk products with only 2.71% of the women consuming this food group within 24 hours proceeding the survey. These patterns indicates relatively levels of dietary diversity among rural households in in the study regions. This is in line with the study by Pauw, Ecker &Verduzco-Gallo, 2013 which states that Malawian diet is heavily dominated by grain and starch such as maize rice and cassava indicating low diversification. In additional, in terms of the least consumed food, following Walters et al, 2019, milk consumption is low in Africa especially for countries with low per capita income such as Malawi.

In terms of OFSP project, participants and non-participants were statistically different in terms of consumption of dark green vegetables and Vitamin A rich fruits and vegetables. The results show that 67.39% and 55.41% of participants and non-participants, respectively consumed dark green vegetables (p-value= 0.035). The assessment gave similar results for Vitamin A rich fruits and vegetables as 76.81% and 61.78% of participants and participants consumed Vitamin A rich fruits and vegetables in the last 24 hours proceeding the survey (p-value=0.005). The high Vitamin A rich fruits consumption may be attributed to the fact that during the period of data collection there was high supply of mangoes and pawpaw which are high in Vitamin A.

In terms of care group, the results show that, statistically participants consumed legumes, milk& milk products, meat, poultry & fish, nuts 7seeds and eggs more compared to non-participants. Statistically, for care groups the least consumed food were eggs and milk products as shown by 0.63 % for OFSP project and caregroup non-participants and 7.30% and 5.11% for OFSP project participants and caregroup participants, respectively.

Table 4.7. DDS-W Food groups

Variable	*Overall (n=363)*	*OFSP PROJECT*		*CAREGROUP*	
		Non-participants (n=167)	*Participants (n=196)*	*Non-Participants (n=193)*	*Participants (n=170)*
Grain roots tubers	294(99.66)	156(99.36)	138(100)	157(99.37)	137(100)
Dark green vegetables	180(61.02)	87(55.41) **	93(67.39) **	90(56.96)	90(65.69)
Pulses& legumes	78(26.44)	40(25.48)	38(27.54)	35(22.15) *	43(31.39) *
Milk &dairy products	8(2.71)	3(1.91)	5(3.62)	1(0.63) **	7(5.11) **
Vitamin A rich fruits & Veg	203(68.81)	97(61.78) ***	106(76.81) ***	103(65.19)	100(72.99)
Meat poultry & Fish	148(50.17)	76(48.41)	72(52.17)	69(43.67) **	79(57.66) **
Nuts and seeds	47(15.93)	20(12.74)	27(19.57)	19(12.03) **	28(20.44) **
Other vegetables	164(55.59)	82(52.23)	82(59.42)	86(54.43)	78(56.93)
Other fruits	11(3.73)	7(4.46)	4(2.90)	6(3.80)	5(3.65)
Eggs	11(3.73)	4(2.55)	7(5.07)	1(0.63) ***	10(7.30) ***
DSS_W threshold	104(35.25)	48(30.57) *	56(40.58) *	42(26.58) ***	62(45.26) ***

Parentheses denotes percentages for categorical variables; *indicate chi-square test* Significant at 10% (p<0.1), ** significant at 5% (p<0.05), and *** significant at 1% (p<0.01)

4.5.2: Impact of participating in OFSP project on dietary diversity of women of reproductive age.

The study further estimated the impact of participating in project on women dietary diversity of reproductive age using DID approach. DID is quasi- or non-experimental method used to estimate causal effects. DID is used to estimate the effect of a specific intervention by comparing the changes in outcomes over time between the intervention group and the control group (Woodridge, 2011). DID requires at least two time periods and a control and treatment group. In this study, baseline data was collected in 2017 and the second wave data was collected in 2020. The control group in this study are households that did not participate in the OFSP project and treatment group are households that participated in the project.

Looking at the results in table 4.8, although in 2017 participants had a dietary diversity score of 3.4 and non-participants had a dietary diversity score of 3.7, statistically, the two (participants and non-participants) were not different in terms of dietary diversity for women of reproductive age (p-value =0.204). However, after the intervention the participants were statistically different from non-participant. Precisely in 2020, DDS-W score for participants was 4.12 and that of non-participants was 3.37. Looking at the table, the participants were statistically different from non-participants by 0.745 (0.083).

Inconclusion, looking at the results, participating in the OFSP project has an impact on dietary diversity of women of reproductive age. Overall, the results show that participating in the project increases the dietary diversity score by 1.072. This means that caregivers in the OFSP project diversified with 1.072 more food group than those that were not in the project.

Table 4.8: Difference in difference output on Impact of Project Participation on Dietary Diversity of Women of Reproductive age

Year	Treatment group	Control group	DID	p-value
2020	4.115	3.370	0.745	0.083*
2017	3.414	3.741	-0.327	0.204
DID	0.701	-0.371	**1.072**	0.023**

Hence, we reject the null hypothesis that project participation has no impact on dietary diversity of women of reproductive age and conclude that participating in the project has a positive and significant impact on dietary diversity of women of reproductive age.

4.6. Consumption of Vitamin A rich Food by Young Child and Caregiver.

Vitamin A deficiency (VAD) is a major nutritional concern among Infants and Women in lower income countries like Malawi (Jemberu et al 2017). As such this study aimed at analyzing the Frequency consumption of different kinds of Vitamin A-rich food consumed by young children and caregivers over a period of 7 days. Looking at the results in table 4.9 and 4.10, the most frequently consumed Vitamin A rich foods were dark green vegetable consumed on average at least 3.91 days a week for a young child and 4.11 for caregivers. In terms of animal-based Vitamin A rich foods, the most frequently consumed food during the 7 days preceding the survey was fish, consumed on average 0.79 times a week for both young child and caregiver. For dark yellow or orange fresh vegetables, the most frequently consumed were Orange fleshed sweetpotatoes, consumed on average 0.50 days a week for young child and 0.48 days a week for caregivers. In

terms of food fortified with Vitamin A, the most frequently consumed was sugar, consumed on average 2.33 days a week for young child and 2.32 days a week for caregivers. Lastly, for dark yellow or dark orange fruits, the most consumed were ripe mangoes with a consumption rate of 1.72 days a week for young child and 1.60 days a week for caregivers. This in line with the study by Gatto et al, 2021 who found similar results on Vitamin A consumption patterns in Malawi.

Table 4.9: Average number of days Vitamin A-rich foods were consumed by young child in one week prior to the study

		OFSP PROJECT		*CAREGROUP*	
Variable	*Overall (n=363)*	*Non-participants (n=167)*	*Participants (n=196)*	*Non-Participants (n=192)*	*Participants (n=170)*
Any dark green leafy vegetables	3.91(2.20)	3.58(2.27) ***	4.30(0.07) ***	3.87(2.23)	3.96(2.18)
Red palm oil	0.04(0.44)	0.04(0.50)	0.04(0.35)	0.06(0.58)	0.01(0.15)
Carrots	0.12(0.48)	0.12(0.49)	0.11(0.46)	0.10(0.50)	0.14(0.45)
Ripe mango	1.72(2.55)	1.59(2.49)	1.87(2.61)	1.74(2.59)	1.71(2.50)
Pumpkin	0.08(0.39)	0.07(0.36)	0.10(0.41)	0.09(0.39)	0.08(0.38)
Ripe papaw,	0.93(1.71)	0.72(1.53) **	1.17(1.87) **	0.83(1.67)	1.04(1.75)
OFSP	0.50(1.25)	0.32(1.07) ***	0.71(1.40) ***	0.47(1.23)	0.53(1.27)
Eggs with Yolk	0.84(1.20)	0.78(1.15)	0.91(1.27)	0.80(1.16)	0.89(1.25)
Fresh fish	0.79(1.19)	0.83(1.23)	0.74(1.15)	0.76(1.16)	0.82(1.23)
Liver	0.72(1.26)	0.6(1.13)	0.87(1.39) **	0.67(1.20)	0.78(1.33)
Butter	0.03(0.33)	0.03(0.36)	0.04(0.29)	0.03(0.37)	0.03(0.28)
Cod liver oil	0.44(1.54)	0.49(1.58)	0.38(1.51)	0.53(1.67)	0.35(1.39)
Passion fruit	0.26(1.14)	0.19(0.96)	0.34(1.31)	0.28(1.21)	0.25(1.05)
Vitamin A fortified margarine	1.43(2.47)	0.96(2.08) ***	1.98(2.76) ***	1.35(2.42)	1.51(2.52)
Fortified Weaning food with vitamin A	0.27(0.96)	0.33(1.06) **	0.20(0.84) **	0.28(0.10)	0.27(0.93)
Infant formula fortified with vitamin A	0.04(0.47)	0.04(0.51)	0.04(0.42)	0.07(0.62)	0.01(0.15)
Sugar with Vitamin A	2.33(2.42)	2.18(2.27)	2.51(2.58)	2.20(2.31)	2.49(2.54)

Parentheses denotes Std. Dev. for continuous variables; * indicate t-test * Significant at 10% ($p<0.1$), ** significant at 5% ($p<0.05$), and *** significant at 1% ($p<0.01$)

The results from table 4.8 above further show that statistically, children in the OFSP project consumed more Orange fleshed sweetpotato and ripe pawpaw per week than children not in project. This may because households in the project were supplied with OFSP vines hence OFSP was easily accessible. Secondly households in the project knew the importance of consuming OFSP to the body hence consuming it more. Similarly, in terms of food fortified with Vitamin A, children in the OFSP project consumed more Vitamin A fortified margarine and Vitamin A fortified weaning food than those not in the OFSP project. However, caregroup participants and non-participants were not statistically different in terms of consumption of Vitamin A rich food.

Table 4.10: Average number of days vitamin A-rich foods were consumed by caregiver

		OFSP PROJECT		*CAREGROUP*	
Variable	*Overall (n=363)*	*Non-participants (n=167)*	*Participants (n=196)*	*Non-Participants (n=193)*	*Participants (n=170)*
Any dark green leafy vegetables	3.92(2.20)	3.84(2.07) ***	4.45(2.04) ***	4.04(2.07)	4.2(2.10)
Red palm oil	0.03(0.26)	0.01(0.10)	0.05(0.36)	0.003(0.31)	0.02(0.19)
Carrots	0.16(0.61)	0.14(0.53)	0.18(0.69)	0.17(0.72)	0.15(0.44)
Ripe mango	1.60(2.49)	1.33(2.28) **	1.92(2.68) **	1.60(2.52)	1.61(2.47)
Pumpkin	0.09(0.54)	0.07(0.54)	0.12(0.55)	0.11(0.63)	0.07(0.43)
Ripe papaw,	0.75(1.56)	0.65(1.57)	0.88(1.54)	0.63(1.47) *	0.9(1.64) *

OFSP	0.48(1.25)	0.31(1.09)***	0.68(1.39)***	0.47(1.31)	0.49(1.18)
Eggs with Yolk	0.76(1.08)	0.74(1.07)	0.79(1.09)	0.68(0.97)	0.86(1.19)
Fresh fish	0.79(1.19)	0.88(1.27)	0.68(1.08)	0.73(1.10)	0.85(1.29)
Liver	0.73(1.32)	0.62(1.26)*	0.86(1.39) *	0.69(1.29)	0.78(1.36)
Butter	0.09(0.63)	0.05(0.51)	0.13(0.75)	0.09(0.71)	0.08(0.53)
Cod liver oil	0.51(1.60)	0.62(1.68)	0.39(1.50)	0.55(1.63)	0.47(1.57)
Passion fruit	0.23(1.08)	0.14(0.90)*	0.34(1.25) *	0.24(1.18)	0.23(0.96)
Vitamin A fortified margarine	1.54(2.54)	1.06(2.13)***	2.09(2.86)***	1.40(2.46)	1.69(2.63)
Sugar with Vitamin A	2.32(2.37)	2.11(2.21)*	2.56(2.53) *	2.19(2.33)	2.47(2.42)

Parentheses denotes Std. Dev. for continuous variables; * indicate t-test * Significant at 10% (p<0.1), ** significant at 5% (p<0.05), and *** significant at 1% (p<0.01)

In terms of Caregivers, looking at the table 4.9 above, the results show that statistically, caregivers in the project consumed Orange fleshed sweetpotato (p-value=0.0056) and yellow fleshed sweetpotato (p-value= 0.0561) more days per week than caregivers not in the OFSP project. Likewise, for care groups, statistically, participants consumed more ripe pawpaw per week than participants.

4.6.1. Vitamin A consumption scores

Figure 4.5 presents the Vitamin A consumption scores for children 6-23-months old. The cut-off score for this semi-quantitative index for animal-sourced and total Vitamin A scores are 4 and 6,

respectively (Rosen et al, 1993). Overall, 42.70% of the children had a Vitamin A deficiency problem. This implies that, 57.30% of children in the study consumed both animal and plant-based Vitamin A food not less than 6 days a week. The results further show that overall VAD was not a problem as show by the animal VA score and total VA score of 6.9 and 8.16, respectively. This is Understandable as there are several projects that have been introduce in Malawi to combat vitamin A deficiency. In addition, following Gatto et al., 2021, Vitamin A deficiency in Malawi has decreased from 59% to 4%. However, although VAD was not a problem, children in participant households consumed significantly higher amounts of Vitamin A from animal sources, and from plant and animal sources combined, than the non-participants.

Results further show, that those in OFSP project consumed higher Vitamin A rich food than those in care groups as shown by the total mean score of 9.11 and 8.45 for OFSP project participants and Caregroup participants, respectively.

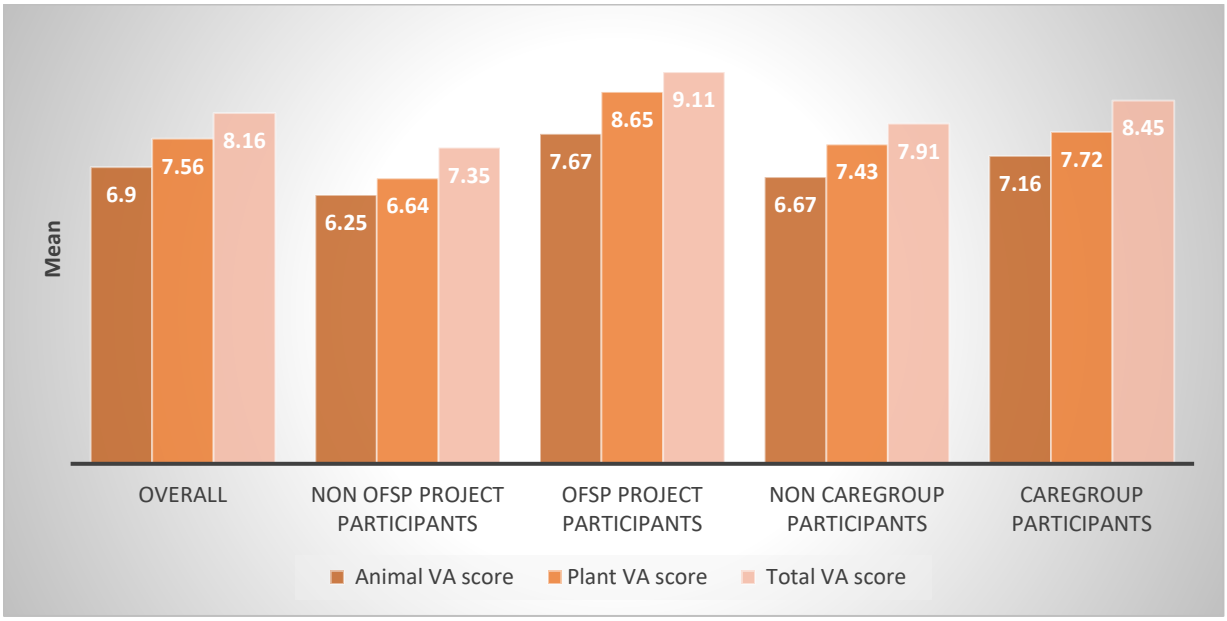


Figure 4.5. Frequency of Vitamin A consumption by young child

Figure 4.6 below presents the Vitamin A consumption scores for caregivers. Similarly, the results show that caregivers in OFSP project consumed more Vitamin A rich food per week than those in care groups. Likewise, Vitamin A deficiency is not a problem in both groups as shown by the total mean score of 8.94 and 7.98 for OFSP project participants and Caregroup participants, respectively.

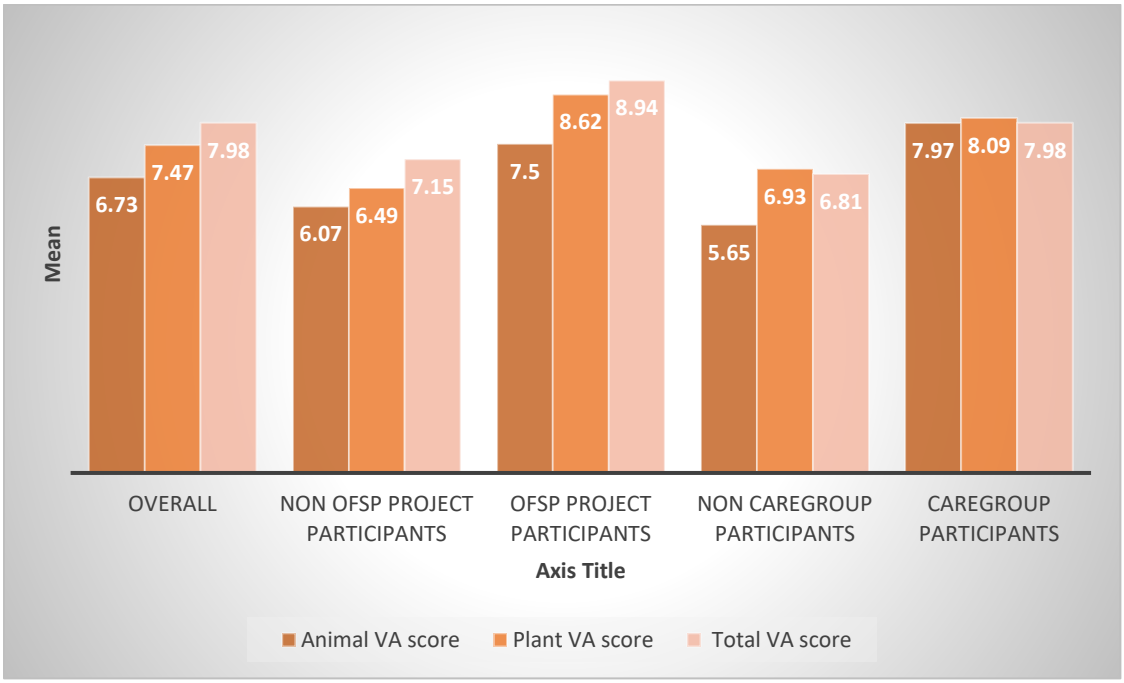


Figure 4.6: Frequency of Vitamin A Consumption by caregiver

4.6.2. Impact of OFSP project on consumption of Vitamin A rich food

In this section propensity score matching was used to analyze the impact of project participation on (1) child consumption of Vitamin A rich food and (ii) Caregiver consumption of Vitamin A rich food. PSM matches participants and non-participants on observable covariates and ensures that any deviation in outcome variable between these two groups is attributed to participation or adoption of the intervention in question.

4.6.3. Impact of project participation on Child consumption of Vitamin A rich food

Looking at table 4.11, before Matching, the mean total VA score for the child was 9.10 and 7.35 for participants and non-participants, respectively. However, after matching, the mean total VA score for participants and non- participants was 9.13 and 7.66, respectively. This Implies that, participants consumed more Vitamin A rich food than non-participants as indicated by the difference of 1.47 after matching. The difference is significant at the 5 percent level as indicated by the t-value of 1.97. This is consistent with research as project participants understand the importance of vitamin A hence high consumption of Vitamin A rich food. Therefore, the null hypothesis that project participation has an no impact on child consumption of Vitamin A rich food is rejected, hence the study concludes that OFSP project participation increases child consumption of Vitamin A rich food.

Table 4.11: Impact of OFSP-project on consumption of Vitamin A rich food

Outcome	Sample	Treated	Controls	Difference	Std. Error	t-value
Total-VA-score	Unmatched	9.10	7.35	1.75	0.57	3.09***
	ATT	9.13	7.66	1.47	0.75	1.97*

Source: own computation

To come up with the PSM outcome results, Caliendo & Bonn (2008) recommends the following steps to be followed, (i)estimating propensity scores, (ii)choosing a good matching algorithm, (iii) checking for overlap/common support, (iv) matching quality/effect estimation, and (v) sensitivity analysis. Hence below describes the analysis results for each step of propensity score matching.

4.6.3.1. estimating propensity score

By estimating propensities, the goal is to obtain propensity score that statistically balance the covariates between treated and control group rather than propensities that estimates the true

propensity score as accurately as possible (Grilli and Rampichini,2011). Looking at table 4.12 below the estimated propensity score varies between 0.03 to 0.96 with mean of 0.46 and standard deviation of 0.22. The average p-score of participants is 0.57 and ranges from 0.03 to 0.93 with a standard deviation of 0.21. While for non-participants the average p-score is 0.36 and ranges from 0.03 to 0.96 with a standard deviation of 0.19. Hence forth the common support region lies between 0.03 and 0.93. This indicates that, households whose estimated propensity scores are less than 0.03 and greater than 0.93 lies outside the common area hence are not considered for the matching

Table 4.12: Distribution of estimated propensity score

Group	Observation	Mean	Standard deviation	Min	Max
Overall	360	0.46	0.22	0.03	0.96
Participants	165	0.57	0.21	0.03	0.93
Non-participants	195	0.36	0.19	0.04	0.96

Source: own estimation

4.6.3.2. choice of matching algorithm

Although several matching methods are viable, this study used kernel matching, nearest neighbor matching and caliper matching (Rosenbaum and Rubin, 1983). The best matching method must produce large number of insignificant variables, small pseudo-R2 and small means bias after matching. Hence, balancing the distribution of covariates in both treatment and control group (Caliendo & Kopeinig, 2008). Table 4.13 below indicates results of test of matching algorithm

Table 4.13. Matching Algorithm

ESTIMATION METHOD	Sample size	Number of insignificant variables	Pseudo-Rsquared	Mean bias	t_stat
Nearest Neighbor					
Nearest Neighbor at 1	360	13	0.105	12.5	2.19**
Nearest Neighbor at 2	360	17	0.061	10.2	2.25**
Caliper Matching					
Caliper at 0.1	360	13	0.105	12.5	2.19**
Caliber at 0.2	360	14	0.105	12.5	2.19**
Kernel Matching					
Bandwidth at 0.1	360	20	0.012	5.0	1.97*
Bandwidth at 0.25	360	20	0.018	5.5	2.36**

Source: own estimation

Looking at table 4.13, kernel matching with of bandwidth 0.1 was selected because it adhered to the proposed criterion of having a small pseudo Rsquared, small mean bias and large number of insignificant variables after matching. Kernel matching compares the outcome of participants to a weighted average of the outcomes of non-participants hence allocates highest weight scores to participants closest to non-participants (Heinrich et al., 2010). In additional, Kernel matching allows more information to be used hence lower variance and lower mean standardized bias between the control and treated group.

4..6.3.3. matching quality

Common support ensures that individuals from the treatment group are matched with individuals from the control group with similar characteristics. The kernel density-distribution plot of the propensity scores was generated to show the common support region. Figure below shows that there was imbalance before matching. However, after matching, inspection of the graph shows an overlap in the distribution of the estimated propensity scores between the treatment and control group thereby implying quality matching.

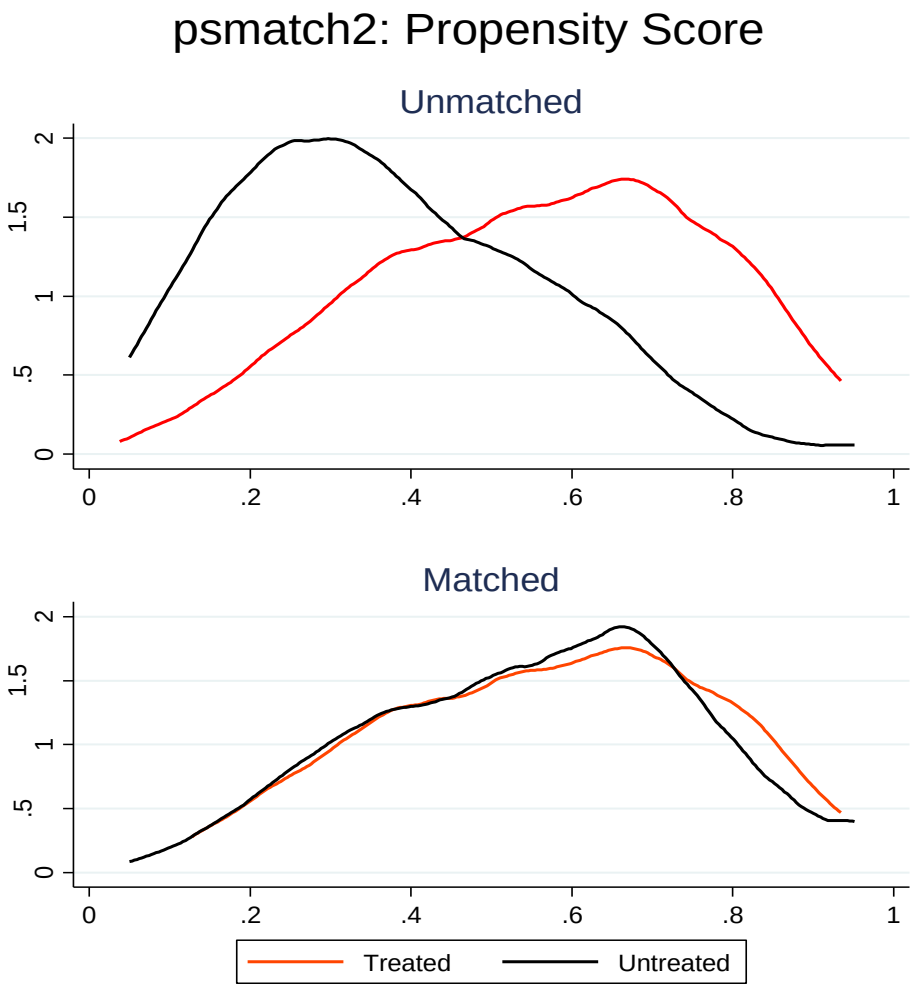


Figure 4. 7: Propensity score distribution before and after matching

Furthermore, looking at table 4.14, participants and non-participants differed significantly in nutrition knowledge, production diversity, age of child, Nutrition information sources, location, and distance to the village market before matching. However, after matching, participants and non-participants do not significantly differ for all variables. This indicate that matching helped in reducing the bias hence individuals from treated group had been matched to individuals of similar characteristics from the control group.

Table 4. 14: Balancing tests for participants and matched controls

Covariates	**Sample**	**Mean**		**p-value**
		Participants	**Non-participants**	
Nutrition Knowledge	U	9.83	9.48	0.050**
	M	9.84	9.79	0.724
Production diversity	U	4.67	4.02	0.000***
	M	4.70	4.58	0.373
Off-farm income	U	11.10	10.98	0.478
	M	11.11	11.09	0.906
Household size	U	5.47	5.30	0.362
	M	5.48	5.52	0.834
Log-Age-child	U	3.21	2.98	0.006***
	M	3.22	3.23	0.834
Log-Age-head	U	3.57	3.55	0.495
	M	3.58	3.58	0.858
Education-head	U	7.83	7.73	0.794
	M	7.83	7.72	0.785

Gender-head	U	0.76	0.71	0.340
	M	0.76	0.72	0.349
Knowledge-sources	U	1.68	0.82	0.000***
	M	1.70	1.75	0.793
Radio-ownership	U	0.41	0.38	0.529
	M	0.41	0.39	0.655
TV-ownership	U	0.05	0.04	0.394
	M	0.05	0.04	0.671
Bicycle-ownership	U	0.59	0.54	0.338
	M	0.60	0.56	0.441
Phone-ownership	U	0.71	0.68	0.512
	M	0.71	0.70	0.734
Location	U	2.12	2.37	0.001***
	M	2.12	2.21	0.206
Log-distance-village-market	U	0.58	0.82	0.003***
	M	0.57	0.55	0.783

***, ** and * represent significance at 1%, 5% and 10% respectively.

Source: Own estimation

Inaddition, looking at table 4.15 below, the mean bias after matching reduced from 16.3% to 5.0%. The 11.3% reduction in mean bias shows that the matching procedure was able to balance the characteristics of the treatment and control group. Inaddition, the mean bias of 5.0 is also within the acceptable range of 1 to 5 percent (Caliendo and Kopeinig, 2008).

Table 4.15: test for the joint significance of variables

Sample	Ps R2	LRchi2	P-values	Mean bias	Med-bias
Unmatched	0.155	77.14	0.000	16.3	9.9
Matched	0.012	5.48	0.997	5.0	3.7

Source: Own estimation

4.6.3.5. sensitivity analysis: rosenbaum bounding approach

The last stage of propensity score matching is sensitivity analysis. The purpose of sensitivity analysis is to test whether unobserved factors may affect child Vitamin A consumption given proper matching. To do this Rosenbaum bounding approach was used. The Result from sensitivity analysis indicates that the impact of the project participation on child Vitamin A consumption will not be changing for participants and non-participants households even if unobserved variables were included. The p-critical values were all significant for the outcome variable estimated at various level of critical value. This shows that important covariates that affected both participation and child consumption of Vitamin A have been included. Hence, the estimates are insensitive to unobserved selection bias.

4.6.4. Impact of project participation on caregiver consumption of Vitamin A rich food

the study also analyses the impact of participating in the project on caregiver consumption of Vitamin A rich food. The results below show that before Matching, participants and non-participants had the mean total VA score of 8.92 and 7.16, respectively. After matching, the mean total VA score for participants and non- participants was 8.95 and 6.88, respectively. This means that on average, caregivers in the project consumed 2.88 more Vitamin A rich food than non-participants. The difference is significant at the 5 percent level as indicated by the t-value of 2.80 Therefore, the null hypothesis that project participation has an no impact on caregiver consumption

of Vitamin A rich food is rejected, hence the study concludes that OFSP project participation increases caregiver consumption of Vitamin A rich food.

Table 4.16: Impact of OFSP-project on caregiver consumption of Vitamin A rich food.

Outcome	Sample	Treated	Controls	Difference	Std. Error	t-value
Total-VA-score	Unmatched	8.92	7.16	1.76	0.58	3.01***
	ATT	8.95	6.88	2.07	0.74	2.80**

Source: own computation

Similar PSM procedures were undertaken with child consumption of Vitamin A were undertaken. More details in the appendix

CHAPTER FIVE

5.0 Conclusion and Recommendation

5.1. Summary and conclusion

The main objective of the research was to assess the effect of OFSP focused nutrition education interventions on nutrition knowledge, infant and young child feeding (IYCF) practice, dietary diversity, and consumption of Vitamin A rich food. Specifically, the study analysed (i) the effect of OFSP-focused nutrition education project on nutrition knowledge (ii) the effect of OFSP focused nutrition education on number of recommended infant and young child feeding practices (iii) the impact of participation in OFSP-project on dietary diversity of women of Reproductive age (iv) analyse the impact of OFSP-project on caregiver and child consumption of Vitamin A rich food.

The study was conducted in three districts in Malawi, namely, Chikwawa, Mulanje and Zomba. overall, 26.45% of the households were female headed households and on average the head of household had 36.58 years of age with 7.77 years of schooling. On the other hand, the respondent(woman), on average had 32.27 years with 6.67 years of schooling.

Poisson regression was used to analyze the effect of OFSP focused education on nutrition knowledge and IYCFP. The results show that participating in care groups has a positive and significant effect on nutrition knowledge but not on Infant and young child feeding practices. This indicates that although caregroup participation significantly improved nutrition knowledge, the knowledge acquired did not translate to changes in infant and young child feeding practices. The study population was able to answer approximately 10 questions about nutrition correctly, however, overall households practiced only 2 out of 8 infant and young child feeding practices. In

addition, although the households correctly answered 10 question out of 13 question correctly, less than 50% of the households had knowledge about meal frequency of children below 2 years. This explains why only 17% of the households practiced minimum acceptable diet and 36% fed their children the recommended number of times per day and these two indicators were the least applied infant and young child feeding practices. In terms of nutrition knowledge, the other factors affecting knowledge were ownership of phone and television. Inaddition, household that obtained nutrition information from the radio, NGO extension worker and government extension workers were able to clearly recall nutrition information better than those that obtained nutrition information from other source of information.

In terms of dietary diversity of women of reproductive age, overall, the study population had a low dietary diversity of 4 food groups out of 10. However, difference in difference was used to analyze the impact of OFSP project on dietary diversity of women of reproductive age and the results show that participating in OFSP project has a positive impact on DDS-W, as those that are in the project have high DDS-W than those not in the project. On the same note, the main food groups consumed are grains and Vitamin A rich fruits and vegetables. While the least consumed are eggs and milk, and milk products.

Lastly, for consumption of vitamin A rich food, the results shows that Vitamin deficiency was not a problem for both children and caregivers as shown by the total VA score of 8.16 and 7.98 for children and caregivers, respectively. In addition, the most frequently consumed Vitamin A rich foods were dark green vegetable consumed on proximately 3.91 days a week for a young child and 4.11 days per week for caregivers and vitamin A fortified sugar was the second most consumed food, consumed approximately 2.33 days a week for young child and 2.32 days a week for caregivers. Fish was the most consumed animal-based Vitamin A rich food (0.79 times a week)

and ripe mangoes were the most consumed dark yellow or dark orange fruits, consumes on average 1.72 days a week for young child and 1.60 days a week for caregivers. In addition, PSM treatment effect model was estimated to evaluate impact of OFSP project on child and caregiver consumption of Vitamin A rich food. Furthermore, the results of PSM revealed a positive impact of OFSP project on both child and caregiver consumption of Vitamin A rich food.

In conclusion, participating in OFSP focused nutrition Education has a positive and significant impact on nutrition knowledge, dietary diversity of women of reproductive age and child and caregiver consumption of Vitamin A rich food. However, although OFSP focused nutrition Education showed a positive impact on infant and young child feeding practices, the results were not statistically significant.

5.2. Recommendations

The study found that OFSP focused nutrition education has a positive impact on nutrition knowledge, dietary diversity of women of reproductive age and child and caregiver consumption of Vitamin A rich food. Hence recommends that there is need to scall up the OFSP project and reach other areas in Malawi.

For further research regarding the effects of nutrition education on nutrition knowledge it is recommended that the study also focuses on Nutrition attitude as to evaluate if people have positive attitude towards nutrition practices. This will help understanding why some nutrition projects are not having an impact just like the case of IYCP in this study. In addition, there is a need for nutrition intervention trainers to focus on issues about child meal frequency since most people are not aware of child meal frequency and acceptable meal diet.

It is also recommended that, there is a need to scale up nutrition information dissemination through phone, television, and radio. As the results show that owning a phone and a Television has a

positive impact on nutrition knowledge also that those that accessed nutrition information via the radio were able to recall nutrition terminologies and had higher nutrition knowledge score.

The study showed overall the population had low dietary levels, hence this paper recommends that nutrition education interventions need to sensitize households to produce food locally for their consumption and for income generation purposes. This will enable households to have access to diverse food group via own production and cover the cost of consumption of the remaining food groups not produced through income generated from excess production.

This study focused on Vitamin consumption of under five children and caregivers. Future research should attempt to engage children of different ages and assess household consumption of vitamin A rich food. Inaddition, further research should incorporate quantitative research data collection techniques such as focus group discussions in order to obtain different perceptions and views on consumption of Vitamin A-rich foods. This would help provide reasons for diverse consumption patterns and also help discover how best to meet household consumption vitamin A rich food.

REFERENCE

Agazhi , Z. D. (2016). *Adoption And Welfare Impact Of Improved Food Legume Technologies In Bale Highlands Of Ethiopia:Intra And Inter-Household Empirical Analysis.* MSc Thesis.

Ahern, M. B., Kennerdy, G., Nico, G., Diabre, O., Chimalilo, F., Khonje, G., & Chanda, E. (2021). *Women's dietary diversity changes seasonally in Malawi and Zambia.* Retrieved from https://hdl.handle.net/10568/113226

Asiimwe, E. (2018). *Effect of an integrated agriculture-nutrition extension program on nutrition knowledge and dietary diversity of farminghouseholds in Central Uganda.* Makerere, University, Kampala, Uganda: Unpublished masters dissertation.

Ayenew, H. Y., Biadgilign, S., Schickramm, L., Sauer, J., & Abate-Kassa, G. (2017). Production diversification, dietary diversity and food poverty: Empirical evidence from Ethiopia and Tanzania. *German Association of Agricultural Economists and the 27th annual conference of the Austrian Society of Economics "Bridging the Gap between Resource Efficiency and Society's Expectations in the Agricultural and Food Economy".* Munich, German.

Babatunde, R. O., & Qaim, M. (2009). Impact of off-farm income on food security and nutrition in Nigeria. *Annual International Conference of the German Economics Association*, (pp. 1-30). Frankfurt.

Bhutta, Z. A. et al. (2012) 'Is it time to replace iron folate supplements in pregnancy with multiple micronutrients?', Paediatric and Perinatal Epidemiology, 26(Suppl. 1), pp. 27–35.

Caliendo, M., & Kopeinig, S. (2008). Some practical guidance for the implementation of propensity score matching. *Journal of Economic Surveys, 22*(1), 31-72.

D'Alimonte, M., Ghai, K., Becker, L., & Flory, A. (2019). *How Evidence Informs Decision-Making: The scale-up of nutrition actions through an early childhood development platform in Malawi.*

Demeke, M., Meerman, J., & Scognamillo, A. (2017). Linking farm diversification to household diet diversification: Evidence from a sample of Kenyan ultra-poor farmers. *ESA Working Paper No. 17-01.* Rome: FAO.

Department: Agriculture, Forestry and Fisheries republic of South Africa. (2011). Sweet potato *(Ipomoea batatas L.) production.* Pretoria: Department of Agriculture, Forestry and Fisheries

Dhillon, C. (n.d.). *Promoting the production and consumption of micronutrient-rich crops: Experiences from Orange Fleshed Sweet Potatoes and Enhanced Homestead Food Production.* CAADP Nutrition Capacity Development Workshop East and Central Africa, 25th February – 1st March .

Epeju, W., & Rukundo, P. (2018). Food security and income through sweeetpotato production in Teso, Uganda. *Sustainable Agriculture Research;, 7*(1), 146-155.

FAO & FHI 360. (2016). Minimum Dietary Diversity for Women: A guide to measurement. Rome: FAO.

FAO. (2014). Guidelines for assessing nutrition related knowledge attitude and practices. Rome.

FAO. (2015). Improving Complememtary Feeding in Malawi: A Lesson Learned a Process review of a food security and nutrition project.

FAO, & FHI 360. (2016). *Minimum Dietary Diversity for Women:A Guide to Measurement.* ROME: the Food and Agriculture Organization of the United Nations and USAID's Food and Nutrition Technical Assistance III Project (FANTA).

GAIN, Johns Hopkins University, University of Michigan, & Michigan State University. (2020). *Food systems Dashboard: About Food Systems.*

Gatto, M., Okello, J., Pradel, W., Kwikiriza, N., Mgomezulu, W., Nyirenda, Z., . . . Heck, S. (2021). *Adoption and Effects of Orange-Freshed Sweetpotato Varieties In Malawi.* Lima, peru: CGIAR Research Program on Roots, Tubers and Bananas.

Geresomo, N., Mbuthia, E., Matofari, J., & Mwangwela, A. (2017). Risk factors associated with stunting among infantsand young children aged 6 - 23 monthsin dedza district of central malawi. *African journal of Food agriculture nutrition and development, 17*(4), 12854-12870.

Grant, F., Okuku, H., Kakuhenzire, R., & Mwenda, M. (2020). IntegratedAgriculture-Nutrition Educationwith Orange-fleshed Sweetpotato (OFSP) Improved Maternal Knowledge, Food-Security and Dietary Intakes in Rural Tanzania. *Global Nutrition*, 911

Grandhi, M., Reddy, G., & . Preethi, M. (2013). Information Sources of Rural Women on Health and Nutrition in Ranga Reddy District of Andhra Pradesh. *International Journal of Scientific Research, 2*, 216-217

Hirvonen, K., & Hoddinott, J. (2014). Agricultural production and children's diets: Evidence from rural Ethiopia.

Jemberu, Y., Zegeye, M., Singh2, P., & Abebe, H. (2017). Consumption of Vitamin A Rich Foods and Associated Factors among Children Aged 6-23 Months in Kachabira District, Southern Ethiopia. *International Journal of Food Science and Nutrition Engineering, 7*(1), 1-10.

Kajjura, R. B., Veldman, F. J., & Kassier, S. (2019). Effect of Nutrition Education on Knowledge, Complementary Feeding, and Hygiene Practices of Mothers With Moderate Acutely Malnourished Children in Uganda. *Food and Nutrition Bulletin (FNB), 40*(2), 221-230..

Kalima, T. Z. (2019). Factors Influencing Dietary Diversity in Malawi. *EC Nutrition RCO, 1*, 04-06.

Kiplangat, J., & Akama, M. (202P). Crop Production Diversity and Women Dietary Diversity in Rural Kenya. Nairobi: African Economic Research Consortium.

Kissoly, L., Faße, A., & Grote , U. (2018). Implications of Smallholder Farm Production Diversity for Household Food Consumption Diversity: Insights from Diverse Agro-Ecological andMarket Access Contexts in Rural Tanzania. *Horticulturae, 4*, 2-23.

Koppmair, S., Kassie, M., & Qaim, M. (2016). Farm production, market access and dietary diversity in Malawi. *Public Health nutrition, 20*(2), 325_335.

Kumwenda, W. (2017). Parental and Caregiver's nutrition knowledge, attitude, perceptions and practices on nfant and young child feeding (aged zero to 24) in Mzimba-north district Malawi. *Msc Thesis*.

Kwikiriza, N., Jogo, W., Okello, J., Tesfay, H., Asfaw, F., & Pambo, K. (n.d.). The impact of school nutritional campaigns on OFSP adoption and food security among smallholder farming households in Tigray region, Ethiopia.

Manikyamba, D., Vidya, D. L., Satyavani, A., Prasad, K., & Deepthi, K. T. (2015). Impact of Nutritional Education on the Knowledge of Mothers Regarding Infant and Young Child Feeding Practices. *Scholars Journal of Applied Medical Sciences, 3*, 1074-1078.

Mutiso, J. M., Okello, J., Lagerkvist, c., Mouki, P., Kosula, W., & Heck, S. (2018). Effect of nutrition education and psychosocial factors on child feeding practices: findings of a field experiment with biofortified foods and different women categorie. *Ecology Of Food And Nutrition, 57*, 346–371.

Muthee, S. W. (2018). Effects of a Combined Horticulture and Peer-led Nutrition EducationIntervention on Food Security, Diet Diversity and Knowledge, Attitudes, and Practices of Women Farmers Belonging to Women's Self-help Groups in Rural Eastern Kenya.

National Statistical Office. (2017). *M*alawi Demographic and Health Survey 2015-16.Retrieved from https://dhsprogram.com/pubs/pdf/FR319/FR319.pdf.

National Statistical Office (NSO) [Malawi] and ICF International. (2016). *Malawi Demographic and Healthy Survey 2015-2016.* Zomba, Malawi, and Rockville, Maryland, USA: NSO and ICF International.

National Statistical Office. (2019). *2018 Malawi Population and Housing Census* . Zomba: Government of Malawi.

Quaidoo1, E. Y., Ohemeng1, A., & Amankwah-Poku, M. (2018). Sources of nutrition information and level of nutrition knowledge among young adults in the Accra metropolis. *BMC Public Health, 18*, 2-7.

Ragasa, C., Aberman, N. L., & Mingote, C. A. (2019). Does providing agricultural and nutrition information to both men and women improve household food security? Evidence from Malawi. *Global Food Security, 20*, 45-59.

Rosen, D. S., Haselow, N. J., & Sloan, N. L. (1993). *How to Use the HKLFood Frequency Method to Assess Commnunity Risk of Vitamin A Dificiency/Hellen Keller International Vitamin A Technical Assistance Program.* Newyork.

Rosenbaum , P. R., & Rubin , D. B. (1983). The central role of the propensity score in observational studies for causal effects. *Biometrika, 79*, 16-24.

Sekabira, H., & Nalunga, S. (2020). Farm Production Diversity: Is it important for food security, dietary diversity and nutrition? Panel Data evidence from Uganda. Nairobi: African Economic Research Consortium.

Sibhatu, K. T., & Qaim, M. (n.d.). Farm production diversity and dietary quality: Linkages and measurement issues. *GlobalFood Discussion Papers, No. 80*.

Sibhatu, K. T., Krishna, V. V., & Qaim, M. (2015). Production diversity and dietary diversity in smalllholder farm households. *PNAS, 112*(34), 10657–10662.

Sibhatu, K., & Qaim, M. (2018). Review: Meta-analysis of the association between production diversity,diets, and nutrition in smallholder farm households. *Food Policy, 77*, 1-18.

Signorelli, S., Haile, B., & Kotu, B. (2016). Exploring the link between agricultural production diversity and dietary quality: Evidence from Ghana.

UNICEF (2020). Global databases Infant and Young Child Feeding.

USAID. (2014). Malawi: Nutrition Profile. .

USAID. (2011). *Maternal, Infant, And Young Child Nutrition In Malawi: Recipe Book.* Government Of Malawi.

Venkatesh, P., Sangeetha, V., & Singh, P. (2016). Relationship between Food Production and Consumption Diversity in India – Empirical Evidences from Cross Section Analysis. *Agricultural Economics Research Review* (pp. 139-148). New Delhi: ICAR-Indian Agricultural Research Institute,.

Walters, C., Bendulo, p., & Stoecker, B. (2019). assessment of dietary diversity, antenatal care, food taboos, meal frequency, and nutritional status of pregnant adolescents in rural malawi: a cross-sectional study. *Afr. J. Food Agric. Nutr. Dev., 19*, 14555-14570.

WHO. (2003). Infant and Young Child Feeding A tool for assessing national practices,policies and programmes. GENEVA.

WHO. (2009). Infant and young child feeding: Model Chapter for textbooks for medical students and allied health professionals. Geneva.

WHO. (2010). Indicators for assessing infant and young child feeding practices. Geneva.

WHO. (2017). Global Nutrition Monitoring Framework: operational guidance for tracking progress in meeting targets for 2025. Genevo.

WHO (2017). Global Health Observatory

World Bank. (2019). Productive Diversification in African Agriculture and its Effects on Resilience and Nutrition.

Yang, S., & Berdine, G. (2015). Poisson Regression. *The Southwest Respiratory and Critical Care Chronicles, 3*(9), 61-64.

APPENDIX

Appendix 1: Distribution of estimated propensity score

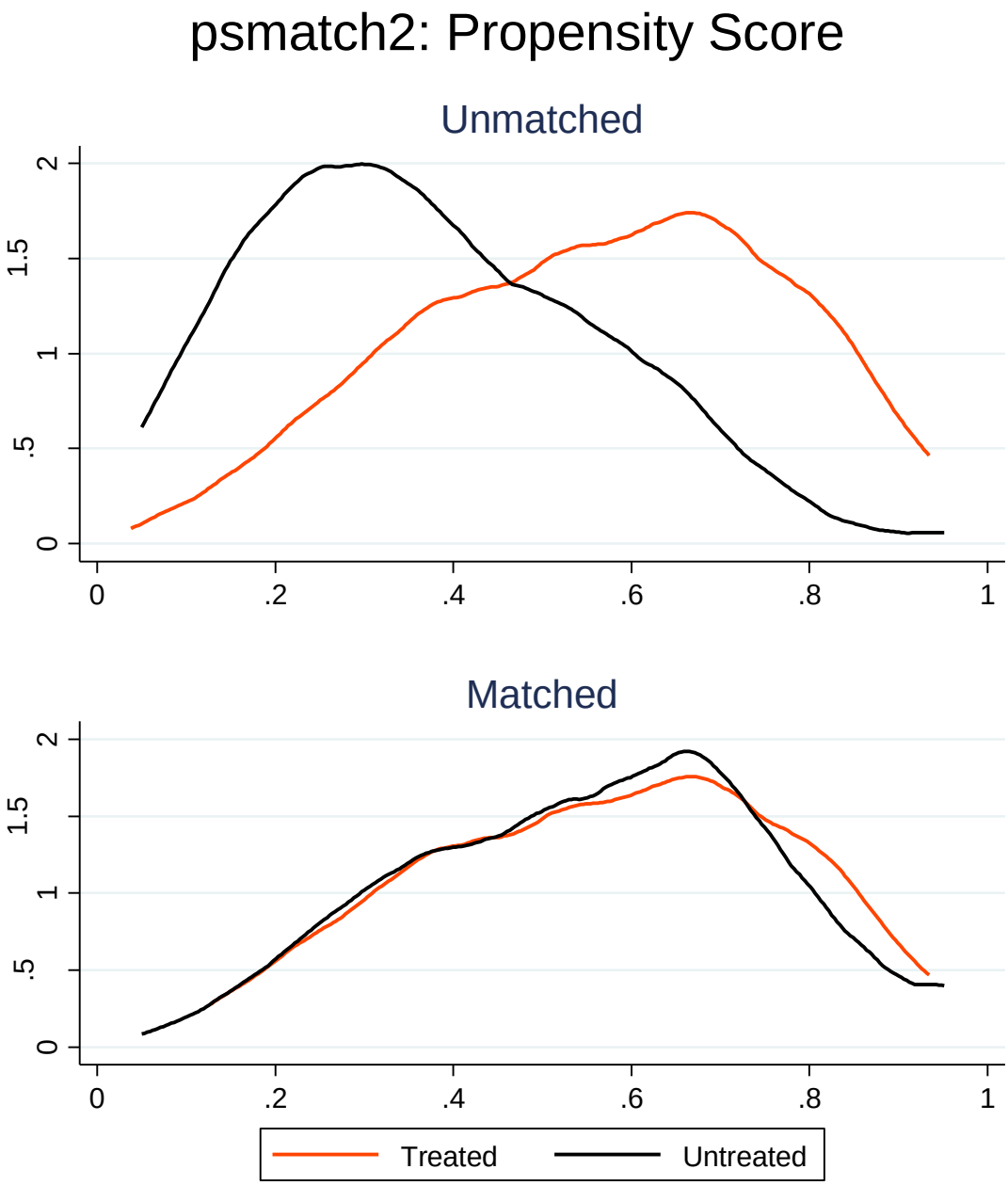
Group	Observation	Mean	Standard deviation	Min	Max
Overall	360	0.46	0.22	0.04	0.95
Participants	165	0.56	0.20	0.04	0.93
Non-participants	195	0.37	0.19	0.05	0.95

Source: own estimation

Appendix2: Matching Algorithm

ESTIMATION METHOD	**Sample size**	**Number of insignificant variables**	**Pseudo-Rsquared**	**Mean bias**	**Med Bias**	**T-stat**
Nearest Neighbor						
Nearest Neighbor at 1	360	17	0.042	9.0	7.8	2.80
Nearest Neighbor at 2	360	20	0.025	6.9	5.5	2.53
Caliper Matching						
Caliper at 0.1	360	17	0.042	9.0	7.8	2.80
Caliber at 0.2	360	17	0.042	9.0	7.8	2.80
Kernel Matching						
Bandwidth at 0.1	360	20	0.012	4.7	4.7	2.80
Bandwidth at 0.25	360	20	0.017	5.0	3.5	2.71

Source: own computation



Appendix 3: propensities before and after matching for caregivers

Appendix 4: Balancing tests for participants and matched controls for caregivers

Covariates	Sample	Mean		p-value
		Participants	Non-participants	
Nutrition Knowledge	U	9.84	9.48	0.050**
	M	9.85	9.78	0.717
Production diversity	U	4.67	4.02	0.000***
	M	4.70	4.63	0.585
Off-farm income	U	11.10	10.98	0.478
	M	11.11	11.14	0.876
Household size	U	5.47	5.30	0.362
	M	5.48	5.37	0.599
Log-Age-woman	U	3.46	3.40	0.101
	M	3.46	3.48	0.589
Log-Age-head	U	3.57	3.55	0.495
	M	3.58	3.57	0.906
Education-woman	U	6.64	6.70	0.880
	M	6.64	6.58	0.868
Education-head	U	7.83	7.73	0.794
	M	7.83	7.63	0.596
Gender-head	U	0.76	0.71	0.340
	M	0.76	0.74	0.621
Knowledge-sources	U	1.68	0.82	0.000***
	M	1.70	1.73	0.890

Radio-ownership	U	0.41	0.38	0.529
	M	0.41	0.40	0.772
TV-ownership	U	0.05	0.04	0.394
	M	0.05	0.04	0.610
Bicycle-ownership	U	0.59	0.54	0.338
	M	0.60	0.59	0.866
Phone-ownership	U	0.71	0.68	0.512
	M	0.71	0.70	0.750
Location	U	2.12	2.37	0.001***
	M	2.12	2.21	0.240
Log-distance-village-market	U	0.58	0.82	0.003***
	M	0.57	0.55	0.782

***, ** and * represent significance at 1%, 5% and 10% respectively.

Source: Own estimation

Appendix 5: test for the joint significance of variables

Sample	Ps R2	LRchi2	P-values	Mean bias	Med-bias
Unmatched	0.148	73.65	0.000	15.1	9.6
Matched	0.012	5.28	1.000	4.7	4.7

Source: Own estimation

Appendix 9: Questionnaire

Effect of participation in RTC-ACTION project on nutrition knowledge, diet diversity and infant and young child feeding practices

QUESTIONAIRE NUMBER:_____

My name is_____. I am from LUANAR. We are carrying out research leading to an award of M.Sc thesis on nutrition knowledge, household diet and caregiver and young child feeding practices in [district]. You've been randomly selected to participate in this research/interview. Your participation is voluntary and the information we get from you will be treated confidentially. It will be reported together with those of others and your name and contact or that of your family will not be specifically identified/mentioned in the thesis report. The findings of this study will help better understand the current issues maternal and child feeding and M.Sc student complete her studies.

You can choose to answer or not answer any questions, and are free to withdraw from further participation in this interview at any time. In case you decline/withdraw, your lack of participation will not have any negative consequence on you, nor will it prevent you from benefitting from future government activities/program in [district]. We would, however, appreciate your participation and completion of the interview, and your honest answers to the issues we shall discuss.

If you have any further questions about this research, you can contact Ms. Flora Ulaya [M.Sc student, Phone _____] or her University Supervisor [Dr. Samson Katengeza, Phone: 0995446202/01277222].

The interview will take about one and half hours to complete. Do you have any questions right now?

With your permission/consent, I would like to start the interview. May I now proceed to start the interview? Yes…… No…… [*You must select one. Stop interview if NO, thank the caregiver and leave*]

PART 0. SITE IDENTIFICATION & DATA QUALITY CONTROL

Interview Date *[dd/mm/yyyy]* |……..||……..||……..| Start time: _____ End time _____	
Interviewer name	
Signed by Supervisor (name) Date *[dd/mm/yyyy]* |…….||.....||……..|	
District_____ EPA _____ Section _____ Village _____	
Latitude of the dwelling unit (in decimal degrees)	North : |___|___|**:** |___|___|___|
Longitude of the dwelling unit (in decimal degrees)	East: |___|___|**:** |___|___|___|
Altitude of the dwelling unit (MASL)	|___|___|___|___| meters
Respondent name in full _____ Questionnaire number _____	

PART 1. SCREENING QUESTIONS

[*Please read*]: **I would like to start by asking you questions relating to your household and location of your farm…** [*Discontinue interview if A08 to A10 are ALL NO*]

	Screening questions	1=Yes 0=No 99=N/A or year (yyyy)
1	Is there a child who is **less than 2yrs old** in this household?	
2	Is there a child 24-49 months old in this households?	
3	Is there a lactating/breastfeeding mother in this household?	
4	Is there a pregnant **woman/girl** in this household?	
5	Have you ever heard of a sweetpotato project in this area?	
6	If Yes, have you participated in any?	
7	When did you start participating? Year_____	
8	Have you or household (HH) member participated in Care Group(s)?	
9	If Yes, when was did you or HH member first join a Care Group? (Year)	
10	Are you or HH currently still a member of a Care Group? 1=Yes 0=No	

PART 2: <u>HOUSEHOLD DEMOGRAPHY AND RELATED INFORMATION</u>

Household composition and characteristics

1. Name (start with respondent, then spouse or anyone next in decision making order)	Sex: **1=Male 0=Female**	Age (years)	Education level (Years of schooling completed)	Relation to household head (**Codes A)**	Occupation (**Codes B)**		How many months have you been away from the farm in 2016
					Main	Secondary	
	2	**3**	**4**	**5**	**6**	**7**	**8**
1.							
2.							
3.							
4.							
5.							
6.							
7.							
8.							
9.							
REFERENCE MOTHER HH ID NUMBER: _____			REFERENCE CHILD HH ID NUMBER: _____				

Codes A: 1=Household head 2=Spouse 3=Son/daughter 4=Parent 5=Son/daughter in law 6=Grandchild 7=Other relative 8=Hired worker 77=Other (specify)……

Codes B: 0=None 1=Farming (crop+ Livestock) 2=Salaried employment 3=Self-employed off-farm 4=Casual laborer on-farm 5=Casual laborer off- farm 6=School/College child 7=Non-school child 8=Herding 9=Household chores 77=Other (specify)…… 88=Not applicable

PART 3. FARM AND HOUSEHOLD ASSETS

A. Land holding, this cropping season (2020)

	Category of plot	**A. Area of land**	Units 1=Hectare 2=acre 3=Msq. 4=Yards	**B. Cultivated area**	Units 1=Hectare 2=acre 3=Msq. 4=Yards
3a1.	Total farm size				
3a2.	Own land				
3a3.	Rented land				
3a4.	Borrowed land				

B. What assets do you currently own? Indicate number and estimated value of assets

Type of Asset		Number	Estimated **TOTAL** value in current state (MK)		Type of Asset	Number	Estimated **TOTAL** value in current state (MK)
Agricultural equip				**3b13.**	Mobile phone		
3b1.	Hoe			**3b14.**	Bed		
3b2.	Machete			**3b15.**	Sofa		
3b3.	Sprayer			**3b16.**	Other furniture		
3b4.	Cart			**Livestock**			
3b5.	Irrigation pump			**3b17a.**	Lactating cows		
				3b17b	Other cattle (cows/bulls)		
3b6.	Wheel barrow			**3b18a.**	Dairy goats on milk		
				3b18b	Other goats		
				3b19a	Layers/hens laying eggs		

Household				**3b19b.**	Other chicken		
3b7.	Radio			**3b20.**	Rabbits		
3b8.	Television			**3b21.**	Pigs		
3b9.	Bicycle			**3b22.**	Ducks		
3b10.	Motorcycle			**3b23.**	Pigeons		
3b11	Car			**3b24.**	Guinea foal		
3b12	Solar & accessory			**3b25.**	Sheep		
				3b26	Others _____		

3c. House wall type: ____1= mud 2=Wood (timber) 3=unburnt Bricks 4=Burnt bricks 5=Stone 6=Cement blocks 77=Other (specify)…..

3d. House Roof type: _____ 1=Grass thatched 2=Iron sheet 3=Tiles 4=Asbestos 77=Other (specify)……..

3e. Floor type: _____ 1=Earth 2=Wood 3=Cement 4=Tiles 77=Other (specify)……

PART 4: SWEETPOTATO PRODUCTION

4a1. When (year) did you start growing sweetpotato? _____

Which varieties have you grown since you started growing sweetpotato **(Codes A)**	Variety type: **0=Local 1=Improved**	Flesh color: **1=White/cream 2=Orange 3=Purple 4= Yellow**	When (year) did you first acquire the variety	Are you still growing the variety? **1=Yes 0=No**	Compared to 3 years ago, under this variety has…. 1=Increased 2=Decreased 3=Stayed the
4a2	**4a3**	**4a4**	**4a5**	**4a6**	**4a7**

Codes A: 1= Kadyaubwerere 2=Kaphulira 3=Chipika 4=Anaakwanire 5=Mathuthu 6=Zondeni 7=Kenya 8= Semusa 9=Mugamba 10=Salera 11=Nyamoyo 12=Sungani 77=Others (Please specify)……..

PART 5: OTHER CROPS GROWN BY THE HOUSEHOLD

Please indicate below which other crops were produced by this household in 2020

			Maize	Tomato	Onion	Cabbage	Amaranth	Beans	Groundnuts	Rice	Cowpea	Pigeon pea	Cassava	Soy bean	Millet/pearl	Tobacco.	Cotton	Bananas	Tea	Other.....
5a.	Did you grow during…..? **1=Yes 0=No**	Rain fed																		
		Dry																		
5b	How much did you produce (50 kg bags)	Rain fed																		
		Dry																		
5c.	Did you sell during …. **1=Yes 0=No**	Rain fed																		
		Dry																		

5d	Do you currently have […] in stock? **1=Yes** **0=No**																			
5e	What storage technologies did you use to protect the maize you harvested last season?																			

CODES 5e: 1= Spraying/dusting (chemicals), 2=Metallic silos, 3=PICS bags, 4=Ashes (traditional methods) 5=Did Nothing, 6=Other (Specify).....

PART 6: CLUB MEMBERSHIP

1. Do you belong to a any group? **_____ 1=Yes; 0=No**

2. If yes, what type of group is it? 1= Farmer club 2= Farmer association 3=Cooperative 4=Care Group 5=Church/religious 6=Other …….

3. If Care Group, what service does your club provide (**multiple responses are accepted) ____**

1= nutrition messaging (health talks for awareness creation) 2=nutrition counselling (one-to-one) 3= Both nutrition messaging and counselling 5= cooking demonstrations 6=Recipes/handouts only 7=infant and young child feeding 8=feeding for people living with HIV 9=Feeding for pregnant and breastfeeding mothers 10=Other (specify)_____

PART 7. HOUSEHOLD FOOD SECURITY AND NUTRITION SITUATION

1. In the past 3 years have you experienced food shortages **1=Yes 0=No**	**2.** If yes, for how many months do you experience food shortages **(Code A)**	**3.** When the household runs out of food what are your coping mechanisms **(Code B)**	**4.** Have there been improvement in the food availability compared to 3 years ago? **1=Yes 0=No**	**5.** If you have experienced improvements what are the reasons **(Code C)**

Code A: 1= the whole year 2= 9 months 3= 6 months 4= 3 months 5= Less than 3 months 77= Other, (specify)_____

Code B: 1= Buys food from the market 2=Appeal from relations 3=Government/NGO free handouts 4=Food for work 5=Ganyu for food 6=Food remittances 7=IGAs 8=Sell of other crops

9=Sell of livestock 10= Sell of household belongings 11=Eat wild food 12=Reduce number of meals per day 13=Eating Chitibu 14=Other, specify

Code C: 1= Enough rains 2= Access to inputs 3= Application of good agricultural practices 4=Access to more land 5=Increased labor 6=Winter farming 7=Access to water 8=Use of improved varieties 9=Crop diversification 10=New income opportunities 11= Food aid 77=(Others), specify……..

Sweetpotato Consumption

6. In this **community** what is the main form of consumption of sweetpotato **(code C)**	**7.** In what form of sweetpotato do you feed your children **(Code C)**	**8.** In what form do you (i.e., caregiver) mostly eat sweetpotato in your household? **(Code C)**

Code C: 1=Whole boiled 2=Fried chips (French flies) 3=Mashed 4=Mixed with beans 6=Mixed with meat 7=Futali (in groundnut paste) 7=Roasting 8=Mixed with pigeon pea 9= Sweet beer (Thobwa) 77=Other

9. In times of maize shortage, which crops do you rely on as your main food crop? [Select all that apply]

1=Rice 2=Finger millet (mawere) 3=Sorghum (mapira) 4=Pearl millet (mchewere) 5=Wheat flour 6=Cassava tubers 7= Cassava flour 8=White sweet potato 9=Orange sweet potato 10=Irish potato 11=Banana

10. In which form do you consume maize in the times of maize shortage

1=Maize ufa Woyera (normal flour) 2=Maize ufa madeya (bran flour) 3=Maize grain (not as ufa)

4=Green maize 5= Maize ufa mgaiwa) 6= Maize gramil

PART 8. HOUSEHOLD FOOD INSECURITY ACCESS SCALE (HFIAS)

[*Each of the questions in the following table is asked with a recall period of four weeks (30 days). The respondent is first asked whether the condition in the question happened at all in the past four weeks (yes or no). If the respondent answers "yes", then she/he is asked to determine whether the condition happened rarely (once or twice), sometimes (three to ten times) or often (more than ten times) in the past four (4) weeks. Explain to the respondent our definitions of rarely, sometimes and often.*]

	HFIAS Question	a. Response **1=Yes; 0=No**	b. If Yes, how often? **Codes A**

i	In the past four weeks, did you worry that your household would not have enough food?		
ii	In the past four weeks, were you or any household member not able **to eat the kinds of foods you preferred** due to lack of resources?		
iii	In the past four weeks, did you or any household member have to eat **a limited variety** of foods due to lack of means to buy them?		
iv	In the past four weeks, did you or any household member have to eat some foods that you really did not want to eat because of a lack of resources to obtain other types of food?		
v	In the past four weeks, did you or any household member have to eat a **smaller meal** than you felt you needed because there was not enough food?		
vi	In the past four weeks, did you or any other household member have to eat **fewer meals** in a day because there was not enough food?		
vii	In the past four weeks, was there **ever (a day when there was) no food** to eat of **any kind** in your household because of lack of resources to get food?		
viii	In the past four weeks, did you or any household member go to sleep at night hungry because there was not enough food?		
ix	In the past four weeks, did you or any household member go a whole day and night without eating anything because there was not enough food?		

Codes A: **01**=Rarely (1-2 time in past four weeks) **02**=Sometimes (3-10 times in past four weeks) **03**=Often (>10 times in past four weeks) **88**=Never

PART 9: INSTRUCTION: For the sections that follow, please consider

[*The reference child is the youngest child between 6 months and 59 months (< 5 years) and the reference woman can be a pregnant /lactating mother. If both women are present, choose pregnant woman. (Both of these women may have a child qualifying as reference child; if so choose the youngest child between 6-59 months of the pregnant woman. If the pregnant woman does not have a child, choose youngest child of lactating woman as reference child*]

Section I:DIETARY DIVERSITY – BASED ON 24-HOUR RECALL

Instructions for collecting data on 24-hour dietary diversity: *Please describe the foods (meals and snacks) that you ate [*at least a tablespoon (15gm minimum)*] yesterday during the day and night. Start with the first food eaten in the morning after you woke up.*

		Question	**Ref Child**	**Ref Woman**
		Name of the respondent (First name):		
		Member ID [F*rom demographic table*]		
	Food Group	Examples	1=consumed 0=Did not consume	1=consumed 0=Did not consume
a.	Cereals	Any starchy foods like bread, noodles, biscuits, cookies or products made from millet, sorghum, maize, rice, wheat + *insert local foods e.g. Ugali, porridge (uji) or pastes or other locally available grains* staple		
b.	White tuber and roots	Any white sweetpotato, white yams, cassava, or foods made from these		
c.	Biofortified foods	A type of sweetpotato that is orange inside or orange maize [*show pictures*]		
d.	Legumes nut and seeds	Any beans or peas, including soybeans		
e.		Any nuts, groundnuts or cashews or seeds like pumpkins or sunflower		
f.	Milk and milk products	Any dairy products like milk, yoghurt or cheese or other milk products		
g.	Organ meat (iron rich)	Any organ meat like liver or heart or other organ meats or blood based foods. e.g., offal,		
h.	Flesh meats	Any beef, pork, lamb, goat, rabbit, wild game, chicken, duck, mice, or other birds		

		Question	**Ref Child**	**Ref Woman**
		Name of the respondent (First name):		
		Member ID [F*rom demographic table*]		
i.	Eggs	Any eggs		
j.	Fish	Any other kind of fish, fresh or dried or shellfish		
k.	Dark green leafy vegetables	Any dark green/leafy vegetables, including wild ones + *locally available vitamin-A rich leaves such as cassava leaves, Mpiru, Rape etc*.		
l.	Other vegetables	Any other vegetables (e.g. Tomato, onion, eggplant) , including wild vegetables		
m.	Vitamin A rich vegetables	Any pumpkin, carrots, squash, + *other locally available vitamin-A rich vegetables*		
n.	Vitamin A rich fruits	Any ripe mangoes, cantaloupe, ripe papaya + *other locally available vitamin A-rich fruit,* Masuku		
o.	Other fruits	Any other kind of fruits e.g., orange, banana, guava, including wild fruits, such as Matowo, Masawo, Ntuza		
p.	Oils and fats	Any source of fat, lard, like cooking oil, coconut milk, or butter		
q.	Sweets	Any sugary foods or drinks like sugar, honey, sweetened soda or sugary foods such as chocolates, cookies, candies		
r.	Spices and condiments	Like spices(black pepper, salt), condiments (soy sauce, hot sauce), coffee, tea, alcoholic beverages OR *local examples*		

Question	Question (*instruction*)	Answer
s.	Yesterday, how many times did the adults and older children (>14 years old) in this household eat orange-fleshed sweetpotato? (*enter # or 88=N/A)*	
t.	Yesterday, how many times did the children from 5 years to 14 years old eat orange-fleshed sweetpotato? (*enter # or 88=N/A)*	
u.	Yesterday, how many times did the reference child in this household eat orange-fleshed sweetpotato? (*enter # or 88=N/A)*	
v.	If the reference child ate orange-fleshed sweetpotato yesterday, how much did s/he eat? *Instruction to enumerator. Show pictures of OFSP root sizes*	
w-1	Number of very small roots (*If none: 0*)	
w-2	Number of small roots (*If none: 0*)	
w-3	Number of medium roots (*If none: 0*)	
w-4	Number of large roots (*If none: 0*)	

Section II: Frequency of consumption of vitamin A rich foods – 7 day recall

	During the last **seven days**, on how many days, the child and you as a reference woman, ate any of the food items below (go one by one by the food items and one by one by the days. [*Note :1. This is about the number of DAYS, NOT about the number of MEALS* *2. This includes food consumed outside the household* *3. This is about food items, which may be part of a dish, such as the child's porridge*]	**Ref Child**	**Reference woman**
		Number	**Number**
1	Any foods made from grains (like maize, rice, wheat, sorghum, millet, , bread, groundnuts, simsim, etc.)		
2	Whole chilies or peppers		
3	Any dark green leafy vegetables (sweetpotato leaves, cassava leaves, pumpkin leaves, Sukuma wiki/ kale, etc.)		
4	Pumpkin leaves		
5	Sweetpotato leaves		
6	Amaranth leaves		
7	Red palm oil		
8	Milk or milk products		

9	Carrots		
10	Ripe mango		
11	Pumpkin or orange squash		
12	Ripe papaw, fresh or as juice		
13	Wheat/Biscuits/Cookies/Bread		
14	White-fleshed sweetpotato		
15	Orange-fleshed sweetpotato		
16	Yellow-fleshed Sweetpotato		
17	Eggs with Yolk		
18	Any fish FRESH (with intact liver)		
19	Liver - from any animal or bird (e.g. chicken) or fish		
20	Meat from cow/pig/sheep/rabbit/rat or wild game		
21	Butter		
22	Cod liver oil		
23	Food fried in oil or with oil		
24	Passion fruit (or other fruit rich in vitamin A)		
25	Vitamin A fortified margarine (e.g., PRESTIGE, BLUEBAND, etc) or oil		
26	Chicken or other fowl		

27	Weaning food fortified with vitamin A, like Cerelac		
28	Infant formula (e.g. NAN, etc) fortified with vitamin A		
29	Coconut milk or oil, cooking oil, ghee		
30	Any sugar to which Vitamin A has been added		
31	Lentils, Beans (all kinds), peas, cowpeas, green gram, chickpeas, soya, other legumes		
32	Groundnut, cashew nut or any other nut		
33	Purple-fleshed sweetpotato, Avocado		

Section III: Consumption of OFSP in the last 7 days (these questions refer to the reference woman and the reference child)

	Question	**a.** Ref Child	**b.** Ref Woman
1	Did you eat OFSP as a completely cooked root or as an ingredient in a dish in the last 7 days? **1**=Yes; **0**=No		
2	If yes, how was it used (cooked or prepared) **1**=Cooked root; **2**=Ingredient; **3**=Both		

3	On a typical day, how many roots of OFSP does [name] eat during the entire day either as roots or as an ingredient? **1**=¼ ; **2**= ½; **3**=3/4; **4**=1 whole; **5**=more than		
4	Approximately what is the average size of each? ***[****Show pictures of OFSP sizes, ask for size****]*** **1**=Very small **2**=Small; **3**=Medium; **4**=Large		
5	[*Ask only if OFSP was eaten as an ingredient*]: Approximately how many OFSP roots were used as an ingredient in the portion of the dish you ate in the past 7 days and average size used? **01**=¼ ; 0**2**= ½; **03**=3/4; **04**=1 whole; 0**5**=more than 1; **99**=N/A		
6	Where did the OFSP you ate this week come from? **01**=Household's field; **02**=market; **03**= Friend; **04**= Other .....; **77**= Don't know; **99**=N/A		
7	In the past 7 days, how many days did you or [child name] eat cooked food outside home that was **<u>purchased</u>** (e.g., in a restaurant, street vendor, etc.)? *[Write zero, if no food consumed outside home]*		
8	Did any of the foods consumed outside contain OFSP to your knowledge? **1**=Yes; **0**=No; **99**=N/A		

9	Do you know what product (s) / food (s) that were? (list 2 only mostly consumed) **1**=Mandazi; **2**=Chapatti; **3**=Bread; **4**=Biscuits; **5**= Noodles **6**=Porridge; **7**=Roasted roots; **8**= Boiled roots; **9**=Juice; **10**= Jam; **11**=Crackers **12**= Cakes; 13=other; **99**=N/A		

PART 10. KNOWLEDGE, OF VITAMIN A *[The respondent is the reference mother and/or child caregiver]*

1.	Have you ever heard of Vitamin A? **1**=Yes **0=**No >>>*go to **15f.***	
2.	If Yes, how long ago did you first hear of Vitamin A? **1**=Recently; **2**=1-3 months; **3**=4- 6 months; **4**= 6-12 months; **5**=1-2 years; **6**=More than 2 years; 77= don't know/remember; 99=NA	
4 **3.**	If Yes, tell me **2 main** reasons why Vitamin A is important **1**=Prevents disease; **2**=Good for eye sight; **3**=Keeps skin healthy; **4**=Produces red blood cells/keeps blood healthy; 5= Others reasons_____**77**=Don't know; 99=NA	
4.	Where did you **first** learn about Vitamin A? **1**=Radio **2**=Field day/Agriculture show 3=Health clinic **4**=Friend/relative; **5**=School; 6= print media 7=Sweetpotato awareness campaigns 77 =Other; 99=NA	

5.	Please name any t**hree** examples of foods that are rich in Vitamin A **1**=Ripe mango; **2**=Ripe papaya; **3**=Carrot; **4**=Eggs; **5**=Pumpkin; **6**=Cantaloupe; **7**=Red pepper; **8**=OFSP **9**=Green leafy vegetable (any) **10**=Other.....; 99=NA	
6.	If you had more money, how much OFSP would you eat compared to now? **01**=Less; 0**2**=More; 0**3**=The same; **88**=Never;	
7.	In your opinion, what is healthier to eat for breakfast, bread or sweetpotato? **1**=Sweetpotato; **0**=Bread	
8.	Have you participated in vitamin A supplementation using a capsule this year? **1**=Yes; **0=**No	
9.	If **No**, when was the last time you received a supplementation dose of Vitamin A capsule? **01**=less than 1 month ago; 0**2**=1-3 months ago; 0**3**=4-6 months ago; 0**4**=6-12 months ago ; **05**=more than 1 year ago; **77=**don't know ; **88**=Never	

PART 11: INFANT AND YOUNG CHILD FEEDING PRACTICES AND MATERNAL KNOWLEDGE

	Question	**Respons e**
1.	HH Member ID of the reference child [*From PART 2*]	
2.	HH Member ID of the caregiver/ref woman [*From PART 2*]	
3.	Child's gender : **1**=Male; **0**=Female	
4.	In what month, day and year was [name] born? [*Record as dd/mm/yyyy*]	
5.	Where was [name] born? **1**=At home in this village; **2**=At home in another village/town ; **3**=At a health facility / hospital; **77=**Don't know/ don't remember	
6.	Was [name] ever breastfed? **1**=Yes; **0=**No	
7.	How many hours after birth was [name] put to the breast? **1**=less than an hour; **0**=greater than an hour; **88**=never; 77=don't know	
8	Has [name] received the first milk (colostrum)? **1**=Yes; **0=**No	
9.	At what age was [name] introduced to solid or semi-solid foods	
10.	At what age was [name] introduced to water or other liquids	
11.	Is [name] still being breastfed? 1=Yes; **0=**No >>> got to **14**	
12.	Is [name] being breastfed exclusively or received breast milk with other foods **1**= exclusively breastfed (100%); **0**=mixed feeding (breast milk with other foods)	
13.	If [name] is exclusively breastfeeding, how frequently is the feeding breast milk? *[skip if response to **12** is 0])* ***Response should be in number of hours***	

	Question		Response
14.	If [name] is not currently being breastfed, at what age did breastfeeding stop		
15.	When was the last time [name] received a vitamin A dose? [*Verify if recorded in vaccination card*]	**01**=less than 1 month ago **02**=1-3 months ago **03**=4-6 months ago **04**=6-12 months ago **05**=more than 1 year ago **77**-don't know / don't remember **88**=Never received	
16.	When was the last time he/she received any fortified lipid supplement? E.g. LNS, Nutributter, Plumpy'Nut etc...		
17.	When was the last time [name] received any fortified porridges?		
18.	Was [name] given **[local name for oral rehydration solution]** in the last 2 weeks? **01**=Yes; **0=**No; **77**=don't know		
19.	When a baby is born, is it good or bad to give the first breast milk? **00**=Bad; **01**=Good ; **77**=Don't know		
20.	How many times should a baby less than 6 months be breastfed in a day **1**=1-2 times; **2**=2-4 times; **3**=4-6 times; **4**=6-8 times; **5**=8-10 times; **6**= more than10 times		
21.	At what age should a baby be given water for the first time?		
22.	At what age should a baby be given other foods such as porridge for the first time?		
23.	At what age should a baby be fed sweetpotato for the first time		
24.	Under normal circumstances, until what age should a mother breast-feed a child		

	Question	**Respons e**
25.	How many times should a breastfeeding child 6-8 months old be fed on porridge or other foods per day. **1**=zero or once; **2**=two times exactly; **3**= 2-3 times; **4**=3 times exactly; **5**=3-4 times; **6**=4 times exactly; **7**=4-5 times; **8**=other_____	
26.	How many times should a breastfeeding child aged 9-23 months be fed on porridge or other foods per day. **1**=zero or once; **2**=two times exactly; **3**= 2-3 times; **4**=3 times exactly; **5**=3-4 times **6**=4 times exactly; **7**=4-5 times; **8**=other_____	
27.	Where did you learn about child feeding? [*Don't prompt*] *Record **3** most important responses after confirming* **1**=Health center/trained staff; **2**=Mother; **3**=Mother-in-law; **4**=Other female relative ; 5=Husband; 6=Church/mosque; **7**=Radio/TV; **8**=mothers' club/group; 9 =Project (specify_____); **10**=NGO (specify_____); **11**=Other_____; **77**=Don't know	
28.	Do you know what the 3 basic food groups are? **1=Yes; 0=No**	
29.	If Yes to **28** name them? [*code based on number/combination provided]* 0= if none is mentioned; 1=(All) energy giving/bodybuilding/protective; 2= Energy giving/bodybuilding(2); 3= Bodybuilding/protective(2); 4=Energy giving/ protective(2); 5=Energy giving foods; 6=Bodybuilding foods; 7=Protective foods	

	Question	**Respons e**
30.	Should a pregnant woman eat less, more, or the same amount of food during her pregnancy, as she would normally eat? **1**=Much less; **2**= Somewhat less; **3**=The same; **4**=More; **5**= A lot more	
31.	Can you tell me if men in your household consume OFSP (**1**=Yes **0=**No)	
32.	Do men in your household discuss any benefits of OFSP with you and others in this home (**1**=Yes; **0=**No)	
33.	If yes, what do they say are the benefits of OFSP [*Circle all that apply*] 1= high yielding; **2**= good income source; **3**= nutritious for children, 4= good for pregnant/breastfeeding mothers; **5**=Healthy food; **6**=other (specify)_____	

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34. In the past 2 years, have you heard about sweetpotato nutrition messages? 1= Yes 0= No

35. If yes, how do you get those messages? [*Select all that apply*]

1= radio programs 2= Open days 3= Community Health Surveillance Assistants 4= Agricultural Extension Officers 5= NGO extension staff 6= other (specify) _____

36. At a market, would you buy an orange fleshed sweetpotato if on sale? 1=Yes 0=No

37. Given a choice, what would you grow orange fleshed Sweetpotato for? 1=Sale 2=Consumption 3=both

38. Do you eat sweetpotato leaves as relish? 1=Yes 0=No

39. Which varieties have the best preferred leaves for relish? 1= Round shaped 2=Lobed 3=any

PART 12. MINIMUM MEAL FREQUENCY FOR REFERENCE CHILD [*Ask only for children aged 6-23 months***]**

	Question	Response
1	Is child aged between 6 and 23 months (**1**=Yes; **0**=No)	
Sometimes adults taking care of the children have to leave the house to go to the field or market, look for water, etc. and have to leave young children behind. How many days in the past week (last 7 days) was [name]		
2	Left alone in the care of another adult for more than an hour	
3	Left in the care of another child, for more than one hour?	
[Now I would like to ask you about liquids that [name] might have had yesterday during the day or the night. I am interested in whether [name} had the item even if it was combined with other foods. Please include liquids consumed outside your home. Then we will ask about the number of times the foods were eaten.]		
4	Did [name] drink plain water yesterday, during the day or night? (**1**=Yes; **0**=No)	
5	Did [name] drink infant formula, during the day or night? (**1**=Yes; **0**=No)	
6	If Yes, how many times did [name] drink infant formula?	

7	Did [name] drink milk, such as tinned, powdered, or fresh animal milk yesterday, during the day or night? (**1**=Yes; **0**=No)	
8	If Yes, how many times?	
9	Did [name] drink or eat any milk-based products like yoghurt yesterday, during the day or night? (**1**=Yes; **0**=No)	
10	Did [name] drink juice or juice drinks yesterday, during the day or night? (**1**=Yes; **0**=No)	
11	Did [name] drink or eat vitamin or mineral supplements or any medicines yesterday, during the day or night? (**1**=Yes; **0**=No)	
12	Did [name] drink any other liquids yesterday, during the day or night? (**1**=Yes; **0**=No)	
13	Did [name] eat thin porridge yesterday, during the day or night? (**1**=Yes; **0**=No)	
14	Did [name] eat any solid or soft, mushy foods yesterday, during the day or night? **(1**=Yes; **0**=No)	
15	If Yes to **Q13-14**, how many times did [name] eat in total porridges, soft, mushy foods or solid foods, including snacks in between main meals, yesterday.	

What times of day did the [name] eat any of the soft, mushy or solid foods? *[Prompt the respondent with the different time/periods. Then check for consistency with number of times reported in **Q15**]*		
17	At breakfast time (sunrise to mid-morning (9 am)? (**1**=Yes; **0**=No)	
18	Later in the morning (9 a.m. to noon)? (**1**=Yes; **0**=No)	
19	Lunch (noon to mid- afternoon (3 pm)? (**1**=Yes; **0**=No)	
20	Later in the afternoon (3-6 p.m.)? (**1**=Yes; **0**=No)	
21	Dinner (6-9 p.m.)? (**1**=Yes; **0**=No)	
22	Late night (9 pm or later)? (**1**=Yes; **0**=No)	
23	Status of head of HH: **1**=Man; **2**=Woman with the support of a non-resident man; **3**=woman without the support of a man	

PART 13. WASH (for household)

24	What is done to the water before households' members drink it? [*record all that apply*] **01**=Nothing; **02**=Boiling; **03**=Filtering with a cloth; **04**=Local sand filter; **05**=Letting it settle; **06**=Chlorination; **07**=Use herbs; **08**=put it out in the sun; **09**=Others(Specify); **99**=NA	

25	When do you usually wash your hands during the day [*record all answers given*] **00**=Never; **01**=Before preparing food/ cooking; **02**=Before serving food; **03**=Before eating; **04**=Before feeding children; **05**=After going to toilet/defecation **06**=After cleaning child's bottom; **08**=Other (specify_____); **99**=NA	
26	What is done with children/baby faeces? **1**=Thrown out with normal rubbish/trash; **2**=Deposited immediately in a latrine; **3**=Scattered around the compound/house; **4**=Given to domestic animals to clear/eat; **5**=Buried; **6**=thrown into the bush **7**=other (specify_____)	

PART 14: OFF-FARM ACTIVITIES AND INCOMES

Please provide information on off-farm employment and incomes in the previous 12 months

	Activity	1. Who was involved? 1=Reference women 2=Spouse 3=Both 4=Other	2. Number of times/week	3. Estimated income per year* (MK)
a.	Artisan/handicraft			
b.	Firewood and charcoal selling			
c.	Unskilled wage labor (e.g. Daily laborer)			
d.	Skilled wage labor (e.g. Carpentry)			
e.	Grain milling			
f.	Petty trade (e.g. Retail shop, vending, selling grains, selling clothes)			
g.	Livestock-based business			
h.	Tailoring			
i.	Drought relief (food aid)			
j.	Food for work			
k	Temporary/daily farm labor elsewhere			

l.	Remittance			
m.	Other sources of income (please specify)_____			

* Convert in-kind income to its cash equivalent

PART 15: INFRASTRUCTURE AND MARKET ACCESS

18a. Distance to the nearest village market (km)…..……..Walking minutes…….…….……

18b. Type of road to major market:1=Non-paved dirt road; 2=Paved dirt road; 3=Paved gravel road; 4= Tarmac

18c. One-way transport cost to the village market using a bus or a pick-up (MK/person)……..…….

18d. Distance to the nearest main market (km)……Walking minutes…….……..……

18e. One-way transport cost (per person) to the main market using a bus or a pick-up (MK/person)……..……

18f. Distance to cooperative (farmer group) collection center (km)…..……Walking minutes……....

18g. How long does it take to the nearest tarmacked road? (Walking minutes) ----------

18h. How long does it take to the nearest health center? (Walking minutes) ----------

18i. How long does it take to the nearest bus stop or public transport?(Walking minutes) ----------

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18j. How long does it take to the nearest clean water supply? (Walking minutes) ----------

18k. How long does it take to the nearest public telephone? (Walking minutes) ----------

18l. Do you have electricity? ---------- **1**=Yes; **0**=No

PART 16: PROCRASTINATION (to be answered by the reference woman)

Please read each statement and select/circle a number 1, 2, 3 or 4 that indicates how much you agree or disagree with the statement. There are no right or wrong answers. Do not spend too much time on any statement.

	Do not agree (1)	**Agree slightly (2)**	**Agree moderately (3)**	**Agree Completely (4)**
a. I rarely begin tasks as soon as I am given them, even if I intend to.				
b. Often I mean to be doing something, but it seems that sometimes I just don't get round to it.				
c. I often seem to start things and don't seem to finish them off.				
d. I intend to get things done, but sometimes this just does not happen.				
e. Often I will set myself a date by which I intend to get something done or make a decision, but miss the deadline.				

	Do not agree (1)	Agree slightly (2)	Agree moderately (3)	Agree Completely (4)
f. I really want to get things finished in time, but I rarely do.				

PART 17: GENERAL PROCRASTINATION (to be answered by ref woman)

People may use the following statements to describe themselves. For each statement, decide whether the statement is like or unlike of you using the following 5 point scale.

Scale: 1=Very much unlike me 2=Unlike me 3=Neutral 4=Like me 5=Very much like me

a. I often find myself performing tasks that I had intended to do days before_____.

b. I often miss major events/celebrations because I don't get around to pay for them on time ___.

c. When planning a party, I make the necessary arrangements well in advance_____.

d. When it is time to get up in the morning, I most often get right out of bed_____.

e. When I am given a message to pass on, I immediately deliver the message_____

f. I generally return phone calls promptly_____.

g. Even with jobs that require little else except sitting down and doing them, I find they seldom get done for days_____.

h. I usually make decisions as soon as possible_____.

h. I generally delay before starting on work I have to do_____.

j. When travelling, I usually have to rush in preparing to arrive at the bus station on time_____.

k. When preparing to visit someone, I am seldom caught having to do something at the last minute____.

l. In preparing for some deadline, I often waste time by doing other things_____.

m. If a bill/debt for a small amount comes, I pay it right away_____.

n. I usually return an RVSP request very shortly after receiving the invitation_____.

o. I often have a task finished sooner than necessary_____.

p. I always seem to end up shopping for Christmas gifts/food at the last minute_____.

q. I usually buy even an essential item at the last minute_____.

r. I usually accomplish all the things I plan to do in a day_____.

s. I am continually saying I will do it tomorrow_____.

t. I usually take care of all the tasks I have to do before I settle down and relax for the day _____

PART 18: SELF-EFFICACY

Now please indicate <u>how much each statement describes you</u> using to the following scale: [*Tick the correct option*]

1	**1=Not at all true 2=Hardly true 3=Moderately true 4= Exactly true**

Statements	1	2	3	4
a. I can always manage to solve difficult problems if I try hard enough.				
b. If someone opposes me, I can find the means and ways to get what I want				
c. It is easy for me to stick to my aims and accomplish my goals.				

d. I am confident that I could deal efficiently with unexpected events.				
e. Thanks to my resourcefulness (skills), I know how to handle unforeseen situations				
f. I can solve most problems if I invest/apply the necessary effort.				
g. I can remain calm when facing difficulties because I can rely on my coping abilities				
h. When I am confronted with a problem, I can usually find several solutions.				
i. If I am in trouble, I can usually think of a solution.				
j. I can usually handle whatever comes my way.				

PART 19: HEALTH-SEEKING BEHAVIORS

For the following questions, use the scale below to respond:

Scale: 1=Never 2=Sometimes 3=Always

a. I daily (24 hours) feed my young children (6-23 months) diverse diets comprising the five food groups (grain/starch, animal protein, plant protein, vegetables & fruits) _____

b. I usually give breakfast to my children_____

c. I exclusively breastfeed my children during the first six months _____

d. I give my young children (2-5 years old) a snack in-between meals _____

f. I breastfeed my children until they are 1 year old _____

g. I breastfeed my children **even after** 1 years old _____

h. I attend antenatal clinics at least 4 times _____

i. I attend postnatal clinics regularly up to 2 years _____

j. I usually dispose feaces of the child into a toilet or bury _____

k. I dispose bath-water with children's feaces into a toilet _____

l. I boil/treat the water used in my family for drinking _____

m. I usually wash my hands before handling foods _____

n. I take my children to the clinic to get vitamin A supplements as recommended _____

Thank you very much [name] for your time!!!