

**MATERNAL PERCEPTION ON USE OF EDIBLE INSECTS FOR
COMPLEMENTARY FEEDING AND NUTRITION STATUS OF CHILDREN
IN KAKAMEGA AND SIAYA COUNTIES, KENYA**

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**A RESEARCH THESIS SUBMITTED IN PARTIAL FULFILLMENT OF THE
REQUIREMENTS FOR THE AWARD OF THE DEGREE OF MASTER OF
SCIENCE (FOOD, NUTRITION AND DIETETICS) IN THE SCHOOL OF
PUBLIC HEALTH AND APPLIED HUMAN SCIENCES OF KENYATTA
UNIVERSITY**

JULY, 2022

DECLARATION

This thesis is my original work and has not been presented for a degree or any other academic award in any university.

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DEDICATION

This thesis is dedicated to; the Almighty God, my supervisors, my loving husband Michael Magina, my parents Mr. Reuben Nakhosi and Mrs. Priscilla Ameyo, VLRI- OUS for their financial support and to all my friends who made the whole study process easy.

ACKNOWLEDGEMENTS

First, my deepest acknowledgment goes to my supervisors: Prof. Judith Kimiywe and Dr. Ann Munyaka for their professional guidance, inspiration and commitment throughout the study process. Their supervision and contributions ensured the completion of this study. Secondly, my appreciation goes to VLRI-OUS for the sponsorship throughout the study. Special appreciation goes to Ms. Fridah Kainda and Mr. Geoffrey Okoth for their invaluable contribution to data analysis and interpretation of this study and the Department of Food, Nutrition and Dietetics for their contributions throughout my study period.

Thirdly, I extend my appreciation to the study participants for allowing me to conduct this study in Kakamega and Siaya Counties. Special thanks go to the research assistants who ensured quality data was collected through their commitment.

Finally, my appreciation goes to my loving husband Michael Magina Wandera for this unwavering moral support during the study period. Thanks, you were understanding throughout the study period.

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ABBREVIATIONS/ACRONYMS

| | |
|-----------------|---|
| CHVs: | Community Health Volunteers |
| DRC: | Democratic Republic of Congo |
| FAO: | Food and Agricultural Organization |
| FFQ: | Food Frequency Questionnaire |
| FGDs: | Focus Group Discussions |
| HAZ: | Height-for Age Z score |
| ICIPE: | International Centre of Insect Physiology and Ecology |
| IFPRI: | International Food Policy Research Institute |
| KDHS: | Kenya Demographic and Health Survey |
| KII: | Key Informant Interviews |
| KNBS: | Kenya National Bureau of Statistics |
| KUERC: | Kenyatta University Ethics Review Committee |
| MAD: | Minimum Adequate Diet |
| MDD: | Minimum Dietary Diversity |
| MMF: | Minimum Meal Frequency |
| MOH: | Ministry of Health |
| MUAC: | Mid-Upper Arm Circumference |
| NACOSTI: | National Commission for Science Technology and Innovation |
| SPSS: | Statistical Package for Social Sciences |
| WAZ: | Weight-for-Age Z score |
| WHO: | World Health Organization |
| WHZ: | Weight- for- Height Z score |
| 24-HR: | 24 Hour Recall |

OPERATIONAL DEFINITIONS OF TERMS

| | |
|---|--|
| Children: | Refers to children aged 6-23 months old |
| Complementary foods: | Refers to solid and semi-solid foods that are usually gradually and timely introduced to a child after attaining 6 months |
| Complementary feeding practices: | Refers to the duration of breastfeeding, food consumption patterns, minimum meal frequency, minimum acceptable diet, minimum dietary diversity |
| Dietary diversity: | Refers to the number of different foods or food groups consumed over a given reference period which in this study will be 24 hours recall |
| Edible insects: | Refers to the insects that are available and consumed by people in Western Kenya i.e. locusts, termites, ants, beetle larvae, crickets, grasshoppers and lake flies |
| Nutritional status: | Refers to WHO indices for growth standards Z scores such as length/height for age, weight for length and weight for age among children 6 to 23 months of age, whereby >-2 Z score will be considered normal, >-3 to <-2 moderate and <-3 severely malnourished |
| Minimum acceptable diet: | Refers to the proportion of breastfed children 6-23 months of age who had at least the minimum dietary diversity and the minimum meal |

frequency during the previous day, and non-breastfed children 6-23 months of age who received at least two milk feedings and had at least the minimum dietary diversity not including milk feeds and the minimum meal frequency during the previous day (WHO, 2008b)

Minimum dietary diversity: Refers to the proportion of children 6-23 months who received foods from four or more food groups during the previous day. The seven food groups used for tabulation of this indicator were: grains, roots and tubers; legumes and nuts; dairy products (milk, yoghurt and cheese); flesh foods (meat, fish, poultry and liver/organ meats); eggs Vitamin A- rich fruits and vegetables and other Fruits and vegetables (WHO, 2008b)

Minimum meal frequency: Refers to the proportion of breastfed and non-breastfed children 6-23 months of age who receive solid, semi-solid or soft foods the minimum number of times or more (minimum was defined as: two times for breastfed infants 6-8 months; three times for breastfed children 9-23 months; and four times for non-breastfed children 6-23 months) in the previous day (WHO, 2008b)

ABSTRACT

Edible insects are a good source of lipids (α -linoleic and linolenic essential fatty acids), carbohydrates, vitamins, high quality protein and minerals. Malnutrition occurs mostly in children 6-24 months old and is often caused by initial introduction of complementary feeding to children below six months, diets with low protein and diseases. The aim of this study was to investigate the maternal perception on use of edible insects for complementary feeding and nutrition status of children in Kakamega and Siaya Counties in Kenya. The study adopted a cross-sectional analytical design which was used on a sample of 592 mother-child pairs (aged 6-23 months) in three wards namely; Kisa North, West Yimbo and West Ugenya in Kakamega and Siaya Counties respectively in Western Kenya. The study sites were purposively selected. Actual measurements of foods consumed were done. A structured questionnaire with different sections was used to obtain information about the socio-economic and socio-demographics, frequency of food consumption, 24-hour dietary recall, anthropometry, household insect consumption and data on maternal perception on use of edible insects for complementary feeding. Data on maternal perceptions was collected using a Likert scale of 1 (strongly disagree) to 5 (strongly agree). Nutrition status data was analyzed using ENA for SMART software while Nutri-survey was used to analyse data for complementary feeding practices. SPSS software version 25 was used to analyze data. Data from Focus Group Discussions and Key Informant Interviews were coded and analyzed based on the content of the study. Majority of the mothers were in the childbearing age group of 15-49 years and were married. More than half of the household heads were males and were aged between 20-49 years in nearly all (97.7%, 98.3% and 99.0%) the households in Kisa North, West Ugenya and West Yimbo respectively. Generally, among the three wards, slightly more than a half (50.9% and 54.2%) of the household heads in Kisa North and West Ugenya respectively and 48.8% in West Yimbo had attained primary education. More than half of the mothers (57.9% in Kisa North, 65.7% in West Ugenya and 64.6% in West Yimbo) had attained primary education. Almost half (49.5%) of the mothers in Kisa North and 38.9% of the mothers in West Ugenya practiced farming while 35.3% of those in West Yimbo were small scale business women. Almost half of the household heads in West Ugenya were farmers, in Kisa North they were casual labourers while in West Yimbo they engaged in fishing. The mean household income was Ksh 6002 \pm 8486, 9352.7 \pm 10434 and 4928.3 \pm 6514.9 for Kisa North, West Ugenya and West Yimbo respectively. The average household size was 5, 6 and 5 for Kisa North, West Ugenya and West Yimbo respectively. More than a third (42.1%, 33.7% and 39.3%) of the mothers in Kisa North, West Ugenya and West Yimbo respectively disagreed about the use of edible insects for complementary feeding. On average the number of meals consumed per day was 4 among the three wards. More than half (65.3%, 56.6% and 61.7%) of the children in Kisa North, West Ugenya and West Yimbo respectively in the study attained the Minimum Dietary Diversity. More than half (58.9% and 55.8%) of the children in West Yimbo and West Ugenya respectively attained the Minimum Acceptable Diet. More than half (70.3%) did not attain the Minimum Acceptable Diet in Kisa North. In terms of nutrition status of the children, there were high prevalence rates of wasting (6.3% in West Ugenya, 7.0% in West Yimbo and 6.0% in Kisa North) among the study children and low stunting (19.5% in West Ugenya and an equal proportion of 19.9% in West Yimbo and Kisa North) and underweight rates (9.2% in West Ugenya, 9.0% in West Yimbo and 8.8% in Kisa North). There was a significant relationship between the ward of residence ($\chi^2=16.86$, p value=0.030), marital status of the mother ($\chi^2=11.14$, p value=0.025), main source of income for the household head ($\chi^2=33.35$, p value=0.007), the education level of the household head ($\chi^2=48.67$, p value=0.009) and the maternal perception on use of edible insects for complementary feeding. This study recommends the use of edible insects that are locally available to improve the nutrient intake of the children. This information will be useful to the MOH through the division of nutrition for inclusion in the MIYCN policy the use of edible insects as a complementary food and to food industries as a basis for developing affordable and nutritious insect based complementary foods.

CHAPTER ONE: INTRODUCTION

1.1 Background information

Malnutrition is the most common cause of high infant mortality and morbidity rates in developing countries (Karim, Muhit & Khandaker, 2017). According to IFPRI, (2016), malnutrition has led to gross economic losses amounting to 11% of the Gross Domestic Product (GDP) in the African and Asian continents. Poor dietary practices during complementary feeding are the major contributors to undernutrition among children (Kimiye & Chege, 2015). This is because, most complementary foods in low-income households are unfortified cereal-based mixtures with low nutrient bioavailability (Shiriki et al., 2015). In Africa, over 80% of children 6 to 23 months are not able to attain the minimum acceptable diet, especially in areas undergoing food scarcity (Onis & Branca, 2016). Consumption of an unhealthy diet compromises the cognitive development of children (Spencer et al., 2017). This hence contributes to the high undernutrition rates amongst children in developing countries (Abeshu et al., 2016).

The Kenya National Micronutrient Survey that was done in 2011 indicated that the micronutrient deficiencies that majorly affect children below five years are: vitamin A deficiency (9.2%), iron deficiency (21.3%), anemia is (26.3%), iron deficiency anemia (13.3%) and zinc (83.3%). The recent Global Nutrition Report in Kenya showed that 26.2% of children are stunted, higher rates being among those 18-23 months and those in the rural areas (29%) (KNBS, 2015).

In Kenya, complementary feeds lack dietary diversity and are domineered by cereals (Bitew et al., 2020). Alternative nutritional food sources are needed to improve the

Minimum Dietary Diversity (MDD) in developing countries (Bégin & Aguayo, 2017). Patel et al., (2019), suggested that edible insects are a paramount food source that can play a crucial part in food security worldwide. The most commonly consumed insects are ants, beetle larvae (in Africa and Asia), locusts, crickets, grasshoppers and lake flies (Ayieko et al., 2010). Globally, approximately 31% of the beetles, 18% of the caterpillars, 13% of the locusts, grasshoppers and crickets, 15% of ants, wasps and bees, 12% of the flies and termites, and 11% of the true bugs are being consumed (Huis, 2016). In western Kenya, the commonly consumed insects include winged termites (*Macrotermes bellicosus*, *Macrotermes subhylanus*, *Pseudacanthotermes militaris* and *P. spiniger*), green and brown grasshoppers (*Ruspolia differens*), locusts (*Locusta migratoria*), black ants (*Carebara vidua*) and lake flies (*Chaoborus* and *Chironomus sp*) (Ayieko et al., 2010a, Raheem et al., 2019).

Edible insects provide vitamins, carbohydrates, minerals (calcium, iron, zinc and phosphorus) and high-quality proteins (Mlcek et al., 2014; Karaš et al., 2015). For instance, Payne et al., (2016), indicates the mean energy contents of edible insects to be between 400 to 500 kcals per 100g of dry matter which is higher than most other protein sources. On the other hand, the content of unsaturated fatty acid in edible insects is the same as that of fish and poultry but has more PUFAs than red meat and poultry (Dobermann et al., 2017). Generally, insects contain 7 to 77g/100g of fat in dry weight (Rumpold & Schlüter, 2013). The iron content in edible insects is between 18 to 1562mg per 100g dry matter with the lowest levels in ants, followed by termites and then crickets have the highest levels (Christensen et al., 2006). Crickets contain zinc levels of between 8 and 25mg/100g dry matter. Termites, ants and crickets contain calcium levels of between 33 and 341

mg/100g dry matter, with the crickets containing the highest levels (Christensen et al., 2006). The Vitamin A content across different insect species has been found to range between 3 to 273 $\mu\text{g}/100\text{g}$ dry matter (Christensen et al., 2006).

In studies by Megido et al., (2014) and Homann et al., (2016) to determine perceptions on edible insects consumption, the formulations that had high acceptance among the population were based on their flavors and crispy textures. About three quarters of the participants in a research by Pambo et al., (2016), appreciated edible insects as a meat alternative based on economic and social factors. Kakamega County is known for the consumption of winged termites during wet seasons between April and October (Kinyuru et al., 2013). Siaya (Ugenya) and Bondo sub-counties are known for the consumption of longhorn grasshopper and black ants (Ayieko et al., 2010a).

1.2 Problem Statement

On average, 2 billion people globally are micronutrient deficient WHO, (2015), 140 million children under 5 years are stunted and more than 47 million are wasted while 41 million (6%) are overweight especially during complementary feeding (Agbemafle et al., 2020, Global Nutrition Report, 2018). On average in Africa, 4.7% of children below 5 years are overweight, 29.1% are stunted and 6.4% are wasted (Global Nutrition Report, 2020). In Kenya, stunting levels of children under 5 years are at 26.2% (Global Nutrition Report, 2020). The highest stunting rates at 36% were reported to be in children between 18-23 months (KNBS, 2015). Rural areas in Kenya were reported to have the highest stunting levels (29%) compared to urban areas (20%) (KNBS, 2015). In western Kenya, stunting was reported to be at 25% while in Nyanza it was reported to be at 23% (KNBS, 2015).

Malnutrition occurs mostly in children 6-24 months old and is mostly attributed to the untimely introduction of complementary foods to children below 6 months, diets with low protein content and diseases (Caetano et al., 2010). The types of ingredients used in preparation determine the adequacy of a complementary diet being able to meet the nutrient requirements of a child (Kimanya et al., 2015). Most of the complementary foods in Africa are cereal mixtures hence have high contents of phytates, low energy densities, poor protein quality and low micronutrient content (Agbemaflé et al., 2020, Hardwick & Sidnell, 2014). This contributes to the increase in infant growth faltering, increased morbidity, mortality and reduced productivity later in life (Kimiye & Chege, 2015). Frequent intake of foods from more than four food groups per day is very essential during complementary feeding (WHO, 2014). Alternative food sources are required to improve the MDD (Mlcek et al., 2014). Okoth et al., (2012), suggested the use of locally available and cheap nutritious foods in the development of complementary foods.

Insects can play a significant role in food security because they are readily available and affordable (Visser et al., 2012). Edible insects are high in vitamins, protein, energy, minerals (iron, zinc, calcium and phosphorus) and the essential fatty acids and hence can be integrated into the children's diet (Rumpold & Schlüter, 2013; Mlcek et al., 2014; Barennes et al., 2015b; Karaś et al., 2015). Edible insects are mostly used as snacks or prepared in desserts and not as valuable nutritious foods (Manditsera et al., 2018). In Kenya, little is known about consumers' preferences of locally available edible insects as part of the main diet (Alemu et al., 2015). Despite the comparable high consumption rates of some edible insects (winged termites), they are hardly served as nutritious foods, especially for the children (Kinyuru et al., 2013). Despite the nutritive value of edible

insects, most people still prefer to consume meat, fish, chicken and eggs as opposed to edible insects. The aim of this study therefore was to establish maternal perception on the use of edible insects in complementary feeding and the nutrition status of children in Kakamega and Siaya Counties.

1.3 Purpose of the Study

The purpose of this study was to establish the maternal perception on use of edible insects in complementary feeding and the nutrition status of children 6 to 23 months in Kakamega and Siaya Counties.

1.4 Objectives of the Study

1. To determine the socio-economic and socio-demographic characteristics of the children in Kakamega and Siaya Counties
2. To determine the maternal perception on use of edible insects for complementary feeding in Kakamega and Siaya Counties
3. To determine the complementary feeding practices of children in Kakamega and Siaya Counties
4. To determine the nutrition status of children 6-23 months in Kakamega and Siaya Counties
5. To establish the relationship between household socio-economic and socio-demographic characteristics, maternal perceptions on use of edible insects for complementary feeding and the nutrition status of children in Kakamega and Siaya Counties

1.5 Hypotheses of the Study

H0₁: There is no significant relationship between the socio-economic and socio-demographic characteristics and use of edible insects in complementary feeding of the children in Kakamega and Siaya Counties

H0₂: There is no significant relationship between the use of edible insects in complementary feeding and the nutrition status of children in Kakamega and Siaya Counties.

H0₃: There is no significant relationship between maternal perception on use of edible insects in complementary feeding of children in Kakamega and Siaya Counties

1.6 Significance of the Study

This information will be of help to the Ministry of Health (MOH) through the division of nutrition for inclusion in the MIYCN policy the use of edible insects as a complementary food. It will also be useful to food industries as a basis for developing nutritious and affordable insect-based complementary foods. It will also contribute greatly to the Government's big 4 agendas and SDGs of reducing hunger and improving food security.

1.7 Delimitation of the Study

This study focused on the consumption of edible insects (winged termites, locusts, grasshoppers and crickets) only available and consumed in Kakamega and Siaya Counties in Kenya.

1.8 Limitation of the study

Since dietary recall was used during data collection, there was a possibility of biasness in reporting. To minimize error, the data was triangulated on the FGD and KII. Also, this

study only used agree-disagree response format since it was able to be used for all the questions so the questionnaire needed only to present the scale once, thereby saving time hence streamlined the questionnaire administration.

1.9 Conceptual Framework

Figure 1.1 shows the conceptual framework on the maternal perception on use of edible insects for complementary feeding and complementary feeding practices by UNICEF, (2009).

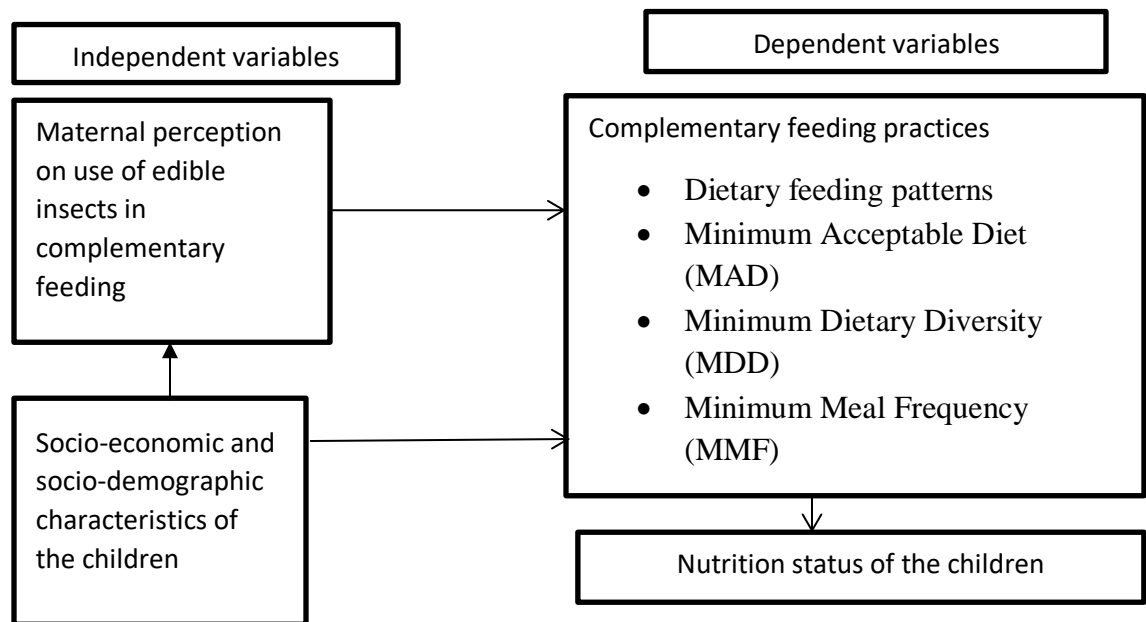


Figure 1.1 Conceptual Framework on the relationship between maternal perception and complementary feeding practices

Source: Adapted and modified from the UNICEF, 2009

Maternal perception on use of edible insects for complementary feeding has been conceptualized to influence the complementary feeding practices of the children. The socio-economic (income and occupation) and socio-demographic characteristics (level of education, age, sex of the household head and the mother and age of the child) equally

affect the complementary feeding practices of the children despite a positive maternal perception about use of edible insects in complementary feeding. On the other hand, poor complementary feeding practices may influence the nutrition status of the children 6-23 months of age by influencing the nutrients available to the child.

CHAPTER TWO: LITERATURE REVIEW

2.1 Socio-economic, Socio-demographic and Socio-cultural Factors and Edible

Insect Consumption

Obstacles to adopting edible insects for food in the Western countries include lack of availability in the market and the absence of the appropriate rules governing insects as food (Belluco et al., 2017, Huis et al., 2014). Edible insect consumption also is inexpensive because it's sustainable in terms of production than the expensive protein components in the livestock industries (Halloran et al., 2014).

In a survey conducted by Barennes et al., (2015b), the majority of the insect vendors were women and 32.6% were illiterate with an average income of 5 to 6 US dollars per day. Among the vendors, 19.1% sold insects as a full-time job and the majority 64% as a part-time job (more than twice a week) (Barennes et al., 2015). About 80.3% also sold other foods, fruits and vegetables apart from the insects and were also insect collectors/harvesters during the harvesting period, while a few received their insects from hunters and occasionally from insect farms (Barennes et al., 2015). In his conclusion, Barennes et al., (2015b) reported that most of the people in Laos consumed insects because of their taste while a few consumed insects because of it being easily accessible as a delicacy. Observations from a similar study carried out by Bouldam, (2010), indicated that insect selling was a lucrative business in Laos since it yielded an extra source of income for the women. Similarly, Ayieko et al., (2010c), suggests that entomophagy has the potential of being a dependable source of income for the poor villagers. In Thailand, locusts and crickets are the most prominent insects consumed because of their market worth and provision of profitable income (Hanboonsong, 2010).

In a study by Olum et al., (2020) in illuminating the food neophobia and socio-cultural dynamics of insect consumption in Uganda, culture and familiarity with the edible insects were found to be important determinants of edible insects consumption. There's however limited information on how socio-economic, socio-demographic and socio-cultural factors can influence maternal perception on the use of edible insects for complementary feeding. This study therefore sought to address this gap.

2.2 Maternal Perception on Use of Edible Insects

As more and more formulations of complementary foods are being made available on the market, there is a need for them to be well perceived by the target children and not endanger their health (Konyole et al., 2012). In a study carried out in Western Kenya, out of 234 participants, about three-quarters adopted edible insects as a meat alternative (Pambo et al., 2016). This was based on environmental and economic factors, convenience, social factors, familiarity and one's perception (Pambo et al., 2016). In a study by Megido et al., (2014) to establish the Belgian's perception on entomophagy, mealworms and house crickets formulations were used. At first people were unwilling to consume but later on they became willing and appreciative after evaluating the preparation methods and embracing their crispy textures and flavors. Studies indicate that appreciating edible insects as a source of protein in Belgium and the Netherlands was greatly influenced by sustainable consumption (Tan et al., 2015). In Germany however, insects were consumed based on how familiar they were and how they tasted (Orsi et al., 2019). Different authors suggested different approaches to improve consumption of insects such as improving consumer's knowledge of the product through providing them with important information about the insects as a sustainable source of food (Lensvelt & Steenbekkers, 2014). On the other hand, Looy,

Dunkel, & Wood, (2014), suggested that edible insect consumption can be improved by ensuring the availability of edible insects and educating people on how to prepare them. Lensvelt & Steenbekkers, (2014), suggest that increasing the frequencies with which these edible insects are exposed and experimental tasting will improve consumption of edible insects. Formulating suitable products that will not only lower obstacles to trial but also have good taste and are alluring to eat also helps to improve edible insect consumption Tan et al., (2017) and through the integration of insects into familiar food items (Giusto et al., 2015). Homann et al., (2016) developed a recipe for cricket biscuits containing 10% cricket powder for school feeding initiatives and tested the perception of Kenyan school children aged 5-10 years while comparing it with similar biscuits made with 10% milk powder. Homann et al., (2016) reported that cricket biscuits had high acceptability among consumers. In another study by Akullo, Agea, Obaa, Acai and Nakimbugwe et al., (2017), whose aim was to improve existing processing methods for the frequently consumed insects in Uganda (crickets, soldier and winged termites), he adopted pan-frying and boiling followed by drying over the sun and then processed into honey. In the findings, Akullo et al., (2017) discovered that the spreads fortified with 8% soldier termite flour and pan fried at 100 °C had better nutritional and sensory components and hence had high acceptability as a potential for use in fortifying food products.

From the reviewed literature, consumer perceptions impact on feeding practices of edible insects. However, little has been done on maternal perception on the use of edible insects for complementary feeding. This study seeks to investigate maternal perception on the use of edible insects for complementary feeding and nutrition status of children in Kakamega and Siaya Counties in Kenya.

2.3 Complementary Foods and Dietary Diversity

Malnutrition is the most common cause of high infant and child mortality rates in third world countries (Kimiye & Chege, 2015). The World Health Organization defines complementary feeding as the gradual introduction after six months of both semi-solid and solid foods such as porridge and other cereal products to a child with continued breastfeeding (WHO, 2016). The adequacy of a complementary diet in being able to meet the recommended nutrient needs of a child depends on the types of ingredients used in the preparation (Kimanya et al., 2015). In Africa, 80% of children 6 to 23 months are unable to attain the minimum acceptable diet during complementary feeding, this is especially true in regions facing food scarcity (Onis & Branca, 2016). This is because of the over-dependence on starchy staple foods which are less nutrient-dense, have poor protein quality, low mineral contents and are high in anti-nutrients such as phytates (Hardwick & Sidnell, 2014). This leads to the increase in infant growth faltering, increased morbidity, mortality and reduced productivity later in life (Kimiye & Chege, 2015). According to reports by KDHS, (2014), only 22% of children aged between 6 to 23 months are able to attain the minimum dietary diversity. Complementary feeding practices are poorest in the rural areas having only 17% of their children being correctly fed while 31% were correctly fed in the urban areas (KNBS, 2015).

Adequate nutrition during the critical window of opportunity greatly influence a child's physical and cognitive development (Skau et al., 2014). The recommended dietary diversity for children aged between 6 to 24 months should not be less than four food groups per day (WHO, 2014). Dietary diversity ensures proper physical, cognitive and intellectual development of children 6 to 24 months (Kinabo et al., 2017; Kimiye & Chege, 2015).

Lack of dietary diversity during complementary feeding leads to poor physical and cognitive development hence contributing to the high undernutrition rates (Hardwick & Sidnell, 2014).

The most commonly consumed complementary foods in Kenya are unfortified cereal porridges, ugali, boiled rice and cow milk (Thuita et al., 2018). From the reviewed literature, most complementary foods are lacking in essential nutrients required for proper growth and development. There is therefore importance for complementary foods to be nutrient-dense so that they may be able to meet the nutrient needs of children aged between 6 to 23 months. This study aims to bridge this gap by suggesting the potential for use of edible insect in complementary feeding to enhance dietary diversity.

2.4 Nutrition Status and Edible Insect Consumption

According to KDHS survey of 2014, 26% of Kenyan children aged 5 years and below were stunted. The prevalence of stunting emerged to be highest at 36% in children 18-23 months. The stunting rates in the rural parts of Kenya were reported to be highest at 29% as compared to 20% in the urban areas (KNBS, 2015). The reports by KNBS, (2015), indicate that in the western part of Kenya, stunting was at 25% with Nyanza at 23%. Countrywide wasting levels were at 4%. It further indicates that children 6 to 8 months had the highest wasting levels just as those in 9 to 11 months (KNBS, 2015).

Macro and micronutrient deficiencies are a major problem world over and especially in third world countries (Abeshu et al., 2016; IFPRI, 2016). The high prevalence of undernutrition among children in developing countries is especially attributed to overdependence on cereal-based mixtures which have low protein quality, bulkiness, high

phytates content which result in low mineral bio accessibility and low energy (Abeshu et al., 2016; Shiriki et al., 2015).

From the literature review, edible insects are known to have high-quality, vitamins, lipids and carbohydrates (Muhoho et al., 2017; Mlcek et al., 2014; Rumpold and Schlüter, 2013). In a study done by Barennes et al., (2015b), it was suggested that the use of insects to counter undernutrition could help promote the farming of insects. Due to their high nutrient content and quality, edible insects can help curb deficiencies in macro and micronutrients and hence improving the nutrition status of individuals. This is especially in children 6 to 24 months through complementary foods. However, there is little information about evidence of improved nutrition status, from edible insects' consumption.

2.5 Summary of Literature Review

Reviewed studies have pointed out gaps globally in how socio-economic and socio-demographic factors can influence maternal perception on the use of edible insects in complementary feeding, maternal perception (with children 6 to 23 months) on use of edible insects for complementary feeding, lack of incorporation of edible insects into complementary foods and limited information on use of edible insects and improved nutrition status. The aim of this study therefore was to determine the maternal perception on the use of edible insects for complementary feeding and nutrition status of children 6 to 23 months in Kakamega and Siaya Counties.

CHAPTER THREE: METHODOLOGY

3.1 Research Design

A cross-sectional analytical design was adapted in this study. This design was used because it facilitates both quantitative and qualitative data collection methods and enable the identification of the relationships between the independent and dependent variables.

3.2 Study Variables

3.2.1 Dependent Variables

In the current study, the dependent variables were the complementary feeding practices (minimum meal frequency, minimum acceptable diet and minimum dietary diversity) and the nutrition status of children aged 6-23 months in Kakamega and Siaya Counties in Western Kenya.

3.2.2 Independent Variables

The Independent variables in this study were the socio-economic and socio-demographic characteristics of the mothers and the maternal perception on the use of edible insects for complementary feeding.

3.3 Study Areas

This study was done in Western Kenya, particularly Kisa North location in Kakamega County and West Ugenya and West Yimbo in Siaya County. The sites selection was informed by the reviewed literature on the areas with the highest edible insect consumption (Ayieko et al., 2010c; Pambo et al., 2016; Kinyuru et al., 2013). The researcher studied the three sites because of the different ethnic groups and the different edible insects being

consumed in the areas in order to understand the variations in the edible insect consumption practices.

3.4 Target Population

The target population were mothers-child (6-23 months) pairs in West Yimbo, West Ugenya and Kisa North. The estimated population size in West Yimbo was 28,503, in West Ugenya 30,325 and in Kisa North 19,074 (KNBS, 2015). Mothers gave out information about the complementary feeding practices of the children then nutrition assessment was carried out on the children to determine their nutrition status.

3.5 Exclusion Criteria

Eligible subjects who did not consent and children 6-23 months old with chronic illnesses during the data collection period were excluded from the study. The health records, the maternal and child health booklet, observation and mothers or caretakers' reports helped to verify these conditions.

3.6 Inclusion Criteria

Mothers and their children 6-23 months old who were residents of the sub-counties for the past 6 months and were willing to participate in the study.

3.7 Sampling Technique

The study was conducted on 592 mother-child (6-23 months old) pairs proportionately sampled from the 3 study sites namely; Kisa North, West Yimbo and West Ugenya in Kakamega and Siaya Counties. These areas are well known for edible insect consumption (Ayieko et al., 2010b; Pambo et al., 2016; Kinyuru et al., 2013) and were purposively selected. West Yimbo ward had 36 villages, West Ugenya ward 41 villages and Kisa North

ward 32 villages. Using simple random sampling, a list of random numbers in MS Excel was prepared for the villages and 29 villages selected in West Yimbo, 30 villages in West Ugenya and 28 villages in Kisa North in order to achieve the targeted sample sizes among the three study sites. The expected sample size of 696 was divided proportionately among the three wards based on the population size. However, the actual number of households with mother-child (6-23 months) pairs that participated in the study were 216 in Kisa North, 175 in West Ugenya and 201 in West Yimbo hence a total of 592 mother-child (6-23 months) pairs. Simple random sampling was used to select study households until the desired sample size was achieved. The children were distributed into four age categories of 6-8, 9-11, 12-18 and 19-23 months to cater for any variations in the complementary feeding practices.

3.8 Sample Size Calculation

The sample size was 592 mother-child (6-23 months) pairs. Cochran, (1977) formula was used to calculate the sample size.

$$n = \frac{Z^2 p(1-p)d}{e^2}$$

Whereby;

n- the desired sample size if the target population is more than 10,000

z- critical value of the confidence interval for standard normal deviation (1.96 if the degree of confidence is 95%)

p- estimate of the expected prevalence which was 29% (KNBS, 2015)

$q=1-p$, an estimate of variance

e - estimated % points from the true value or the desired precision level

d - design effect (often assumed to be 2 but varies by type of sampling and by indicator)

$$n = (1.96 \times 1.96) \times 0.29(1-0.29) / 0.05 \times 0.05$$

$$n = 633 + 63(10\% \text{ to cater for non-respondents}) = 696$$

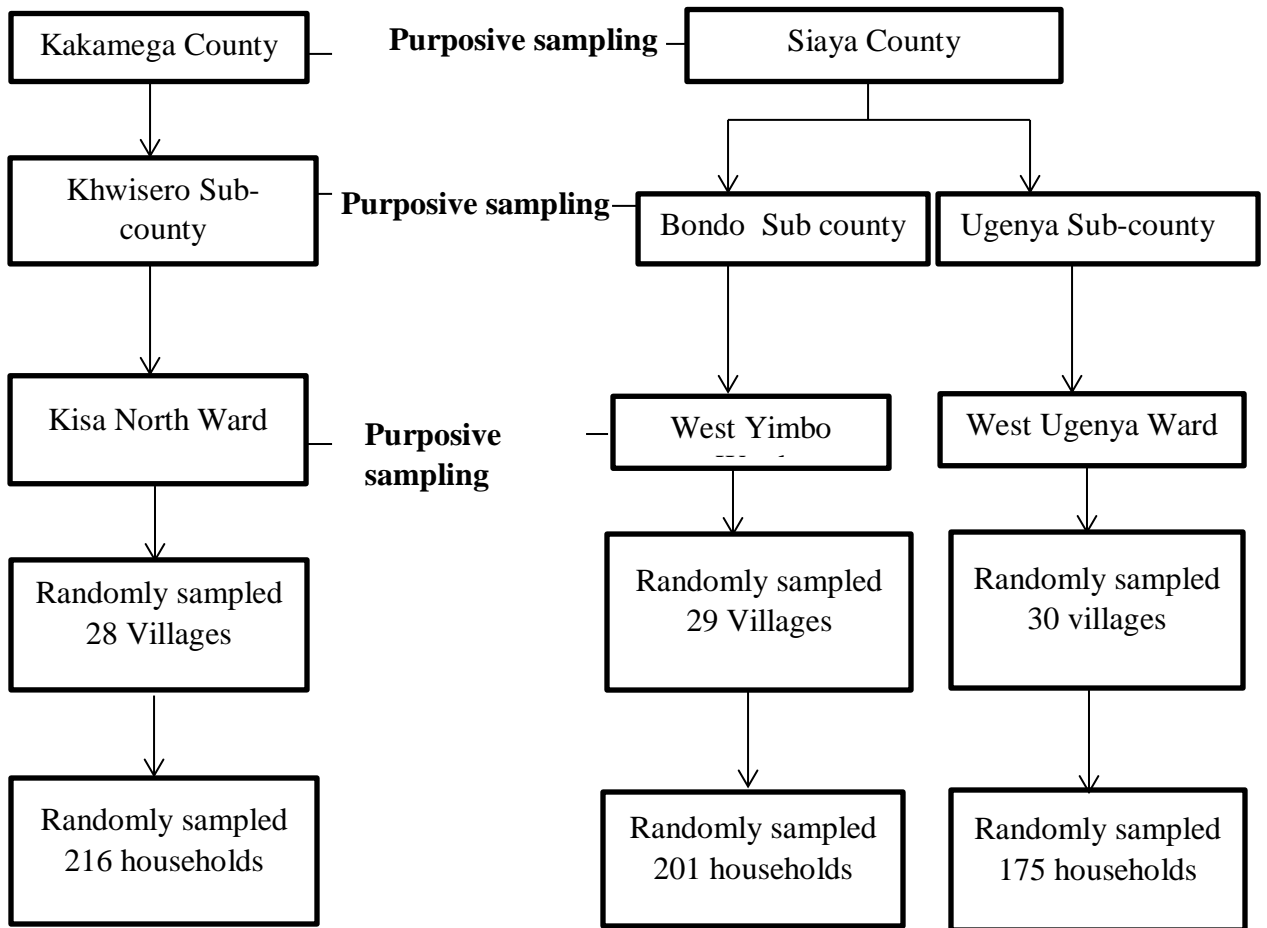


Figure 3.1: Flow chart on the sampling procedure

3.9 Data Collection Tools

A semi-structured questionnaire (Appendix B) with different sections to collect data on the frequency of food consumption, 24-hour dietary recall, anthropometry, socio-economic and demographic factors and household insect consumption patterns was used. In addition, Focus Group Discussion guide (FGDs) (Appendix C) and Key Informant Interview guides (KII) (Appendix D) were used to get an in-depth understanding of maternal perceptions on use of edible insects for complementary feeding and other issues surrounding insect consumption in the study communities.

3.10 Pre-testing of Instruments

The questionnaires were pretested on 70 children (10% of the sample size) in 3 villages each in Kisa North, West Yimbo and West Ugenya. These villages were not included in the main study. During the pre-testing an effort was made to check for consistency in how the questions were interpreted, to identify ambiguous items and to establish the time taken for the interview. It also ensured that the interviews were done systematically. After reviewing the study instruments all suggested revisions were made before being administered in the actual study.

3.11 Validity

The questionnaire contents were validated by experts from the Kenyatta University Department of Food Nutrition and Dietetics to ascertain that the data collection instruments measured what they purported to measure. Modifications were done as per the review. Calibration of the Seca balance was done from time to time through checking the reading on the balance against a known object's weight.

3.12 Reliability

The Test-retest method was used to test the consistency of the questionnaire in producing the same results. About 70 mothers from villages similar to the study areas were interviewed two times (with a span of one week between the interviews) using the same questionnaire. A comparison was then made between the answers obtained from both interviews. Correlation coefficient was determined using Cronbach correlation formula by Cronbach & Shavelson, (2004) which yielded a correlation coefficient of 0.8 which was acceptable. The pre-test subjects were allowed to make comments and give suggestions concerning the questionnaire.

3.13 Data Collection Procedures

3.13.1 Recruitment and Training of Research Assistants

To ensure quality in data collection, eight research assistants possessing a minimum of a Diploma in Nutrition and Dietetics were recruited. Previous participation in nutrition surveys was an added advantage. Six of the assistants had participated in nutrition surveys before. They were taken through the necessary training by the researcher for 2 days prior to participating in the study. They were trained about the different facets of the study including the objectives, the sampling procedures, consenting, techniques for interviewing and interpretations, administration of questionnaires, ethical reviews and taking of anthropometric measurements. The training entailed the use of discussions, lectures and role plays with the help of training aids.

The research assistants were exposed to a practical experience in conducting the interviews and taking anthropometric measurements during classroom demonstrations, role plays and also during pre-testing of the questionnaires. The responses recorded by the research

assistants were compared with those of the researcher herself and advice given to the assistants on areas they needed to improve. A total of nine CHVs, three per ward assisted the researcher and the research assistants in order to identify eligible households. The selection criteria was; attainment of the Kenya Certificate of Secondary Education and fluency in Kiswahili and English languages. During the data collection, the mothers were interviewed and the anthropometric measurements of the children taken.

3.13.2 Determination of maternal perception

Maternal perception on the use of edible insects for complementary feeding was determined using the 5 point Likert scale which was interpreted as; 1=strongly disagree, 2=disagree, 3=neutral, 4=agree, 5=strongly agree. The data was then analyzed using mean and standard deviations.

3.13.3 Determination of the Nutrition Status

The nutrition status of the children were determined using the length, weight and mid-upper arm circumference (MUAC) measurements. An infantometer (length board) was used to take length measurements (measurement taken to the nearest 0.1cm). An electronic Seca balance (read to the nearest 0.1cm) placed on a levelled and flat surface was used to obtain the weight of the children. The children's heavy clothes, diapers and shoes were removed before taking their weight measurements. Calibration of the Seca balance was done from time to time through checking the reading on the balance against a known object's weight.

3.13.4 Dietary Intake

The complementary feeding practices of children were determined using the WHO protocols. A 24 hour dietary recall and a Food Frequency Questionnaire were used to collect dietary intake data. The FFQs and 24-HR dietary intake information was collected by intensely trained enumerators. The interviews were conducted in Luhya, Luo and Swahili languages.

For the 24 hour dietary recall, the child's mother was asked to list the various foods/drinks taken during the past 24 hour period. For the 24 hours dietary intake, portion sizes were estimated using normal household utensils (tablespoons, teaspoons, heaped or leveled spoons/ladles, cups, glasses, bowls and plates) and photographs of foods in the Kenyan photographic food atlas.

A food frequency questionnaire (FFQ) was also filled for each of the children 6-23 months. The mothers were asked the frequency with which their children took a specific food item among the seven different groups of food as recommended by the (WHO, 2009b). To determine the minimum meal frequency, the proportion of all the children who received both semi-solid and solid foods were determined. The dietary diversity score was calculated based on the 8 food groups recommended by WHO, (2008b) which include; roots and tubers, breast milk, grains, flesh foods, legumes and nuts, dairy products, eggs, Vitamin A-rich fruits and vegetables (Dark green leafy vegetables, for example amaranth (red or green), spinach and chard, carrots, squashes/pumpkins, yellow maize, mangoes and papayas, other fruits and vegetables. Any amount of food consumed from each of the food groups qualified to be counted apart from the food items used as spices. A dietary diversity

score of four times or more from the eight food groups was indicative of the MDD of children aged between 6 to 23 months (WHO, 2014).

3.13.5 Focused Group Discussion (FGD)

Two FGDs with both men and women (those with children 6-23 months) were conducted in each of the wards, hence a total of 6 FGDs. The men and women were selected based on their ages and their fluency in speaking both English and Swahili languages. The Focus Group Discussions were carried out after the quantitative data collection in each of the wards to obtain information on the maternal perception on use of edible insects for complementary feeding using the FGD guide (Appendix D). Each of the FGDs had six men and women, both younger (22 years old) and older (50 years). The researcher assisted by the Community Health Volunteers (CHVs) enrolled the participants of the FGDs. The men were included in the FGDs because as household heads they greatly influence the decisions made in a household (Ochieng et al., 2017). This would hence influence the maternal perceptions on use of edible insects for complementary feeding since they were the main food providers for the household. Most of the mothers depended on their spouses for provision of food. While the researcher coordinated the discussions, one of the assistants took summary notes. Each FGD lasted between 45-90 minutes and the focus group discussions were recorded using a tape recorder.

3.13.6 Key Informant Interviews

One village elder and one area chief who were involved in the Key Informant Interviews among the study sites were selected using simple random sampling technique. The chief and village elder were selected based on their gender and their fluency in speaking both English and Swahili languages. The interviews lasted approximately 60 minutes and were

guided by KII guide questions (Appendix D) and were recorded using a digital tape recorder. This was carried out by the researcher with the help of research assistants.

3.14 Data Analysis

All the data was analyzed using SPSS version 25. Descriptive statistics (mean, median, frequencies and percentages) for categorical data were computed and comparisons made. Data on children's anthropometrics were analysed using ENA for SMART software. This was adopted to compute the nutrition status of the children (Height for age z scores (HAZ), weight for height z scores (WHZ) and weight for age z scores (WAZ). Stunting, wasting and underweight levels were defined by the WHO as height-for-age Z scores (HAZ) \leq -2SD, weight-for-height Z scores (WHZ) \leq -2SD and weight-for-age Z scores (WAZ) \leq -2SD respectively (WHO, 2009). For the MUAC measurements a UNICEF MUAC measuring tape was used. MUAC measurements below 115mm were indicative of wasting and severe food insecurity among these children (Masters & Kinabo, 2016; Roberfroid et al., 2013).

Data on associations between factors such as children's age, growth indicators, nutrient intake and intake of food products were analyzed through Chi-square tests. Statistical significance was set at $p < 0.05$. Data on the socio-economic and socio-demographic characteristics were analyzed using SPSS version 25. Data from the 24-hour dietary recall was used to determine the minimum meal frequency, minimum dietary diversity and minimum acceptable diet while that from the FFQ was used to determine the dietary practices of the children. The information from FGDs and KIIs that were recorded using digital recorders were analyzed after transcribing and coding through content analysis by determining the common and main findings on maternal perceptions in response to the

main areas of focus. The relationship between the independent and dependent variables were determined through Chi-square tests. Table 3.1 shows the data analysis matrix.

Table 3.1 Data Analysis Matrix

| Objective | Methods/Instruments of Data Collection | Who was involved | Data analysis |
|---|---|---|---|
| 1.To determine the socio-economic and socio-demographic characteristics of the children in Kakamega and Siaya Counties | -Researcher administered questionnaire | -592 sampled households | -Descriptive statistics i.e. percentages and measures of central tendencies |
| 2.To determine the maternal perception on use of edible insects for complementary feeding in Kakamega and Siaya Counties | -Researcher administered questionnaire -6 FGDs -6 KIIs | -Mothers/caregivers of children 6-23 months -Women and men -Village elders and area chief | -Likert scale of 1-5 -Content analysis -Percentages |
| 3.To determine the complementary feeding practices of children 6-23 months in Kakamega and Siaya Counties | -24 hour recall(MDD, MMF and MAD) -FFQ | -Mothers/caregivers of children 6-23 months old | -Nutri-survey software and SPSS |
| 4.To determine the nutrition status of children 6-23 months in Kakamega and Siaya Counties | Weight-for-age Z scores, height-for-age Z scores, weight-for-height Z scores and MUAC | Children 6-23 months old | -WHO Anthro-software |
| 5.To establish the relationship between household socio-economic and demographic characteristics, maternal perceptions, complementary feeding practices and nutrition status of children 6-23 months in Kakamega and Siaya Counties | -FFQ Structured questionnaire -6 FDGs -6 KIIs | -Children 6-23 months old -Women and men | -Chi square tests |

3.15 Ethical Consideration

Research authorization was sought from Kenyatta University Graduate School and the Ethics Committee of Kenyatta University (KUERC) (Appendix F). A permit to conduct the study was obtained from the National Commission for Science, Technology and Innovation (NACOSTI) (Appendix G). Permission to conduct the study was sought from the Siaya and Kakamega County Directors for Health and Sub Counties Health Management Committees to conduct the study in their areas. The local area chiefs were asked to inform the community members about the study through local area chief's gatherings/meetings. An informed consent was obtained from each mother in written form in the language of choice. The consent forms were signed by the mothers on the children's behalf after explaining the research to them. Respondents' participation was voluntary and there was no discrimination in case one decided to withdraw from the study. The mothers were briefed about the benefits of the study and that minimal risks were expected from the study. The information collected was kept secretly and was confidentiality maintained. The identity of the children was kept confidential by serializing the questionnaires.

CHAPTER FOUR: FINDINGS

4.1 Characteristics of the Study Population

A total of 592 mother-child pairs took part in the study, a response rate of 85%. Table 4.1 shows the sociodemographic characteristics of the current study population.

4.1.1 Socio-demographic characteristics of the children 6-23 months

There were more female children in Kisa North (58.3%), West Ugenya (54.3%) and West Yimbo (54.7%) respectively compared to males 41.7% in Kisa North, 45.7% in West Ugenya and 45.3% in West Yimbo. Twenty nine percent (29%) of the children in Kisa North were between the ages of 13-18 months. In West Ugenya, there was an equal proportion (29.7%) of the children in the age groups of 9-12 months and 13-18 months while in West Yimbo, 36.3% were between 9-12 months old (Table 4.1).

4.1.2 Socio-demographic characteristics of the mothers

In the current study, nearly all the mothers in Kisa North (96.8%), West Ugenya (99.0%) and West Yimbo (98.5%) respectively were in the childbearing age group 15-49 years. About 83.3% of the mothers in Kisa North, 84.0% in West Ugenya and 78.1% in West Yimbo were married. More than two thirds (65.7% and 64.6%) and slightly more than half (57.9%) of the mothers in West Ugenya, West Yimbo and Kisa North respectively had attained primary education level. Slightly more than a third (33.8%, 31.4% and 30.8%) of the mothers in Kisa North, West Ugenya and West Yimbo respectively had attained secondary education level while 6.0%, 2.3% and 3.6% had attained college/university education level in Kisa North, West Ugenya and West Yimbo respectively (Table 4.1).

4.1.3 Socio-demographic Characteristics of the Household Head

From the study findings, more than three quarters (93.1% and 88.6%) of the households from Kisa North and West Ugenya respectively and 78.6% in West Yimbo were male headed. More than three quarters (99.0% and 98.3%) of the household heads in West Yimbo and West Ugenya respectively were between the age groups of 20-49 years while in Kisa North they were 97.7%. Notably, 2.3% of the household heads in Kisa North, 1.7% in West Ugenya and 1.0% in West Yimbo were above 50 years. More than half (50.9% and 54.2%) of the household heads had attained primary education in Kisa North and West Ugenya respectively, while in West Yimbo they were 48.8%. Almost a half (44.0% and 42.9%) of the household heads in Kisa North and West Ugenya respectively and 50.2% in West Yimbo had attained secondary education. On the other hand, 5.1% in Kisa North, 2.9% in West Ugenya and 1.0% in West Yimbo had attained tertiary education. The average household size for Kisa North, West Ugenya and West Yimbo at 95% confidence interval was 5, 6 and 5 with standard errors of 0.13, 0.16 and 0.12 respectively (Table 4.1).

Table 4.1 Socio-demographic characteristics of the study population

| Characteristic | Kisa North n(%) | West Ugenya n(%) | West Yimbo n(%) | Total N=592 N (%) |
|---|----------------------------|-----------------------------|----------------------------|------------------------------|
| a) Socio-demographic characteristics of the children 6-23 months | | | | |
| Sex of the children | | | | |
| Male | 90(41.7) | 80(45.7) | 91(45.3) | 261(44.1) |
| Female | 126(58.3) | 95(54.3) | 110(54.7) | 331(55.9) |
| Age in complete months | | | | |
| 6-8 | 48(22.2) | 31(17.7) | 36(17.9) | 115(19.4) |
| 9-12 | 55(25.5) | 52(29.7) | 73(36.3) | 180(30.4) |
| 13-18 | 63(29.2) | 52(29.7) | 59(29.4) | 174(29.4) |
| 19-23 | 50(23.2) | 40(22.9) | 33(16.4) | 123(20.8) |
| b) Socio-demographic characteristics of the mother | | | | |
| Age of the mother | | | | |
| 15-49years | 209(96.8) | 173(99.0) | 198(98.5) | 580(98.0) |
| Above 50 years | 7(3.2) | 2(1.1) | 3(1.5) | 12(2.0) |
| Highest education level of the mother | | | | |
| No formal education | 5(2.3) | 1(0.6) | 2(1.0) | 8(1.4) |
| Primary | 125(57.9) | 115(65.7) | 130(64.6) | 370(62.5) |
| Secondary | 73(33.8) | 55(31.4) | 62(30.8) | 190(32.1) |
| Tertiary (college and university) | 13(6.0) | 4(2.3) | 7(3.6) | 24(4.1) |
| Marital status of the mother | | | | |
| Single | 34(15.7) | 26(14.8) | 41(20.4) | 101(17.0) |
| Married | 180(83.3) | 147(84.0) | 157(78.1) | 484(81.8) |
| Widowed | 1(0.5) | 1(0.6) | 1(0.5) | 3(0.5) |
| Separated/divorced | 1(0.5) | 1(0.6) | 2(1.0) | 4(0.7) |
| c) Socio-demographic characteristics of the household head | | | | |
| Sex of the household head | | | | |
| Male | 201(93.1) | 155(88.6) | 158(78.6) | 514(86.8) |
| Female | 15(6.9) | 20(11.4) | 43(21.4) | 78(13.2) |
| Age of the household head | | | | |
| 20-49 years | 211(97.7) | 172(98.3) | 199(99.0) | 582(98.3) |
| Above 50 years | 5(2.3) | 3(1.7) | 2(1.0) | 10(1.7) |
| Highest education level of the household head | | | | |
| Primary | 110(50.9) | 95(54.2) | 98(48.8) | 303(51.2) |
| Secondary | 95(44.0) | 75(42.9) | 101(50.2) | 271(45.8) |
| Tertiary (college and university) | 11(5.1) | 5(2.9) | 2(1.0) | 18(9.0) |
| d) Average household size | 5±0.13 | 6±0.16 | 5±0.12 | |

4.1.4 Socio-economic Characteristics of the Study Population

The Table 4.2 shows the socio-economic characteristics of the study population. Thirty eight percent (38.0%) of the households in Kisa North, 26.8% in West Ugenya and 35.0% in West Yimbo had iron sheets as the roofing material. Nearly half (51.5%) of the households in West Ugenya, 22.7% in Kisa North and 25.8% in West Yimbo had grass/straw as the roofing material. More than three-quarters (89.4%) of the households in Kisa North, 72.6% in West Ugenya and 41.8% in West Yimbo had the walls of their houses made of mud. Almost 90.7% of the households in Kisa North, 70.3% in West Ugenya and 27.9% in West Yimbo had earthen floors. The rest of the households (71.6% in West Yimbo, 9.3% in Kisa North and 29.7% in West Ugenya) had cemented floors.

From the findings in this study, the mean monthly household income in West Ugenya was between Ksh 9352±10434, in Kisa North Ksh 6002±8486 and West Yimbo Ksh 4928±6515. The main occupation of more than a third (40.3%) of the household heads in West Ugenya was farming. In Kisa North, slightly more than half (50.6) of the household heads were employed while in West Yimbo fishing was the main socio-economic activity for 66.3% of the household heads. More than a fifth (20.0%, 23.4% and 26.9%) of the mothers in Kisa North, West Ugenya and West Yimbo respectively in the study were housewives. Almost a half (49.5%) of the mothers in Kisa North and 38.9% in West Ugenya practiced farming as a source of income while 35.3% of the mothers in West Yimbo engaged in business as a source of income (Table 4.2).

Table 4.2 Socio-economic Characteristics of the Study Population

| Characteristics | Kisa North n(%) | West Ugenya n(%) | West Yimbo n(%) | Total N=592 n(%) |
|---|----------------------------|-----------------------------|----------------------------|-----------------------------|
| Household house material | | | | |
| a)Type of roofing material | | | | |
| Grass/straw | 15(22.7) | 34(51.5) | 17(25.8) | 66(100.0) |
| Iron sheets | 201(38.2) | 141(26.8) | 184(35.0) | 526(100.0) |
| b)Wall type | | | | |
| Mud | 193(89.4) | 127(72.6) | 84(41.8) | 404(68.2) |
| Bricks | 12(5.6) | 20(11.4) | 71(35.3) | 103(17.0) |
| Iron sheet | 10(4.6) | 8(4.6) | 3(1.5) | 21(3.6) |
| c)Type of floor | | | | |
| Cemented | 20(9.3) | 52(29.7) | 144(71.6) | 216(36.5) |
| Earth floor | 196(90.7) | 123(70.3) | 56(27.9) | 375(63.3) |
| d)Average monthly household income (Ksh) | | | | |
| | 6002±8486 | 9352±10434 | 4928±6515 | |
| e)Main source of income for the household head | | | | |
| Farming | 47(39.5) | 48(40.3) | 24(20.2) | 119(100.0) |
| Casual labour | 77(48.7) | 42(26.6) | 39(24.7) | 158(100.0) |
| Business | 32(24.2) | 45(34.1) | 55(41.7) | 132(100.0) |
| Employment | 43(50.6) | 24(28.2) | 18(21.1) | 85(100.0) |
| Other (e.g. fishing) | 17(17.4) | 16(16.3) | 65(66.3) | 98(100.0) |
| f)Main source of income for the mother | | | | |
| None(housewives) | 43(20.0) | 41(23.4) | 54(26.9) | 138(23.3) |
| Farming | 107(49.5) | 68(38.9) | 10(5.0) | 185(31.3) |
| Casual labour | 26(12.0) | 22(12.5) | 61(30.3) | 109(18.4) |
| Business | 34(15.7) | 39(22.2) | 71(35.3) | 144(24.3) |
| Employment | 6(2.8) | 5(2.9) | 5(2.5) | 16(2.7) |

4.2 Maternal Perception on use of Edible Insects for Complementary Feeding

4.2.1 Maternal Perception on use of edible insects (lake flies, termites, grasshoppers, locusts and crickets) for Complementary Feeding

Table 4.3 shows the maternal perception on use of edible insects for complementary feeding. In this study only 1.9%, 4.0% and 6.0% of the mothers in Kisa North, West Ugenya and West Yimbo respectively strongly agreed that edible insects (lake flies, termites, grasshoppers and crickets) were good for use in complementary feeding. Less

than a fifth (8.3%, 16.6% and 16.4%) of the mothers in Kisa North, West Ugenya and West Yimbo agreed while 16.7% in Kisa North, 16% in West Ugenya and 17.9% in West Yimbo were neutral about this. More than a third (42.1%, 33.7% and 39.3%) of the mothers in Kisa North, West Ugenya and West Yimbo disagreed, while 31.0% from Kisa North, 29.7% from West Ugenya and 20.4% from West Yimbo strongly disagreed about the use of edible insects for complementary feeding (Table 4.3). This information was echoed by the Key Informant who implied that, *“Children that are fed on termites are from two years old and above. We don’t feed younger children because we don’t know how to prepare and make it easier for them to consume it. If the insects would be ground into fine particles, then it would be okay to incorporate it in the porridge, although I have not tried that before.”* KII at Ny’angu market, KII, 2019 while others gave children the edible insects but in very small portions and with precaution *“Yes, termites are given to children in very small amounts because large amounts cause diarrhea because they are fatty. They are therefore given 2-3 spoons with ugali little by little”* man Khwisero, FGD 2019.

Table 4.3 Maternal Perception on use of Edible Insects for Complementary Feeding

| Variable | Kisa North n(%) | West Ugenya n(%) | West Yimbo n(%) | Total N=592 n(%) |
|-------------------|----------------------------|-----------------------------|----------------------------|-----------------------------|
| Strongly disagree | 67(31.0) | 52(29.7) | 41(20.4) | 160(27.0) |
| Disagree | 91(42.1) | 59(33.7) | 79(39.3) | 229(38.7) |
| Neutral | 36(16.7) | 28(16.0) | 36(17.9) | 100(16.9) |
| Agree | 18(8.3) | 29(16.6) | 33(16.4) | 80(13.5) |
| Strongly agree | 44(1.9) | 7(4.0) | 12(6.0) | 23(3.9) |

4.2.2 Maternal Perception on Better Nutrient Content in Edible Insects Compared to Other Foods

Table 4.4 shows the maternal perception on better nutrient content in edible insects compared to other foods. In regard to the maternal perception on better nutrient content in edible insects compared to other foods, only 1.4% of the mothers in Kisa North, 4.6% in West Ugenya and 5.5% in West Yimbo strongly agreed that edible insects had better nutrient content compared to other foods while almost a fifth (21.3%, 22.9% and 17.4%) in Kisa North, West Ugenya and West Yimbo strongly disagreed (Table 4.4). In the focus group discussions, the two schools of thought also came up. Some agreed that the edible insects had better nutrient content compared to other foods as they reported, *“These insects we usually eat them because they help us a lot for example like the termites when you eat them, they provide fats to our bodies.”* man Khwisero, FGD, 2019. A village elder said, *“I think consuming insects is a good thing. They are nutritious”* A village elder in Got Agulu. KII, 2019.

More so, it is interesting to know that edible insects had a medicinal aspect attached to them as a village elder reported, *“Termites are good for health because they are not only used as food, but they also have a medicinal value attached to them. They help in the treatment of chest problems, to prevent arthritis, relieve knee pain, as well as deworming children.”* Village elder Khwisero, KII, 2019.

Table 4.4 Maternal Perception on Better Nutrient Content in Edible Insects

| Variable | Kisa North n(%) | West Ugenya n(%) | West Yimbo n(%) | Total N=592 n(%) |
|-------------------|----------------------------|-----------------------------|----------------------------|-----------------------------|
| Strongly disagree | 46(21.3) | 40(22.9) | 35(17.4) | 121(20.4) |
| Disagree | 78(36.1) | 50(28.6) | 50(24.9) | 178(30.1) |
| Neutral | 63(29.2) | 41(23.4) | 64(31.8) | 168(28.4) |
| Agree | 26(12.0) | 36(20.6) | 41(20.4) | 103(17.4) |
| Strongly agree | 3(1.4) | 8(4.6) | 11(5.5) | 22(3.7) |

4.2.3 Maternal Perception on Edible Insects Having Better Taste than Other Foods

The results on the maternal perception of edible insects having a better taste than other foods are shown in table 4.5. Notably, only about 1.9% of the mothers in Kisa North, 8.6% in West Ugenya and 5.5% in West Yimbo strongly agreed that edible insects were of better taste than other foods. On the contrary, almost a third of the mothers (29.2%, 30.9% and 20.9%) in Kisa North, West Ugenya and West Yimbo respectively disagreed while 43.5% in Kisa North, 25.7% in West Ugenya and 15.4% in West Yimbo strongly disagreed about edible insects having better taste than other foods (Table 4.5). The results from the focus group discussions showed that some respondents had an opinion that edible insects were more delicious than other foods “... *They help us a lot because like the termites when you eat with Ugali they are more delicious than kales and cowpeas*” Khwisero FGD, 2019. While others reported eating the insects with precaution that, “... *They are also delicious when roasted. The downside is if you eat too much, you might have a running stomach.*” Sifuyo KII, 2019.

Table 4.5 Maternal Perception on Edible Insects having Better Taste than Other Foods

| Variable | Kisa North n(%) | West Ugenya n(%) | West Yimbo n(%) | Total N=592 n(%) |
|-------------------|----------------------------|-----------------------------|----------------------------|-----------------------------|
| Strongly disagree | 94(43.5) | 45(25.7) | 31(15.4) | 170(28.7) |
| Disagree | 63(29.2) | 54(30.9) | 42(20.9) | 159(26.9) |
| Neutral | 39(18.1) | 29(16.6) | 66(32.8) | 134(22.6) |
| Agree | 16(7.4) | 32(18.3) | 51(25.4) | 99(16.7) |
| Strongly agree | 4(1.9) | 15(8.6) | 11(5.5) | 30(5.1) |

4.2.4 Maternal Perception on Children’s Dislike of Edible Insects

Table 4.6 shows the maternal perception on children’s dislike to consume edible insects. A small proportion of the mothers, i.e., 9.7% in Kisa North, 5.7% in West Ugenya and 4.0% in West Yimbo strongly agreed that their children did not like consuming edible insects. However, majority of the respondents, i.e., 45.8% in Kisa North, 45.7% in West Ugenya and 46.3% in West Yimbo were neutral about their children disliking edible insects.

This data was complemented by information from Key Informant Interviews. During the interview, it was evident that very young children did not consume/were not given edible insects as the key informant said *“The insects are just eaten by adults and children who can chew not small children without teeth.”* Key informant in West Yimbo, KII, 2019. In West Ugenya too, the Key Informant said, *“Children who are fed on termites are from 23 months and above. We don’t feed younger children because we don’t know how to prepare and make it easier for them to consume it,* Key Informant at Ny’angu market in West Ugenya, KII, 2019.

Table 4.6 Maternal Perception on Children's Dislike on Consumption of Edible Insects

| Variable | Kisa North n(%) | West Ugenya n(%) | West Yimbo n(%) | Total N=592 n(%) |
|-------------------|----------------------------|-----------------------------|----------------------------|-----------------------------|
| Strongly disagree | 5(2.3) | 15(8.6) | 6(3.0) | 26(4.4) |
| Disagree | 23(10.7) | 26(14.9) | 30(14.9) | 79(13.3) |
| Neutral | 99(45.8) | 80(45.7) | 93(46.3) | 272(46.0) |
| Agree | 68(31.5) | 44(25.1) | 64(31.8) | 176(29.7) |
| Strongly agree | 21(9.7) | 10(5.7) | 8(4.0) | 39(6.6) |

4.2.5 Maternal Perception on Satiety in Feeding Children Other Foods Rather than Edible Insects

Table 4.7 shows the maternal perception on satiety in feeding children other foods rather than edible insects. About 13.0% of the mothers in Kisa North, 12.6% in West Ugenya and 11.4% in West Yimbo strongly agreed that they were satisfied with feeding their children other foods rather than edible insects. On the other hand, the majority, i.e., (57.4%) in Kisa North, 36.0% in West Ugenya and 49.3% in West Yimbo agreed.

Table 4.7 Maternal Perception on Satiety in feeding children other foods rather than Edible Insects

| Variable | Kisa North n(%) | West Ugenya n(%) | West Yimbo n(%) | Total N=592 n(%) |
|-------------------|----------------------------|-----------------------------|----------------------------|-----------------------------|
| Strongly disagree | 13(6.0) | 20(11.4) | 19(9.5) | 52(8.9) |
| Disagree | 26(12.0) | 39(22.3) | 27(13.4) | 92(15.4) |
| Neutral | 25(11.6) | 31(17.7) | 33(16.4) | 89(15.0) |
| Agree | 124(57.4) | 63(36.0) | 99(49.3) | 286(48.3) |
| Strongly agree | 28(13.0) | 22(12.6) | 23(11.4) | 73(12.3) |

4.2.6 Maternal Perception on Influence of Religion on Consumption of Edible Insects

Table 4.8 shows the maternal perception on influence of religion on consumption of edible insects. In this study, only less than a half 48.6% of the mothers in Kisa North, 45.7% in West Ugenya and slightly more than a third (36.3%) in West Yimbo strongly agreed that consumption of edible insects was acceptable in their religious beliefs. Forty-eight percent (48%) in Kisa North, 46.9% in West Ugenya and 53.2% in West Yimbo agreed. Only a small proportion of about 0.5% of the mothers in Kisa North, 4.0% in West Ugenya and 5.0% in West Yimbo strongly disagreed about the consumption of edible insects being acceptable in their religion.

Table 4.8 Maternal Perception on Influence of Religion on Consumption of Edible Insects

| Variable | Kisa North n(%) | West Ugenya n(%) | West Yimbo n(%) | Total N=592 n(%) |
|-------------------|----------------------------|-----------------------------|----------------------------|-----------------------------|
| Strongly disagree | 1(0.5) | 7(4.0) | 10(5.0) | 18(3.0) |
| Disagree | 2(0.9) | 4(2.3) | 5(2.5) | 11(1.9) |
| Neutral | 4(1.9) | 2(1.1) | 6(3.0) | 12(2.0) |
| Agree | 104(48.2) | 82(46.9) | 107(53.2) | 293(49.5) |
| Strongly agree | 105(48.6) | 80(45.7) | 73(36.3) | 258(43.6) |

4.2.7 Maternal Cultural Perception on Consumption of Edible Insects

Table 4.9 shows the maternal cultural perception on consumption of edible insects. In regard to the maternal perception of the influence of culture on the consumption of edible insects, half (50.5%) of the mothers in Kisa North, 47.4% in West Ugenya and 40.8% in West Yimbo strongly agreed that consumption of edible insects was acceptable in their culture. Nearly a half (48.1% and 49.1%) of the mothers in Kisa North and West Ugenya and 53.7% in West Yimbo agreed about consumption of edible insects being acceptable in their cultures. About 0.5% of the

mothers in Kisa North, 2.3% in West Ugenya and 3.0% in West Yimbo strongly disagreed about the consumption of edible insects being acceptable in their culture.

From the focus group discussions, it was evident that consuming edible insects is a tradition that has existed for generations as one man reported, “...*These insects are our foods we usually eat them, and since we were born we found our grandparents eating them, and until today we usually eat them.....*” Khwisero man, FGD, 2019. In fact, an elderly respondent was reminiscing on the good old day as he said “*I will eat them if I find them and if I find people who are able to prepare like during the ancient times when they were so sweet.*” Elderly respondent, CHV, Got Agulu.

Table 4.9 Maternal Cultural Perception on Consumption of Edible Insects

| Variable | Kisa North n(%) | West Ugenya n(%) | West Yimbo n(%) | Total N=592 n(%) |
|-------------------|----------------------------|-----------------------------|----------------------------|-----------------------------|
| Strongly disagree | 1(0.5) | 4(2.3) | 6(3.0) | 11(1.9) |
| Neutral | 2(0.9) | 2(1.1) | 5(2.5) | 9(1.5) |
| Agree | 104(48.1) | 86(49.1) | 108(53.7) | 297(50.2) |
| Strongly agree | 109(50.5) | 83(47.4) | 82(40.8) | 275(46.5) |

4.3 Complementary Feeding Practices

The aspects of complementary feeding studied were minimum dietary diversity (MDD), minimum meal frequency (MMF), minimum acceptable diet (MAD)

4.3.1 Minimum Dietary Diversity of Children 6-23 months

Table 4.10 shows the study findings of the average number of food groups consumed by children 6-23 months in Kisa North, West Ugenya and West Yimbo. About 39.4% of children from Kisa North, 33.1% from West Ugenya and 28.4% in West Yimbo had consumed foods from a minimum of 4 food groups in the past 24 hours prior to the study.

Overall, more than half (65.3%, 56.6% and 61.7%) of the children 6-23 months from Kisa North, West Ugenya and West Yimbo attained the MDD.

Table 4.10 Average Number of Food Groups Consumed by the Children 6-23 Months

| Variable | Kisa North N=216 n(%) | West Ugenya N=175 n(%) | West Yimbo (N=201) n(%) |
|---|-----------------------------|------------------------------|-------------------------------|
| Average number of food groups consumed | | | |
| 1 | 7(3.3) | 7(4.1) | 6(2.9) |
| 2 | 12(5.7) | 24(14.0) | 32(15.9) |
| 3 | 56(25.8) | 45(26.1) | 39(19.4) |
| 4 | 85(39.4) | 58(33.1) | 57(28.4) |
| 5 | 42(19.4) | 32(18.5) | 56(27.9) |
| 6 | 12(5.7) | 9(5.2) | 10(5.0) |
| 7 | 2(0.7) | 0(0.0) | 1(0.5) |
| Attained MDD | 141(65.3) | 99(56.6) | 124(61.7) |
| Did not attain MDD | 75(34.7) | 76(43.4) | 77(38.3) |

4.3.2 Minimum Meal Frequency (MMF) of Children 6-23 Months

The Figure 4.1 shows the proportion of children aged 6-8 months, 9-12 months and 12-23 months who attained MMF in Kisa North, West Yimbo and West Ugenya. More than three-quarters of the children in Kisa North (89.4%, 94% and 98%) of the children 6-8 months, 9-12 months and 12-23 months respectively attained the MMF in Kisa North. More than half (81.1%, 78.7% and 83.3%) of the children 6-8, 9-12 and 12-23 months respectively in West Yimbo attained the MMF. A significantly higher proportion (21.7%) of the children 9-11 months in West Yimbo did not attain the MMF compared to other age groups.

More than three quarters (80.6%, 97.4% and 93.1%) of the children 6-8, 9-12 and 12-23 months respectively in West Ugenya attained the minimum meal frequency. Almost a fifth

(19.0%) of the children 6-8 months did not attain the MMF compared to children in other age groups.

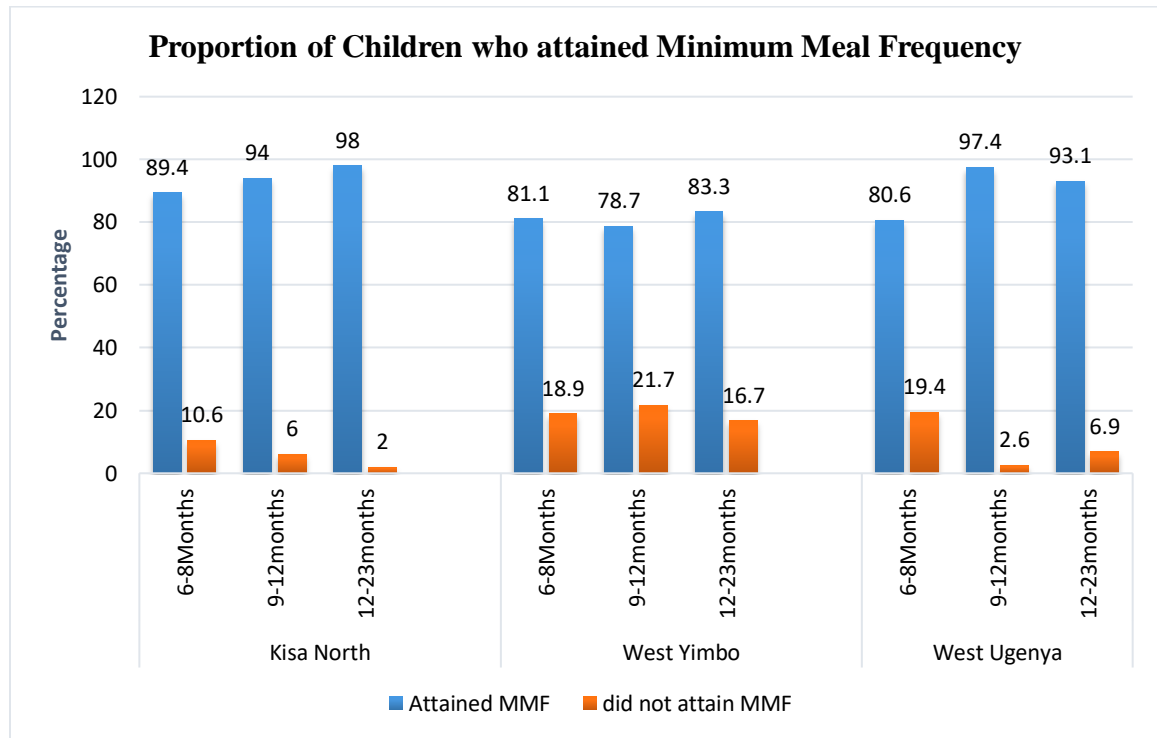


Figure 4.1 Minimum Meal Frequencies of Children 6-23 Months in Kisa North, West Yimbo and West Ugenya

4.3.3 Minimum Acceptable Diet of Children 6-23 Months

The Figure 4.2 shows the proportion of children 6-23 months who attained the Minimum Acceptable Diet among the three wards of study. Slightly more than half (58.9% and 55.8%) of the children in West Yimbo and West Ugenya respectively attained the MAD. On the contrary, almost three-quarters (70.0%) of the children who did not attain the MAD were from Kisa North.

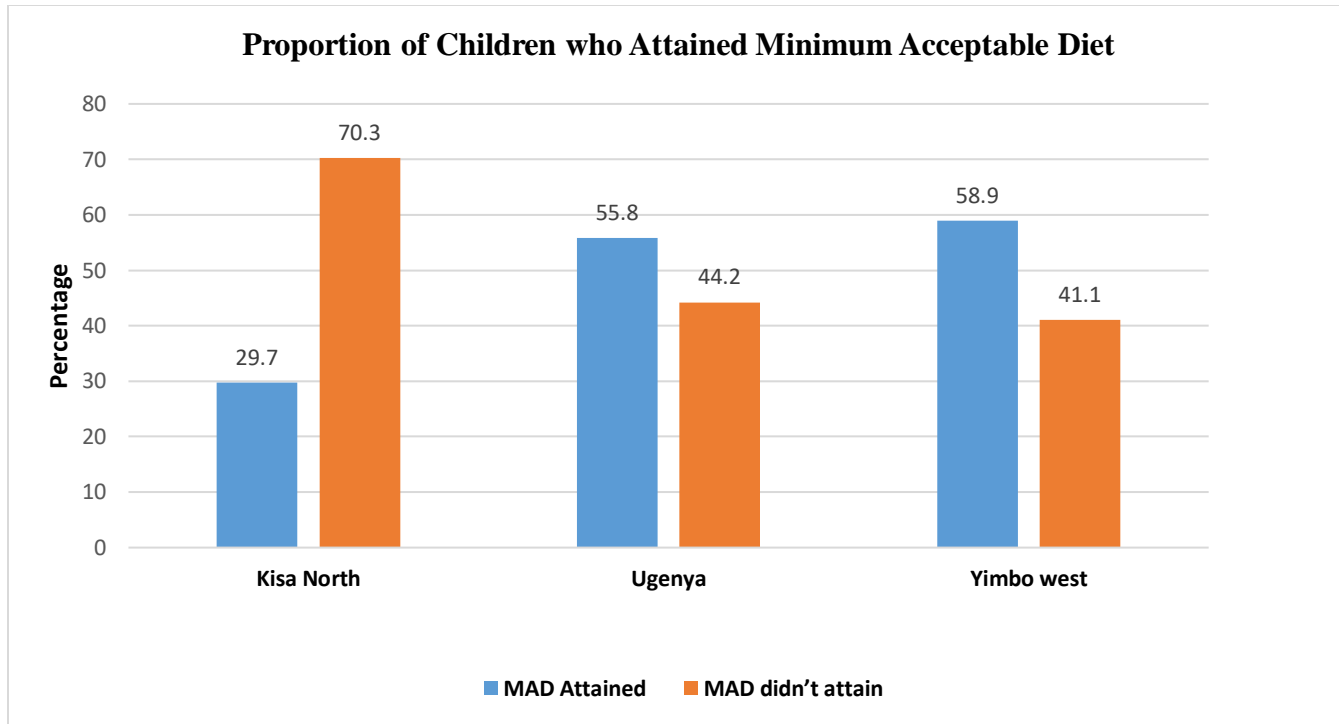


Figure 4.2 Proportion of Children who Attained Minimum Acceptable Diet

4.3.4 Minimum Acceptable Diet (MAD) per age group for breastfed and non-breastfed children

Table 4.11 shows the number of breastfed and non-breastfed children 6-23 months who attained MAD in Kisa North, West Yimbo and West Ugenya. Out of the 65.3% of the children 6-23 months who attained the MAD in Kisa North, more than half (70.1%) were those breastfed. A higher percentage (73.1%) of these children was those between the age groups of 12-23 months, followed by those 9-11 months (64.1%) and lastly those between 6-8 months (44.7%). Out of the 56.2% children who attained the MAD in West Yimbo, more than three quarters (91.2%) were those breastfed, with the majority (93.3%) being those between 6-8 months, followed by those between 9-11 months (91.7%) and then 12-23 months (93.3%). Out of the 60.6% children who attained the MAD in West Ugenya,

80.2% were being breastfed. More than half (65.0%) of these children were those 9-11 months, followed by those 12-23 months (61.5%) then 6-8 months (51.6%).

Table 4.11 Average MAD for breastfed and non-breastfed children per age group in Kisa North, West Yimbo and West Ugenya

| Age group | Kisa North | | West Yimbo | | West Ugenya | |
|---------------------|------------------|------------------|------------------|------------------|------------------|-----------------|
| | Attained MAD | | Attained MAD | | Attained MAD | |
| | N(%) | n(%) | N(%) | n(%) | N(%) | n(%) |
| 6-23 months | 216(100.0) | 141(65.3) | 201(100.0) | 113(56.2) | 175(100.0) | 106(60.6) |
| breastfed | 177(81.9) | 124(70.1) | 166(82.6) | 103(91.2) | 135(77.1) | 85(80.2) |
| Non-breastfed | 39(18.1) | 17(43.6) | 35(17.4) | 10(8.8) | 40(22.9) | 21(19.8) |
| 6-8 months | 47(21.8) | 21(44.7) | 35(17.4) | 15(42.9) | 31(17.7) | 16(51.6) |
| breastfed | 45(95.7) | 20(4.4) | 34(97.1) | 14(93.3) | 30(96.8) | 15(93.8) |
| Non-breastfed | 2(4.3) | 1(50.0) | 1(2.9) | 1(6.7) | 1(3.2) | 1(6.2) |
| 9-11 months | 39(18.0) | 25(64.1) | 46(22.9) | 24(52.2) | 40(22.9) | 26(65.0) |
| Breast fed | 37(94.9) | 24(64.9) | 44(95.7) | 22(91.7) | 38(95.0) | 25(96.2) |
| Non-breastfed | 2(5.1) | 1(50.0) | 2(4.3) | 2(8.3) | 2(5.0) | 1(3.8) |
| 12-23 months | 130(60.2) | 95(73.1) | 120(59.7) | 74(61.7) | 104(59.4) | 64(61.5) |
| breastfed | 99(76.2) | 80(84.2) | 87(72.5) | 62(83.8) | 65(62.5) | 43(67.2) |
| Non-breastfed | 31(23.8) | 15(15.8) | 33(16.4) | 12(16.2) | 39(37.5) | 21(32.8) |

4.3.5 Food Consumption Patterns of the Children 6-23 Months

Table 4.12 shows the food consumption patterns of the children. A seven-day food-frequency questionnaire was used to assess the food consumption patterns of the children in the study. Respondents were asked to state the frequency with which these foods had been consumed by their children in the previous week prior to the data collection. Cereals were the most frequently consumed foods, with 90.7% of the children in West Ugenya, 93.5% in Kisa North and 89.6% in West Yimbo having consumed cereals for more than 5 days in the previous week. The second most frequently consumed foods were sugar alternatives, which were consumed by 82.3% of the children in West Ugenya, 80.6% in

Kisa North and 90.0% in West Yimbo. Vegetables were consumed by 74.9% of the children in West Ugenya, 72.7% in Kisa North and 76.1% in West Yimbo. Milk and milk products were also consumed by 51.4% of the children in West Ugenya, 58.0% in Kisa North and 54.7% in West Yimbo. About 26.3% of the children in West Ugenya, 23.6% in Kisa North and 30.8% in West Yimbo had consumed fruits in the previous 5 days. The least consumed foods were roots and tubers, flesh foods, legumes, pulses and nuts, beverages and spreads and the edible insects. Roots and tubers were consumed by 11.1% of the children in Kisa North, 5.0% of the children in West Yimbo and 6.0% in West Ugenya. Flesh foods were consumed by 13.7% of the children in West Ugenya, 7.4% in Kisa North and 49.8% in West Yimbo. About 13.7% of the children in West Ugenya, 10.6% in Kisa North and 28.9% in West Yimbo had consumed beverages and spreads in the past 5 days prior to the study.

Table 4.12 Food consumption patterns of the children 6-23 months

| | Cereals n(%) | Roots & tubers n(%) | Milk & milk products n(%) | Flesh foods n(%) | Legumes /pulses and nuts n(%) | Vegetabl es n(%) | Fruits n(%) | Sugar alternati ves n(%) | Beverag es and spreads n(%) |
|--------------------|-------------------------|--|--|---------------------------------|--|---------------------------------|------------------------|---|--|
| West Ugenya | | | | | | | | | |
| Never | 0(0.0) | 64(36.6) | 28(16.0) | 28(16.0) | 36(20.6) | 15(8.6) | 26(14.9) | 13(7.4) | 89(50.9) |
| 1-2 days | 10(5.8) | 78(44.6) | 40(22.9) | 80(45.7) | 86(49.1) | 11(6.2) | 72(41.1) | 12(6.9) | 35(20.0) |
| 3-4 days | 6(3.5) | 21(12.0) | 17(9.7) | 43(24.6) | 31(17.7) | 18(10.3) | 31(17.7) | 6(3.4) | 27(15.4) |
| >5 days | 159(90.7) | 12(6.0) | 90(51.4) | 24(13.7) | 22(12.6) | 131(74.9) | 46(26.3) | 144(82.3) | 24(13.7) |
| West Yimbo | | | | | | | | | |
| Never | 0(0.0) | 81(40.2) | 31(15.4) | 20(10.0) | 44(21.9) | 21(10.4) | 25(12.5) | 8(4.0) | 63(31.3) |
| 1-2 days | 12(5.9) | 90(44.8) | 32(15.9) | 35(17.3) | 88(43.8) | 11(5.5) | 70(34.8) | 6(3.0) | 40(19.9) |
| 3-4 days | 9(4.5) | 20(10.0) | 28(13.9) | 46(22.9) | 41(20.4) | 16(8.0) | 44(21.9) | 6(3.0) | 40(19.9) |
| >5 days | 180(89.6) | 10(5.0) | 110(54.7) | 100(49.8) | 28(13.9) | 153(76.1) | 62(30.8) | 181(90.0) | 58(28.9) |
| Kisa North | | | | | | | | | |
| Never | 0(0.0) | 59(27.3) | 39(18.4) | 56(25.9) | 64(29.6) | 21(9.7) | 39(18.1) | 25(11.6) | 120(55.6) |
| 1-2 days | 9(4.2) | 89(41.2) | 23(10.8) | 101(46.8) | 103(47.7) | 13(6.0) | 88(40.7) | 6(2.8) | 50(23.2) |
| 3-4 days | 5(2.3) | 44(20.4) | 27(12.7) | 43(19.9) | 32(14.8) | 25(11.6) | 38(17.6) | 11(5.1) | 23(10.6) |
| >5 days | 202(93.5) | 24(11.1) | 123(58.0) | 16(7.4) | 17(7.9) | 157(72.7) | 51(23.6) | 174(80.6) | 23(10.6) |

4.3.5.1 Status of Edible insect consumption

Table 4.13 shows the status of edible insect consumption among the three wards. Majority (78.9% in West Ugenya, 96.5% in West Yimbo and 61.1% in Kisa North) of the children 6-23 months had never consumed edible insects in the past seven days prior to the study. About 13.1% of the children in West Ugenya, 1.0% in West Yimbo and 26.4% in Kisa North had consumed the edible insects 1-2 days prior to the study. About 2.3% of the children in West Ugenya, 1.0% in West Yimbo and 6.9% in Kisa North had consumed the edible insects 3-4 days prior to the study. Notably, 5.7% of the children in West Ugenya,

5.6% in Kisa North and 1.5% in West Yimbo had consumed edible insects five days prior to the study.

Table 4.13 Status of Edible Insect Consumption

| Ward | Never n(%) | 1-2 days n(%) | 3-4 days n(%) | >5 days n(%) |
|--------------------|-----------------------|--------------------------|--------------------------|----------------------------|
| West Ugenya | 138(78.9) | 23(13.1) | 4(2.3) | 10(5.7) |
| West Yimbo | 194(96.5) | 2(1.0) | 2(1.0) | 3(1.5) |
| Kisa North | 132(61.1) | 57(26.4) | 15(6.9) | 12(5.6) |

4.4 Nutrition Status of Children 6-23 Months

The nutrition status of children in this study was determined by the z-scores and Mid-Upper Arm Circumference (MUAC). The z-scores categorized the children's nutrition status as normal, stunted, underweight, wasted or overweight. The MUAC readings classified children as normal, moderately malnourished or severely malnourished.

Children were classified as being underweight, stunted or wasted based on z-scores cut-off values of less than -2 SD of weight for age (WAZ), height for age (HAZ), and weight for height (WHZ).

4.4.1 Wasting

Table 4.14 shows the weight for height z scores for the children 6-23 months among the three wards and the mean Mid Upper Arm Circumference (MUAC) values and their standard deviations. Weight for height Z score (WHZ) is used to determine wasting which is a sign of acute malnutrition. Majority of the children (90.9% in West Ugenya, 91.5% in West Yimbo and 93.1% in Kisa North) had normal WHZ (-1 to +2SD). An equal proportion (4.6%) of the children in West Ugenya and Kisa North and 5.0% in West Yimbo were

moderately wasted ($-3SD$ to $<-2SD$). About 1.7% of those in West Ugenya, 2.0% in West Yimbo and 1.4% of the children in Kisa North were severely wasted ($<-3SD$). In terms of overweight, 2.9% of the children West Ugenya, 1.5% in West Yimbo and 0.9% in Kisa North were overweight ($>+2SD$). In general, the mean weight for height z scores of the children were (0.23 ± 1.64 , 0.25 ± 1.41 and 0.35 ± 2.18) in West Ugenya, West Yimbo and Kisa North wards respectively. The mean MUAC values of the children were 14.28 ± 1.95 in West Ugenya, 14.64 ± 2.26 in West Yimbo and 14.12 ± 1.91 in Kisa North.

Table 4.14 Weight-for-height z-scores and mean MUAC values

| Weight for height z scores | N | % |
|---|------------|----------|
| West Ugenya | | |
| <-3SD (Severely malnourished) | 3 | 1.7 |
| -3SD to <-2SD (Moderately malnourished) | 8 | 4.6 |
| -1SD to +2SD (Normal WHZ) | 159 | 90.9 |
| >+2SD (Overweight/obese) | 5 | 2.9 |
| Total (N) | 175 | 100.0 |
| Mean WHZ±SD | 0.23±1.64 | |
| Mean MUAC±SD | 14.28±1.95 | |
| West Yimbo | | |
| <-3SD (Severely malnourished) | 4 | 2.0 |
| -3SD to <-2SD (Moderately malnourished) | 10 | 5.0 |
| -1SD to +2SD (Normal WHZ) | 184 | 91.5 |
| >+2SD (Overweight/obese) | 3 | 1.5 |
| Total | 201 | 100.0 |
| Mean WHZ±SD | 0.25±1.41 | |
| Mean MUAC±SD | 14.64±2.26 | |
| Kisa North | | |
| <-3SD (Severely malnourished) | 3 | 1.4 |
| -3SD to <-2SD (Moderately malnourished) | 10 | 4.6 |
| -1SD to +2SD (Normal WHZ) | 201 | 93.1 |
| >+2SD (Overweight/obese) | 2 | 0.9 |
| Total | 216 | 100.0 |
| Mean WHZ±SD | 0.35±2.18 | |
| Mean MUAC±SD | 14.12±1.91 | |

4.4.2 Stunting

Table 4.15 shows the height for age z scores for children 6-23 months. Height for Age Z score was used to determine the stunting rates of the children among the three wards. The results showed that 81.0% of the children in West Ugenya and an equal proportion (80.1%) of the children West Yimbo and Kisa North had a normal height for age Z score (-1 to +2SD). About 10.9% of the children in West Ugenya and West Yimbo and 11.1% of the children in Kisa North were moderately stunted (-3SD to <-2SD). About 8.6% of the children in West Ugenya, 9.0% in West Yimbo and 8.8% of the children in Kisa North

were severely stunted (<-3SD). The mean height for age z scores were -1.00 ± 1.65 , -0.81 ± 1.71 and -0.64 ± 2.30 for West Ugenya, West Yimbo and Kisa North respectively.

Table 4.15 Height-for-age z-scores for children 6-23 months

| Height for age z scores | N | % |
|------------------------------------|-----------------|----------|
| West Ugenya | | |
| <-3SD (Severely stunted) | 15 | 8.6 |
| -3SD to <-2SD (Moderately stunted) | 19 | 10.9 |
| -1SD to +2SD (Normal HAZ) | 141 | 81.0 |
| Total | 175 | 100.0 |
| Mean HAZ±SD | -1.00 ± 1.65 | |
| West Yimbo | | |
| <-3SD (Severely stunted) | 18 | 9.0 |
| -3SD to <-2SD (Moderately stunted) | 22 | 10.9 |
| -1SD to +2SD (Normal HAZ) | 161 | 80.1 |
| Total | 201 | 100.0 |
| Mean HAZ±SD | -0.81 ± 1.71 | |
| Kisa North | | |
| <-3SD (Severely stunted) | 19 | 8.8 |
| -3SD to <-2SD (Moderately stunted) | 24 | 11.1 |
| -1SD to +2SD (Normal HAZ) | 173 | 80.1 |
| Total | 216 | 100.0 |
| Mean HAZ±SD | -0.64 ± 2.30 | |

4.4.3 Underweight

Table 4.16 shows the weight for age z scores for children 6-23 months among the three wards. Weight for Age Z-score (WAZ) was used to determine the prevalence of underweight among the children 6-23 months among the three wards of the study. The study found out that 90.9% of the children in West Ugenya, 91.0% in West Yimbo and 91.2% in Kisa North had normal HAZ (-1 to +2SD). About 6.3% of the children in West Ugenya, 6.0% in West Yimbo and 6.9% in Kisa North were moderately underweight (-3SD to < -2SD) while 2.9% in West Ugenya, 3.0% in West Yimbo and 1.9% in Kisa North

were severely underweight with a Z score of $<-3SD$. The mean weight for age z scores were -0.37 ± 1.37 , -0.27 ± 1.23 and -0.15 ± 1.46 for West Ugenya, West Yimbo and Kisa North respectively.

Table 4.16 Weight-for-age z-scores for children 6-23 months

| Weight for age z scores | N | % |
|--|-----------------|----------|
| West Ugenya | | |
| <-3SD (Severely underweight) | 5 | 2.9 |
| -3SD to <-2SD (Moderately underweight) | 11 | 6.3 |
| -1SD to +2SD (Normal WAZ) | 159 | 90.9 |
| Total | 175 | 100.0 |
| Mean WAZ \pm SD | -0.37 ± 1.37 | |
| West Yimbo | | |
| <-3SD (Severely underweight) | 6 | 3.0 |
| -3SD to <-2SD (Moderately underweight) | 12 | 6.0 |
| -1SD to +2SD (Normal WAZ) | 183 | 91.0 |
| Total | 201 | 100.0 |
| Mean WAZ \pm SD | -0.27 ± 1.23 | |
| Kisa North | | |
| <-3SD (Severely underweight) | 4 | 1.9 |
| -3SD to <-2SD (Moderately underweight) | 15 | 6.9 |
| -1SD to +2SD (Normal WAZ) | 197 | 91.2 |
| Total | 216 | 100.0 |
| Mean WAZ \pm SD | -0.15 ± 1.46 | |

4.5 Relationship between Household Socio-economic and Demographic

Characteristics, Maternal Perceptions on use of edible insects for complementary feeding and Nutrition Status of the Children

4.5.1 Relationship Between Socio-demographic Characteristics and maternal perception on use of edible insects for Complementary Feeding

Table 4.17 indicates the relationship between the ward of residence, respondent's marital status, main source of income for the household head, highest education level of the

household head and the maternal perception on use of edible insects for complementary feeding of children 6-23 months. An association was found between respondent's ward of residence ($\chi^2=16.86$, $p=0.030$), respondent's marital status ($\chi^2=11.14$, $p=0.025$), main source of income for the household head ($\chi^2=33.35$, $p=0.007$) and the highest education level of the household head ($\chi^2=48.67$, $p=0.009$) and the maternal perception on use of edible insects for complementary feeding of the children.

Table 4.17 Relationship Between Socio-economic, demographic Characteristics and the Maternal Perception on Use of Edible Insects for Complementary Feeding

| Characteristics | Strongly Agree n(%) | Agree n(%) | Neutral n(%) | Disagree n(%) | Strongly disagree n(%) | Chi-square value (χ^2) | Chi-square test; P value |
|--|--------------------------------|-----------------------|-------------------------|--------------------------|-----------------------------------|---|---|
| Maternal Perception on Better Nutrient Content than other foods | | | | | | | |
| Ward | | | | | | 16.86 | 0.030 |
| Kisa North | 45(21.2) | 76(35.8) | 63(29.7) | 25(11.8) | 7(3.2) | | |
| West Ugenya | 37(21.6) | 49(28.7) | 41(24.0) | 36(21.1) | 12(6.9) | | |
| West Yimbo | 39(18.7) | 53(25.4) | 64(30.6) | 42(20.1) | 3(1.5) | | |
| Maternal Cultural Perception on Consumption of Edible Insects | | | | | | | |
| Marital status | | | | | | 11.14 | 0.025 |
| No | 45(43.7) | 53(51.5) | 2(1.9) | 3(2.9) | 0(0.0) | | |
| Yes | 287(58.7) | 178(36.4) | 7(1.4) | 8(1.6) | 9(1.8) | | |
| Maternal Perception on use of edible insects (lake flies, termites, grasshoppers, locusts and crickets) for complementary feeding | | | | | | | |
| Main source of income for the household head | | | | | | 33.35 | 0.007 |
| Farming | 42(35.3) | 37(31.1) | 20(16.8) | 15(12.6) | 5(4.2) | | |
| Casual labour | 38(24.1) | 65(41.1) | 29(18.4) | 23(14.6) | 3(1.9) | | |
| Business | 39(29.5) | 57(43.2) | 13(9.8) | 18(13.6) | 5(3.8) | | |
| Employment | 17(20.0) | 34(40.0) | 25(29.4) | 8(9.4) | 1(1.2) | | |
| Other (fishing) | 24(24.5) | 36(36.7) | 13(13.3) | 16(16.3) | 9(9.2) | | |
| Maternal Perception on use of edible insects (lakeflies, termites, grasshoppers, locusts and crickets) for complementary feeding | | | | | | | |
| Education level of the household head | | | | | | 48.67 | 0.009 |
| None | 3(37.5) | 1(12.5) | 1(12.5) | 1(12.5) | 3(37.5) | | |
| Primary | 81(27.1) | 120(40.1) | 49(16.4) | 39(13.0) | 10(3.3) | | |
| Secondary | 37(25.2) | 50(34.0) | 31(21.1) | 21(14.3) | 8(5.4) | | |
| Tertiary | 11(35.5) | 12(38.7) | 5(16.1) | 2(6.5) | 1(3.2) | | |

4.5.2 Relationship between Complementary Feeding Practices and the Nutrition

Status of the Children

The table 4.18 shows the relationship between complementary feeding practices and the nutrition status of children 6-23 months. Based on the study findings, the minimum acceptable diet had an association with the nutrition status of the children 6-23 months ($\chi^2=10.04$, $p=0.0494$).

Table 4.18 Relationship between complementary feeding practices and the nutrition status of children

| Nutritional Status | Not Attained MAD | Attained MAD | χ^2 | p value |
|---------------------------|-------------------------|---------------------|----------|----------------|
| Severely Wasted | 4(30.8%) | 9(69.2%) | 10.04 | 0.0494 |
| Moderately wasted | 8(32.0%) | 17(68.0%) | | |
| Normal | 190(39.1%) | 296(60.9%) | | |
| Overweight | 17(46%) | 20(54.1%) | | |
| Obese | 4(28.6%) | 10(71.4%) | | |
| Total | 223(38.8%) | 352(61.2%) | | |

4.5.3 Relationship between the Maternal Perception and the Complementary

Feeding Practices of the Children 6-23 Months

Table 4.19 indicates the relationship between children's perceived dislike for the consumption of edible insects and the complementary feeding practices of children 6-23 months. From the study, there is a significant relationship between the children's perceived dislike for consumption of edible insects and the complementary feeding practices ($\chi^2=4.24$, $p=0.024$). Majority of the mothers/caregivers who reported that their children did not like consuming edible insects or were neutral about it did not attain the Minimum

Acceptable Diet. On the other hand, the Pearson Chi-square test results indicated that there was no significant relationship between maternal perceived satisfaction in feeding their children other foods rather than edible insects and the complementary feeding practices ($\chi^2=4.45$, $p=0.108$).

Table 4.19 Relationship between Maternal Perception on Use of Edible Insects for Complementary Feeding and the Complementary Feeding Practices of the Children

| Independent Variables | Not Attained MAD | Attained MAD | χ^2 | p value |
|--|-------------------------|---------------------|----------------------------|----------------|
| Perception on maternal child dislike for consumption of edible insects | | | | |
| Strongly disagree/ Disagree | 42 | 63 | 4.24 | 0.024 |
| Neutral | 116 | 154 | | |
| Strongly agree/ Agree | 72 | 141 | | |
| Perception on satisfaction in feeding children other foods rather than edible insects | | | | |
| Strongly disagree/ Disagree | 154 | 263 | 4.45 | 0.108 |
| Neutral | 44 | 46 | | |
| Strongly agree/ Agree | 32 | 4 | | |

CHAPTER FIVE: DISCUSSION

5.1 Introduction

This study looked at the maternal perception on use of edible insects for complementary feeding and the nutrition status of children in Kakamega and Siaya Counties. Three wards; West Ugenya, West Yimbo and Kisa North, were selected for the study, and a total of 592 mothers were recruited in the study.

5.2 Socio-demographic and Socioeconomic Characteristics of the Children 6-23

Months in Kakamega and Siaya Counties

The socio-demographic and socio-economic characteristics of a household affect how food can be accessed and its availability and hence affect children's feeding patterns, food diversity, intake of nutrients and nutrition status (Ali et al., 2019). In this study, 592 mother/child (6-23 months) pairs took part in the study. There were more female children than male children among the three wards. Significantly, majority of the children were between 9-12 months while the least number were between 6-8 months. This was similar to a study by Mwangi, (2018) done in Mwea East Sub county in Kirinyaga County.

Most of the mothers were in the childbearing age group and were married. In this study, more than half of the household heads were males. The decisions made in a household are greatly influenced by the age of the head of the household which, on the other hand, influences a child's nutritional status (Ochieng et al., 2017). Majority of the household heads were between 20-49 years in more than three-quarters of the households in West Yimbo and West Ugenya respectively.

The average household sizes were 5, 6 and 5 for Kisa North, West Ugenya and West Yimbo respectively at a 95% confidence interval. According to the demographic and health

survey, the average size of a household is 3.9 (KDHS, 2014). These household sizes were larger. According to Zulu (2019), a large household size is associated with food insecurity while a small household size is advantageous in terms of efficiency in ensuring child well-being hence they are less likely to be stunted. In a study by Sarkar (2015), he stated that the size of a household has a significant association with the nutrient intake in a household.

In the current study, more than half of the mothers had attained primary education; a third had attained secondary education, while only less than 6% in each ward had completed tertiary education. The level of education is very important in adequately caring for a child. The level of education of a mother leads to a better nutritional status of the child since she is able to be empowered and to understand issues pertaining health (Mwangi, 2018; USAID, 2018). In this study, majority of the household heads in West Ugenya and West Yimbo had attained primary education. According to Viswanathan et al. (2015), the highest education level of a household head greatly influences the child's nutritional status, the nutrient adequacy and dietary diversity, as well as their general well-being. The level of education attained by an individual greatly influences their main occupation (Zulu, 2019). About a half (50.6%) of the household heads in Kisa North were employed, while in West Yimbo, fishing was the main socio-economic activity for 66.3% of the household heads. Almost half (49.5%) of the mothers in Kisa North and West Ugenya (38.9%) practiced farming as a source of income while in West Yimbo about 35.3% of the mothers engaged in small scale businesses.

Notably, majority of the households had grass/straw as the roofing material, earthen floors and mud walls for their main houses. However, it was more likely to find stone/brick walls in West Yimbo than in Kisa North and West Ugenya. The average monthly household

income in West Yimbo was between Ksh 4928±6515, while that in Kisa North and West Ugenya was Ksh 6002±8486 and Ksh 9352±10434 respectively. This was an indicator of poor socio- economic status. Various studies indicate that monthly income and the nutritional status of children are significantly associated (Sarkar, 2015, Ogechi et al., 2017). The more the monthly income, the more the amount spent on the well-being of a child (Sekhampu, 2017). The average monthly food expenditures of the households in the study sites were lower than the national food expenditure.

5.3 Maternal Perception on use of Edible insects for Complementary Feeding

From findings in the current study, majority of the mothers were negative about the use of edible insects for complementary feeding. In West Yimbo, the majority of the respondents were positive because they believed that edible insects were more nutritious than other food sources. This finding concurs with a study by Megido et al., (2014) and Homann et al. (2016), who determined the perceptions on edible insects consumption; they found out that the formulations that had high acceptance among the population were based on their flavors and crispy textures. Most of the respondents who disagreed were from Kisa North. This finding is supported by a similar finding from a study done by Geertsen (2019), who stated that among the factors that led to the acceptance of the edible insects were previous experience with the edible insects and the taste of the edible insect.

Findings from this study indicate that children from Kisa North were less likely to consume edible insects compared to the other wards. This is because apart from being neutral, the majority of the respondents agreed that their children did not like consuming edible insects. This finding relates to findings from a research by Chow et al. (2021), who stated that most children were not able to consume edible insects because of neophobia from both parents

and the children. He, therefore, came up with a palpable interconnected form of a cooking activity to introduce edible insects to children to enhance tolerability. This could be a viable solution since from focus groups discussions, it was reported that if taught how to prepare the edible insects, it would enhance their effectiveness. However, the majority of the respondents from Kisa North in this study agreed that they were satisfied in giving their children other food sources, and they would never give their children edible insects.

Among the mixed aspects that determine acceptability or rejection of consumption of edible insects is societal influence (Geertsen, 2019). Findings from this study show that, in terms of principles of consuming edible insects as complementary foods, the majority of the respondents, especially from Kisa North, felt that it was not against their religious beliefs and culture.

5.4 Complementary Feeding Practices of Children 6-23 Months

5.4.1 Minimum Dietary Diversity

Majority of the children (more than half) had consumed at least 4 of 8 food groups that are advocated by WHO. There was however still an opportunity to enrich the complementary foods with edible insects. A similar study in Kuria West, Migori County reported that 63.7% of the children had achieved the MDD (Nyakundi et al., 2019). Unlike in Ethiopia, only 10.6% of the children had achieved the minimum recommended dietary diversity (Dangura & Gebremedhin, 2017).

5.4.2 Minimum Meal Frequency

Minimum Meal Frequency (MMF) relates to the daily total nutrient intake and is therefore important in obtaining optimal growth. WHO defines MMF as the number of children who

received complementary foods the minimum recommended number of times in the previous 24 hours 2-3 times for 6–8-month-olds 3-4 times for 9–11month olds and 3-4 times for children aged 12–23-month-olds. For non-breastfed children, the minimum meal frequency is four meals in the prior 24 hours.

The current study established that most of the children 6-23 months among the three wards attained the MMF, the majority being those between the age groups of 12-23 months. A significantly higher number of children between 6-8 months (19%) did not attain the MMF. These findings are consistent with the literature as it is purported that meal frequency increases with an increase in age (Mekonnen et al., 2017). These findings are in agreement with Korir (2013), who reported that over 90% of the children in the study attained MMF. Nyakundi et al., (2019) reported that all the breastfed children 6-8 months and 78.4% of those 9-23 months attained MMF.

5.4.3 Minimum Acceptable Diet

WHO defines MAD as a combination of MDD and MMF and in addition milk feeds; children who are breastfed and meet both the MMF and the MDD are regarded to have achieved the MAD. More than half of the children 6-23 months attained MAD in West Yimbo (58.9%) and West Ugenya (55.8%) while only 29.7% attained the MAD in Kisa North. The majority of the children 6-23 month olds who did not attain the MAD were from Kisa North (70.3%). The proportion of children who achieved the MAD was higher than that reported by Nyakundi et al., (2019) for children in Kuria West in Migori County, where only 32.2% of all the children had achieved the MAD. Similarly in a survey by Saaka et al. (2015), he found out that only 27.8% of the children between 6 to 23 months had attained the MAD. In rural, central and western China, less than half (31.6%) of the

children aged 6–23 months achieved the recommended MAD, Molla et al., (2021) and 44.1% achieved a minimum acceptable diet in Pakistan (Ariff et al., 2020).

5.4.4 Minimum Acceptable Diet Per Age Group for Breastfed and Non- breastfed Children

WHO recommends that children are exclusively breastfed for the first six months of life because breast milk is pure and contains all the nutrients necessary for growth (WHO, 2009). In addition, the antibodies of the mother that are in breast milk boost the immune system of the child. Reasons why early complementary feeding is not allowed are; it exposes the child to pathogens and increases their infection risks, particularly disease, it reduces the child's breast milk intake because of reduced suckling, which eventually reduces the production of breastmilk and finally in low-resource settings, complementary food is often nutritionally inadequate (WHO, 2009).

According to the Kenya National Bureau of Statistics KNBS, (2015) 61% of children below 6 months in Kenya are breastfed, while 53% of children continue breastfeeding up to two years. In the current study, the percentage of children who were breastfeeding was just slightly higher than the national data. In the current study, the children who were being breastfed were more likely to attain MAD compared to those non-breastfed. This finding was in agreement with KDHS report where 23% of the breastfed children attained MAD as compared to 18% of non-breastfed children (KDHS, 2014). Majority of the children 6-23 months old among the three wards that were able to attain the MAD were those who were breastfed. Among the three age groups in the three wards, the majority of the children that attained the MAD were those 9-11 months in West Ugenya and 12-23months both in West Yimbo and in Kisa North. This was similar to the national data where more (24.5%)

children 12-23 months attained MAD compared to 17.8% of children 9-11 months (KNBS, 2015).

5.4.5 Food Consumption Patterns of the Children

Mothers stated the frequency with which certain foods were consumed by their children in the week prior to the data collection using an FFQ. Generally, among the three wards, the most consumed foods for 5 days or more in the previous week were cereals followed by sugar alternatives, vegetables, milk and milk products, fruits, flesh foods, beverages and spreads, legumes/pulses and nuts, roots and tubers and edible insects. Majority of the children had consumed foods made from cereals, roots and tubers, mainly in porridge form. This is in agreement with a study by Mwangi (2018). The high consumption rates of the cereals, roots and tubers can be attributed to the fact that they are poor communities hence mothers would opt for affordable foods like the cereals.

Vitamin A deficiency is one of the nutritional deficiencies of concern since it is important in immune function, vision, growth and development (Ribeiro et al., 2013). The consumption of fruits and vegetables rich in vitamin A was quite high among the children in the study sites with the majority having consumed fruits and vegetables rich in vitamin A 24 hours prior to the study. These findings contradict various studies conducted in Ethiopia by Wolle et al., (2020), in Zambia by Marinda et al., (2018) and in Kenya by Mwangi, (2018). The low intake of iron-rich and iron-fortified foods in the current study among the three wards is compatible with past observations in Kenya by Gatahun, (2015), who found out that most complementary foods were inadequate in iron. Various studies (Haileselassie et al. (2020); Marinda et al. (2018)) indicate that consumption of flesh foods is consistently low especially in rural areas, findings that concur with that of the present

study. The low consumption of flesh foods could be accredited to the high poverty levels hence limited income to purchase flesh foods.

5.4.5.1 Status of Edible Insect Consumption

Majority of the children 6-23 months had never been fed on edible insects. However, the few that had consumed the edible insects had consumed them as a snack but not as part of complementary foods, “... *Even my child who is 2 years old I just found him eating the edible insects without me introducing it to him. He goes to collect and eats them,*” Woman, Khwisero FGD, 2019. This was an indication that edible insects were acceptable and consumed among the residents. This finding is similar to a study by Hlongwane et al., (2020), who discovered that 95% of the respondents in Limpopo area occasionally consumed edible insects while only 28% did so in Kwazulu-Natal.

5.5 Nutrition Status of Children Aged 6-23 Months Old

The nutrition status of children in this study was determined by the Mid-Upper Arm Circumference (MUAC) and z-scores. The z-scores categorized the children’s nutrition status as overweight, underweight, stunted, normal or wasted. The Mid Upper Arm Circumference readings classified children as normal, moderately malnourished or severely malnourished.

Wasted, stunted or underweight children were classified based on the z-scores cut-off values of less than -2 SD of weight for age (WAZ), height for age (HAZ), and weight for height (WHZ). Underweight was defined as a z-score of weight for age (WAZ) less than -2 SD. Stunting was defined as a z-score of height for age < -2 SD. Wasting was defined as a z-score of weight for height (WHZ) < -2 SD. Overweight/obese children were defined

as those whose WHZ values were more than +2 SD. There was a high prevalence rate of wasting among the children 6-23 months in the three wards of study. According to the Kenya demographic and health survey KDHS, (2014), wasting levels among children under 5 years in Kenya are at 4%. The prevalence of stunting and underweight among the children in the three wards of study were lower than the national levels [26% of children below 5 years are stunted and 11% underweight (KDHS, 2014)]. These findings were slightly lower than those of Kahawa West, Nairobi Ochola et al., (2017), where the underweight rates were 16.8% and the stunting and wasting levels which were at 13.3% and 11.9% respectively.

Overall, the magnitude of malnutrition was higher than the national levels based on wasting (6.3% in West Ugenya, 7.0% in West Yimbo and 6.0% in Kisa North) and lower in terms of stunting (19.5% in West Ugenya, an equal proportion of 19.9% in West Yimbo and Kisa North) and underweight (9.2% in West Ugenya, 9.0% in West Yimbo and 8.8% in Kisa North). These findings were slightly lower than findings by Kimiywe & Chege, (2015) where the rates for wasting, stunting and underweight were 7.0%, 22.9% and 10.9% respectively. The wasting levels of these children 6-23 months could be as a result of food insecurity as evidenced by low dietary intake of flesh foods.

5.6 Associations of Variables

5.6.1 Relationship Between Socio-demographic and Socioeconomic Factors and the Maternal Perceptions on Use of Edible Insects for Complementary Feeding

The ward where a child came from, household head education level, marital status of the mother and the source of income for the household head had a significant effect on the maternal perception on use of edible insects for complementary feeding. Education level

category had two levels; lower education and higher education. Higher education was defined as those respondents and spouses who completed high school and then went for vocational training, college or university. Lower education was defined as those who did not go to school, those who had informal education, some primary, completed primary or had some secondary. From the results, household heads who had higher education had more likelihood of their children being fed on edible insects hence consequently attaining Minimum Acceptable Diet than those who had lower education. High education level is associated with better chances of formal employment, income, and access to knowledge which in turn affects the purchasing power (Mwangi, 2018).

In Mongolia, children from wealthier households had the advantage of attaining the MDD, as compared to children who came from poor households (Janmohamed et al., 2020). The socio-demographic and socio-economic characteristics had a significant relationship with the maternal perception on use of edible insects for complementary feeding. Therefore, the hypothesis that there is no significant relationship between socio-economic and socio-demographic characteristics and the maternal perception on use of edible insects for complementary feeding of children 6 to 23 months in Kakamega and Siaya Counties was rejected.

5.6.2 Relationship between Complementary Feeding Practices and the Nutrition

Status of the Children

A good quality diet enhances the physical and cognitive development of children, and the vice versa is true that more inferior diet quality can hinder child optimal growth and development, resulting in malnutrition. The UNICEF conceptual framework UNICEF, (2009) shows a relationship between dietary intake and nutrition status. In Kitui, Kimiywe

& Chege, (2015) noted that nutrition status and complementary feeding practices were significantly related. In a study by Menasria et al., (2018), in a study to determine the potential use of edible insects in complementary foods for children reported that the study did not have any significant effect on the prevalence of stunting and wasting even though the insect-based meal provided an extra 132–198 kcal for 12 months. In this study the nutrition status (WHZ) of the children was significantly related to attainment of MAD among the children age 6-23 months; therefore, the hypothesis that there is no significant relationship between the maternal perception on use of edible insects in complementary feeding and the nutrition status of children 6 to 23 months in Kakamega and Siaya Counties was rejected.

5.6.3 Relationship between Maternal Perception on Use of Edible Insects for complementary Feeding and the Complementary Feeding Practices of Children 6-23 Months

Children whose mothers reported that they did not like consuming edible insects were less likely to attain MAD than those whose mothers disagreed that their children did not like edible insects. Mothers who were neutral about whether their children did not like consuming edible insects or not had no significant difference in attaining Minimum Acceptable Diet compared to respondents who disagreed that their children did not like edible insect.

CHAPTER SIX: SUMMARY, CONCLUSION AND RECOMMENDATIONS

6.1 Introduction

The study adapted a cross-sectional analytical design. The main purpose was to determine maternal perception on use of edible insects for complementary feeding and nutrition status of children 6-23 months in Kakamega and Siaya Counties, Kenya.

6.2 Summary of the Findings

In the current study, the target population was mother-child pair, where 592 participants were recruited in the study. Among the children whose mothers agreed to participate in the study, the females were more than the males. Significantly, majority of the children were between 9-12 months while the least number of children were between 6-8 months. Most of the mothers were in the childbearing age group and were married. More so, more than half of the household heads were males. The ages of the household head was between 20-49 years in more than three quarters of the households in West Yimbo and West Ugenya respectively, however, in Kisa North almost a third of the household heads in Kisa North were above 50 years. The average household size in the three wards was five among the three study sites.

More than half of the mothers had attained primary education, a third secondary education, while only less than 5.0% in each ward had tertiary education. The majority of the mothers from West Ugenya and Kisa North practiced subsistence farming as a socio-economic activity while in West Yimbo they engaged in business. In Kisa North, most of the household heads were employed while in West Yimbo fishing was the main socio-economic activity for majority of the household heads. The average monthly household income was lower than the national monthly food expenditure.

From this study, majority of the mothers among the study sites were negative about the use of edible insects for complementary feeding. However, findings from the FGDs and KIIs were of contrary opinion whereby in one of the FGDs some mothers indicated that they would be willing to give their children edible insects if they were taught how to prepare them in a form that their children can easily consume without choking. In West Yimbo, a significantly higher proportion of the mothers were in agreement because they believed that edible insects were more nutritious and had better taste than other protein food sources. However, most mothers stated that consumption of edible insects or the lack thereof had nothing to do with cultural or religious beliefs. There were no taboos governing edible insect consumption among the study sites.

A higher rate of the children from findings in this study achieved the MDD and MAD among the three wards. Majority of the children who did not attain the MAD were from Kisa North. Additionally, most of the children 6-23 months among the three wards attained the MMF, the majority being between the age groups of 12-23 months. However, a significantly higher number of children between 6-8 months did not attain the MMF in West Ugenya. Factors that significantly related to complementary feeding practices included; the ward of residence, marital status of the mother, main source of income for the household head and the education level of the household head.

6.3 Conclusions

A higher proportion of the mothers from the three wards were breastfeeding their children from the 24-hour recall. This indicates that these mothers were aware of the benefits of breastfeeding their children for up to two years. In terms of the MDD there was still room for improvement through incorporation of the edible insects in the children's diet. Mothers

who were aware about the nutritional benefits of edible insects were likely to enrich complementary foods with edible insects hence attained the MAD. Lack of attainment of the MAD significantly related to the nutrition status of children based on wasting.

In terms of the nutrition status of the children, there were high prevalence rates of wasting among the study children and low stunting and underweight rates. The socio-economic and sociodemographic characteristics of the children significantly related to the maternal perception on use of edible insects for complementary feeding. Therefore the null hypothesis that there is no significant relationship between socio-economic and socio-demographic characteristics and the maternal perception on the use of edible insects by the children 6 to 23 months in Kakamega and Siaya Counties was rejected. A conclusion is drawn that the socio-economic and socio-demographic characteristics significantly related to the maternal perception on use of edible insects for complementary feeding by children 6 to 23 months in Kakamega and Siaya Counties.

The attainment of MAD significantly related to the nutrition status of the children; therefore, the null hypothesis that there is no significant relationship between the complementary feeding practices and the nutrition status of children 6 to 23 months in Kakamega and Siaya Counties was rejected and a conclusion is drawn that there is a significant relationship between the complementary feeding practices and the nutrition status of children 6 to 23 months in Kakamega and Siaya Counties.

There was a significant relationship (<0.05) between the attainment of the MAD and the maternal perception on the use of edible insects in complementary feeding. Therefore the null hypothesis that there is no significant relationship between the maternal perception

and the complementary feeding practices of children 6 to 23 months in Kakamega and Siaya Counties was rejected, and a conclusion is drawn that there is a significant relationship between the maternal perception and the complementary feeding practices of children 6 to 23 months in Kakamega and Siaya Counties.

6.4 Recommendations

6.4.1 Recommendations for Practice

The use of edible insects was an acceptable practice among the mothers in the two counties; however, the issue was the preparation method for the children who could not chew. The researcher recommends that:

- Mothers should be counseled and sensitized by the relevant stakeholders on the nutrition benefits of edible insects as an alternative source of flesh food to children
- The relevant stakeholders to guide mothers through demonstrations on how they can prepare edible insects as a substitute of flesh foods
- Nutrition education interventions be strengthened to include nutritional benefits of edible insects as an alternative source of flesh foods for the children.

6.4.2 Recommendation for Policy

The nutritional benefits of edible insects are invariable, including high sources of proteins micronutrients and possibly solving food insecurity which is among the big four agenda. It is therefore variable that existing policies on MIYCN should promote the use of edible insects as a substitute source of flesh foods in complementary feeding, promote research

that supports the use of edible insects as a substitute source of flesh foods and foster interventions that enhance rearing of edible insects for home and industrial use.

6.4.3 Recommendation for further research

The current study looked at the maternal perceptions on use of edible insects for complementary feeding for children 6-23months in Kakamega and Siaya Counties. The research recommends a comparative study in a different location that is known to consume edible insects and a location that consumption of edible insects is not a common practice. An issue that came up in this study was that edible insects could be used for medicinal purposes, while others purported that too much consumption of edible insects can lead to diarrhoea, alluding to some cultural beliefs and practices. The researcher, therefore, recommends an ethnographical study to understand the social-cultural issues surrounding the use and consumption of edible insects. A rat bioassay could also be done to ascertain or not the belief that too much consumption of termites causes diarrhea.

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APPENDICES

APPENDIX A: Informed consent

My name is Rhoda Nakhosi, I am a Masters student from Kenyatta University. I am conducting a study on “Maternal Perception and use of edible insects for complementary food and nutrition status of children 6-23 months in Kakamega and Siaya Counties” The information will be useful to the government in formulating policy concerning the use of edible insects as a complementary food. The information generated will also be useful to food industries as a basis for developing nutritious and affordable insect based complementary foods. It will also contribute greatly to the Government big 4 agendas and SDGs of improving food security.

Procedures to be followed

Participation in this study will require that I ask you some questions and to also take your child’s weight, height and MUAC measurements in order to determine his/her nutrition status

I will record the information from you in a questionnaire.

You have the right to refuse participation in this study. There will be no discrimination in case you decide not to participate.

Please remember the participation in this study is voluntarily. You may ask questions related to the study at any time. You may refuse to respond to any questions and you may stop an interview at any time. You may also stop being in the study at any time without any consequences now or in the future.

Discomforts and risks

Some of the questions you will be asked are on intimate subject and may be embarrassing or make you uncomfortable. If this happens, you may refuse to answer these questions if you so choose. You may also stop the interview at any time. The interview may take 40 minutes.

Benefits

If you participate in this study you will help us to learn how to improve complementary feeding practices hence improve the health and nutrition status of children and reduce the risk of malnutrition. You will also benefit from this exercise through knowing your child's nutrition status and if you he/she is found to have a problem you will be advised on proper complementary feeding practices.

Reward

If you agree to participate in this study, lunch will be provided and transport expenses will be reimbursed.

Confidentiality

Your name will not be recorded on the questionnaire. The questionnaires will be kept in a locked cabinet for safe keeping at Kenyatta University. Everything will be kept private.

Contact information

If you have any questions you may contact Prof. Kimiywe Supervisor 1. On 0722915459 or Dr. Munyaka Supervisor 2. On 0712108087 or the Kenyatta University Ethical Review

Committee Secretariat on chairman.kuerc@ku.ac.ke, secretary.kuerc@ku.ac.ke,
secretariat.kuerc@ku.ac.ke

Participant’s statement

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

Name of Participant.....

Signature or Thumbprint

Date

Investigator’s statement

I, the undersigned, have explained to the volunteer in a language s/he understands, the procedures to be followed in the study and the risks and benefits involved

Name of Interviewer.....

Signature or Thumbprint

Date

APPENDIX B: Structured Questionnaire

SECTION 1: Socio-economic and demographic characteristics

Questionnaire Id: Household id/code

Date of interview..... Enumerator's name.....

Supervisor name.....

Name of household head: Is respondent HH? 1=Yes 2=No

If No, Name of Respondent.....

Household Location

| Location | Name |
|---------------|------|
| 1. Country | |
| 2. County | |
| 3. Sub-County | |
| 5. Division | |
| 6. Ward | |
| 8. Village | |

PART ONE

A: GENERAL INFORMATION

| Variable | Response | Codes |
|--|----------|--|
| Demographic data | | |
| 1. Gender of Household head | | 1=Female, 2=Male |
| 3. Date of birth of the respondent (check on ID) | | |
| 4. Marital status | | 1=Single, 2=Monogamously married, 3=Polygamous married, 4=surrogately married 5=Widowed, 6=Separated/Divorced, 7=Other (Specify) _____ |
| 5. If married, age of spouse | | |

| | | |
|---|--|---|
| 6 Education level of respondent | | 1= Some primary 2= Completed primary 3= Some secondary 4= Completed secondary 5= Vocational training 6= College 7= University 8= Informal education 9= None |
| 7 Education level of Spouse | | |
| 8 Main source of income for the household head | | 1= Farming 2= Casual labour 3= Business 4= Employment 5=Other (specify)_____ |
| 9. Household size | | A household includes all members of a common decision making unit (usually within one residence) that normally share the same pot |
| 10. Alternative source of income of the mother /female caretaker of the index child | | 1= Farming 2= Casual labour 3= Business 4= Employment 5= None 6=Other (specify)_____ |
| House characteristics/identifiers (OBSERVE, Don't Ask) | | |
| 11. Roofing material of household's main residence | | 1= Grass/straw, 2= Iron sheets, 3= Tiles, 4= Tin, 5= Other (specify)_____ |
| 12. Type of floor of household's main residence | | 1= Tiles/wooden 2= Cemented 3= Earth floor |
| 13. Type of wall of household's main residence | | 1= Stone 2= Wood 3=Mud 4 = Bricks 5=Iron sheets |

SECTION TWO: Maternal Perception on use of edible insects for Complementary Food

I) I will read you statements about your perception of feeding edible insects to your child. Kindly indicate whether you strongly agree, agree, Disagree, Strongly Disagree or you are Neutral

| Statement | Strongly Agree | Agree | Neutral | Disagree | Strongly Disagree |
|---|----------------|-------|---------|----------|-------------------|
| i) Consumption of insects (lakeflies, termites, grasshoppers and crickets as complementary foods is good for children | | | | | |
| ii) I am satisfied in giving my child other foods and I will never give my child edible insects | | | | | |
| iii) Edible insects are more nutritious than other foods | | | | | |
| iv) My child does not like consuming edible insects | | | | | |
| v) Edible insects have better nutrient content than other foods | | | | | |

II) I will read to you statements on the feeling of ethics of feeding your child with edible insects. Please indicate whether you strongly agree, Agree, Disagree, Strongly Disagree, or are Neutral

| Statement | Strongly agree | Agree | Neutral | Disagree | Strongly Disagree |
|--|----------------|-------|---------|----------|-------------------|
| i) Consumption of edible insects is against my religious beliefs | | | | | |
| ii) Consumption of edible insects is against my culture | | | | | |

SECTION THREE**24-HOUR DIETARY RECALL (FOR CHILD)**

Questionnaire Id: Household id/code

Date of interview.....Enumerator’s name.....

Supervisor name.....

Tick the day of the week, which you are recalling:

Monday () Tuesday () Wednesday () Thursday () Friday () Saturday ()

Steps for the interviewer to follow when interviewing each participant

Step 1: “I want you to think back to when your child woke up yesterday morning. What time was it?”

“Now I want you to try to remember what your child ate and drank yesterday from the moment that he/she got up until he/she went to sleep again last night. Run through the whole day in your mind and try to remember everything that he/she ate or drank. “

The interviewer must then give the participant a little time to do what she was asked to do – during this time the interviewer must be quiet. Then he/she can carry on:

“Now I would like you to tell me what your child ate and drank starting in the morning after you got up.”

*After the participant mentions an item, the interviewer should prompt her by saying “**and then?**” It is important for the interviewer not to ask any specific detail at this point. Enter the information on Sheet 1 (column 1).*

What **legumes and pulses** are usually eaten in your home? (If beans, type of beans).....

What type of **butter** or **margarine** is usually used in your home?

What type of **oil** or **fat** is usually used in your home?

Step2: To check whether the participant forgot anything, the interviewer asks the following:

- “Did your child have any drinks yesterday?”
- “Did your child have any sweets/honey/jaggery (*sukari nguru*) yesterday?”
- “Did your child have any cookies/cakes yesterday?”
- “Did your child have any other snacks like nuts/chips/pop corns yesterday?”
- “Did your child have any (other) fruit yesterday?”
- “Did your child have any (other) vegetables yesterday?”

Step 3: “Now I am going to ask you more about each food item or drink that your child had yesterday. Let us start with the first item on the list. At what time did your child eat.....”

SHEET 2: RECORDING SHEET FOR INFORMATION COLLECTED IN STEP 3 OF THE 24-HOUR RECALL INTERVIEW

| Time | Any comments on time | Food item (carried forward from sheet 1) | Detailed description of the item as well as preparation | Detailed description of the portion size | Weight (gram) |
|-------------|-----------------------------|---|--|---|----------------------|
| | Breakfast | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | In-between | | | | |
| | | | | | |
| | | | | | |
| | Lunch | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | In-between | | | | |
| | | | | | |
| | | | | | |
| | Dinner | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | After dinner | | | | |
| | | | | | |
| | | | | | |

Step 4: “Is there anything your child ate or drank yesterday but you have forgotten?”

Step 5: “Is there **anything that your child always like to eat or to drink every day** that he/she did not eat/drink yesterday?”

| | | | | | | | | |
|---|--|--|--|--|--|--|--|--|
| Green bananas | | | | | | | | |
| Others (specify) | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| 2.Dairy foods | | | | | | | | |
| Whole milk | | | | | | | | |
| Low fat milk(<2% fat) | | | | | | | | |
| Skimmed milk | | | | | | | | |
| Fermented milk(mala) | | | | | | | | |
| Yoghurt (specify) | | | | | | | | |
| Ice cream | | | | | | | | |
| Butter | | | | | | | | |
| Ghee | | | | | | | | |
| Margarine | | | | | | | | |
| Others (specify) | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| 3.Meats and meat products | | | | | | | | |
| Beef | | | | | | | | |
| Mutton | | | | | | | | |
| Chicken fish | | | | | | | | |
| Pork | | | | | | | | |
| Matumbo | | | | | | | | |
| Processed meat(sausages, bacon, ham, smokies etc) | | | | | | | | |
| Eggs | | | | | | | | |

| | | | | | | | | |
|---------------------------------|--|--|--|--|--|--|--|--|
| 8. Beverages and spreads | | | | | | | | |
| Soda | | | | | | | | |
| Juice | | | | | | | | |
| Peanut butter | | | | | | | | |
| Margarine | | | | | | | | |
| Jam | | | | | | | | |
| Others (specify) | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |

(Please tick where applicable)

| FREQUENCY OF CONSUMPTION EDIBLE INSECTS | | | | | | | |
|--|------|---------|---------|---------|---------|-------|-------|
| Edible insect | Once | 2 times | 3 times | 4 times | 5 times | Daily | Never |
| 1. Termites | | | | | | | |
| 2. Lake flies | | | | | | | |
| 3. Black ants | | | | | | | |
| 4. Locusts | | | | | | | |
| 5. Grasshoppers | | | | | | | |
| 6. Any other (specify) | | | | | | | |
| 7. | | | | | | | |
| 8. | | | | | | | |
| 9. | | | | | | | |

SECTION FOUR: Anthropometric data

Mother/Caretaker: Name: _____ Surname:

Mother/caretaker: DOB: ____/____/____ Age: _____ Sex: _____

Index Child: Name: _____ Surname:

Index child: DOB: ____/____/____ Age: _____ Sex: _____

C: Anthropometric measurements of Index Child

Please present the child's clinic card

| | | Measurements | | | | |
|------|----------------------------|------------------------------|----------------------------|----------------------------|----------------------------|---------|
| Code | | Index child | | | | |
| | | Units in grams, kgs,cm | 1 st reading | 2 nd reading | 3 rd reading | Average |
| 1.0 | Length/height for child | | | | | |
| 2.0 | MUAC for child | | | | | |
| 3.0 | Weight for child | | | | | |

APPENDIX C: Focus Group Discussion Guideline for women, men and CHVs

Study Title: Maternal Perception on use of Edible Insects for Complementary Feeding and Nutrition Status of Children 6-23 months in Kakamega and Siaya Counties, Kenya

FGD Location:

Date:

Respondents:

Introduction

Hello. My name is Rhoda Nakhosi and I am here on behalf of VLIR and Kenyatta University to do a study on Edible insect consumption. Thank you for finding time to participate in the data collection process. I would like to ask some questions regarding the consumption of edible insects. This discussion will take approximately 60-90 minutes.

The information shared here will be treated with a lot of confidentiality. May I proceed with the discussion?

Thank you.

(If the respondent agrees then proceed with the research. If not then look for another respondent)

1. What is the community's perception about consumption of edible insects?
2. What are the names of the commonly consumed edible insects in your area?
3. What is your own perception on consumption of edible insects?
4. Are there any specific edible insects for specific age groups?
5. Are there any edible insects used for complementary feeding?

Thank you very much for your time. We shall be consulting with you again in the near future!

APPENDIX D: Key Informant Interviews Guideline

Study Title: maternal Perception on Use of Edible Insects in Complementary Feeding and Nutrition Status of Children 6-23 months in Kakamega and Siaya Counties, Kenya

Key Informant Location:

Date:

Respondent:

Introduction

Hello. My name is Rhoda Nakhosi and I am here on behalf of VLIR and Kenyatta University to do a study on Edible insect consumption. Thank you for finding time to participate in the data collection process. I would like to ask some questions regarding the consumption of edible insects. This interview will take utmost 60 minutes.

The information shared here will also be treated with a lot of confidentiality. May I proceed with the interview?

Thank you.

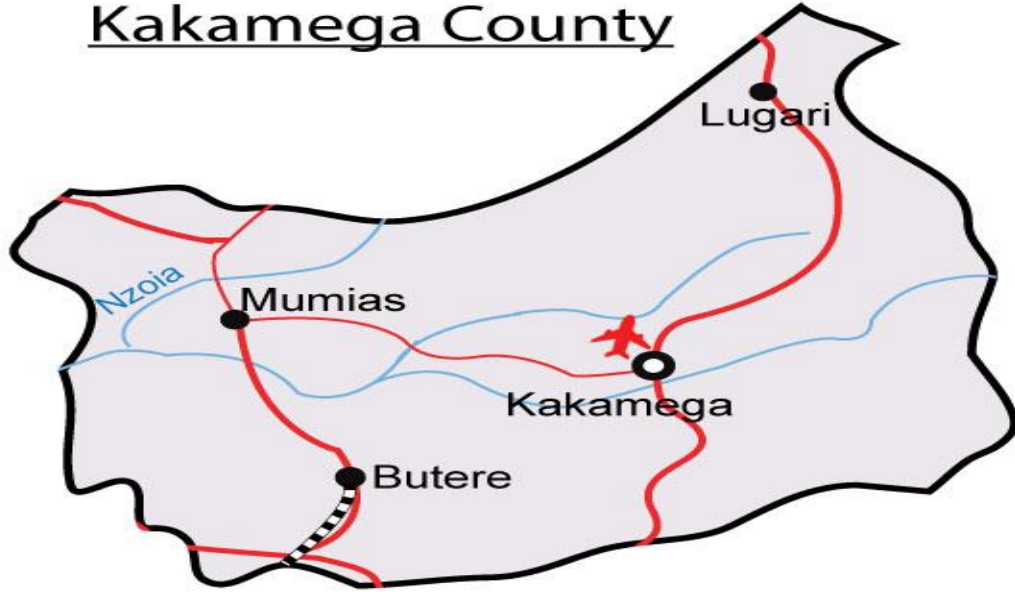
(If the respondent agrees then proceed with the research. If not then look for another respondent)

1. Are you aware of any edible insects consumed in your area?
2. If YES what types of edible insects are commonly consumed?
3. Are you aware of any edible insects being used for complementary feeding?
4. What are your opinions about edible insect consumption? (positive or negative and why)

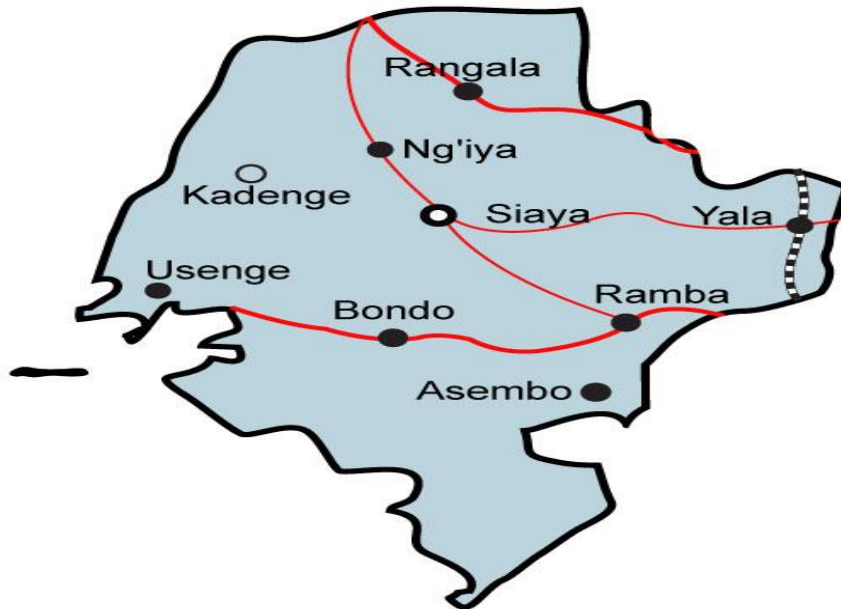
Thank you very much for your time. We shall be consulting with you again in the near future!

APPENDIX E: Maps of Kakamega and Siaya Counties

Kakamega County



Siaya County



APPENDIX F: Clearance from Ethics Review Committee

**KENYATTA UNIVERSITY
ETHICS REVIEW COMMITTEE**

Fax: 8711242/8711575
Email: kuerc.chairman@ku.ac.ke

P. O. Box 43844,
Nairobi, 00100
Tel: 8710901/12

Website: www.ku.ac.ke

Our Ref: **KU/ERC/APPROVAL/VOL.1**

Date: 17TH AUGUST 2020

Name Nakhosi Rhoda Nabuloobi
P.O Box 43844-00100
NAIROBI

Dear Nakhosi

RE: APPLICATION NUMBER: PKU/ 2130/I1274 MOTHERS PERCEPTION AND USE OF EDIBLE INSECTS FOR COMPLEMENTARY FOOD AND NUTRITION STATUS OF CHILDREN IN KAKAMEGA AND SIAYA COUNTIES

This is to inform you that *KENYATTA UNIVERSITY ETHICS REVIEW COMMITTEE* has reviewed and approved your above research proposal. Your application approval number is **PKU/2130/I1274**. The approval period is **17TH Aug. 2020 TO 17TH Aug. 2021**

This approval is subject to compliance with the following requirements;

- i. Only approved documents including (informed consents, study instruments, MTA) will be used
- ii. All changes including (amendments, deviations, and violations) are submitted for review and approval by *KENYATTA UNIVERSITY ETHICS REVIEW COMMITTEE*.
- iii. Death and life threatening problems and serious adverse events or unexpected adverse events whether related or unrelated to the study must be reported to *KENYATTA UNIVERSITY ETHICS REVIEW COMMITTEE* within 72 hours of notification
- iv. Any changes, anticipated or otherwise that may increase the risks or affected safety or welfare of study participants and others or affect the integrity of the research must be reported to *KENYATTA UNIVERSITY ETHICS REVIEW COMMITTEE* within 72 hours
- v. Clearance for export of biological specimens must be obtained from relevant institutions.
- vi. Submission of a request for renewal of approval at least 60 days prior to expiry of the approval period. Attach a comprehensive progress report to support the renewal.
- vii. Submission of an executive summary report within 90 days upon completion of the study to *KENYATTA UNIVERSITY ETHICS REVIEW COMMITTEE*.

Prior to commencing your study, you will be expected to obtain a research license from National Commission for Science, Technology and Innovation (NACOSTI) <https://oris.nacosti.go.ke> and also obtain other clearances needed.



Yours sincerely

Prof. Judith Kimiywe



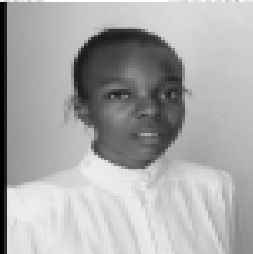
CHAIRPERSON- KENYATTA UNIVERSITY ETHICS REVIEW COMMITTEE.

APPENDIX G: Research Authorization and Permit from NACOSTI

 NATIONAL COMMISSION FOR SCIENCE, TECHNOLOGY & INNOVATION

RESEARCH LICENSE
 Date of Issue: 30/July/2021



This is to Certify that MSc. RODAH NABULOCHI NAKHOSI of Kenyatta University, has been licensed to conduct research in Kakamega, Siaya in the topic: 'MOTHERS' PERCEPTION AND USE OF EDIBLE INSECTS FOR COMPLEMENTARY FOOD AND NUTRITION STATUS OF CHILDREN IN KAKAMEGA AND SIAYA COUNTIES, KENYA for the period ending: 30/July/2021.

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