ajfand Since 2001
AFRICAN JOURNAL OF FOOD, AGRICULTURE, NUTRITION AND DEVELOPMENT
SCHOLARLY, PEER REVIEWED
Volume 24 No. 6
June 2024
PUBLISHED BY AFRICAN SCHOLARLY SCIENCE COMMUNICATIONS TRUST
ISSN 1684 5374

Afr. J. Food Agric. Nutr. Dev. 2024; 24(6): 26678-26705 https://doi.org/10.18697/ajfand.131.22905

Date	Submitted	Accepted	Published
	19th August 2022	8th June 2024	24th June 2024

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

Nakhosi RN[1]*, Kimiywe J[2] and A Munyaka[3]

Rhoda Nakhosi

*Corresponding author email: rhodanakhosi@gmail.com

[1]School of Public Health and Applied Human Sciences, Department of Food Nutrition and Dietetics, Kenyatta University, P.O. Box 43844-00100. Nairobi, Kenya

[2]School of Public Health and Applied Human Sciences, Department of Food Nutrition and Dietetics, Kenyatta University, P.O. Box 43844-00100. Nairobi, Kenya

[3]School of Public Health and Applied Human Sciences, Department of Food Nutrition and Dietetics, Kenyatta University, P.O. Box 43844-00100. Nairobi, Kenya

Since 2001 ajfand AFRICAN JOURNAL OF FOOD, AGRICULTURE, NUTRITION AND DEVELOPMENT
SCHOLARLY, PEER REVIEWED
Volume 24 No. 6
June 2024
PUBLISHED BY AFRICAN SCHOLARLY SCIENCE COMMUNICATIONS TRUST
ISSN 1684 5374

ABSTRACT

Despite the high protein levels, essential fatty acids and minerals that are found in edible insects, they are still not being used in complementary feeding. The aim of this study was to investigate maternal perception on use of edible insects for complementary feeding and nutrition status of children in Kakamega and Siaya Counties, 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 Kisa North, West Yimbo and West Ugenya wards. Majority of the mothers were in the childbearing age group of 15-49 years, were married and 57.9% in Kisa North, 65.7% in West Ugenya and 64.6% in West Yimbo had attained primary education. Generally, 50.9%, 54.2% and 48.8% of the household heads in Kisa North, West Ugenya and West Yimbo, respectively had attained primary education. About 49.5% and 38.9% of the mothers in Kisa North and West Ugenya practiced farming while 35.3% of those in West Yimbo engaged in business. About 40.3% of the household heads in West Ugenya were farmers, 48.7% in Kisa North were casual labourers while 66.3% in West Yimbo engaged in fishing. Approximately 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. More than half (65.3%, 56.6% and 61.7%) of the children in Kisa North, West Ugenya and West Yimbo respectively attained the Minimum Dietary Diversity. More than half (58.9% and 55.8%) of the children in West Yimbo and West Ugenya respectively and 29.7% in Kisa North attained the Minimum Acceptable Diet. In terms of nutrition status, the prevalence rates of wasting were (6.3% in West Ugenya, 7.0% in West Yimbo and 6.0% in Kisa North), stunting rates (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 were significant relationships between the maternal perceptions of the appropriateness of insects in complementary food and the ward of residence (χ^2=16.86, p value=0.030), marital status of the mother (χ^2=11.14, p value=0.025), main source of income for the household head (χ^2=33.35, p value=0.007) and the education level of the household head (χ^2=48.67, p value=0.009). This information will be useful to the Ministry of Health through the division of nutrition for inclusion in the MIYCN policy the use of edible insects as a complementary food.

Key words: Children, Complementary feeding, Edible Insects, Nutritional Status, Maternal Perception

Since 2001 ajfand AFRICAN JOURNAL OF FOOD, AGRICULTURE, NUTRITION AND DEVELOPMENT
SCHOLARLY, PEER REVIEWED
Volume 24 No. 6
June 2024
PUBLISHED BY AFRICAN SCHOLARLY SCIENCE COMMUNICATIONS TRUST
ISSN 1684 5374

INTRODUCTION

Insects can play a significant role in food security because they are readily available and affordable [1]. 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 [2, 3, 4, 5]. Edible insects are mostly used as snacks or prepared in desserts and not as valuable nutritious foods [6]. In Kenya, little is known about consumers' preferences of locally available edible insects as part of the main diet [7]. Despite the comparable high consumption rates of some edible insects (winged termites), they are hardly served as nutritious foods, especially for the children [8].

Poor dietary practices during complementary feeding are the major contributors to under nutrition among children [9]. Most complementary foods are starchy [10]. Complementary foods should be diverse with frequent intake of foods from ≥4 out of eight food groups per day [9]. In Africa, >80% of children 6-23 months do not attain the Minimum Acceptable Diet [11]. Only about 36.9% of children 6-23 months attain the Minimum Dietary Diversity (MDD) [12]. Alternative food sources are required to improve the MDD [3]. Edible insects are an alternative source of protein [13]. Edible insects are high in protein, α linoleic and linolenic fatty acids, phosphorus, iron and zinc [5]. Despite the incredible benefits of edible insects, people still prefer to feed their children on meat, chicken, fish and eggs [8].

In studies by Ayieko *et al*. [14] and Homann *et al*. [15] 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 study by Kinyuru *et al*. [8], 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 [8]. Siaya (Ugenya) and Bondo sub-counties are known for the consumption of longhorn grasshoppers and black ants [16].

In Kenya 18.0% of children below five years are stunted (height-for-age <-2SD from the reference [12]. Rural areas in Kenya have been reported to have higher stunting levels (20%) compared to urban areas (12%) [12]. In Kakamega, stunting is reported to be at 12% while in Nyanza 19% [12]. Those children reported to be wasted (weight-for-height <-2SD from the reference median) are 5% countrywide [12]. Wasting levels are reported to be highest (7%) in children of age groups 6-8 months similar to the age group 9-11 months [17]. In Kakamega County, wasting is reported to be about 7.2% while in Siaya 9.1% [12]. The Kenya Demographic Survey 2022 [12] report states that 10% of children are underweight (weight-for-

Since 2001 ajfand AFRICAN JOURNAL OF FOOD, AGRICULTURE, NUTRITION AND DEVELOPMENT
SCHOLARLY, PEER REVIEWED
Volume 24 No. 6
June 2024
PUBLISHED BY AFRICAN SCHOLARLY SCIENCE COMMUNICATIONS TRUST
ISSN 1684 5374

age <-2SD from the reference median). Underweight rates are highest in Western Kenya (1.5%) just like in Nyanza, about 2.8% [12].

In Kenya, little is known about consumer perception of edible insects as part of the main diet [7]. The aim of this study, therefore, was to establish maternal perception on the use of edible insects in complementary feeding and the nutritional status of children 6-23 months in Kakamega and Siaya Counties.

MATERIALS AND METHODS

Study sites

The study was conducted in Western Kenya particularly in Kakamega County (Khwisero sub-county) and Siaya County (Bondo and Ugenya sub-county). The sites selection was informed by the reviewed literature on the areas with the highest edible insect consumption [8, 14, 18]. The researcher sampled three wards namely: Kisa North, West Yimbo and West Ugenya. The three wards of the study were selected based on the different edible insects consumed in these areas.

Study design

The study was a household-based survey and the researcher adopted a cross-sectional analytical design. This design allows data to be collected at one point in time, it facilitates both quantitative and qualitative data collection methods, identifies the extent and nature of cause and effect relationships between variables and describes the characteristics associated with the subjects under study and report them in their present condition.

Study population

Children aged 6-23 months, distributed into categories of 6-8, 9-11, 12-18 and 19-23 months. This was to allow for variability in complementary feeding practices. Study participants were randomly selected from various households in the three selected wards. The researcher included only the households with mothers who had children 6-23 months who had been residents of the sub-counties for the past 6 months and were willing to participate in the study.

Sampling

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 [8, 14, 18] and were purposely 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 households in each of the villages to which random numbers were then assigned. Twenty-nine villages were randomly selected in West Yimbo, 30

ajfand Since 2001
AFRICAN JOURNAL OF FOOD, AGRICULTURE, NUTRITION AND DEVELOPMENT
SCHOLARLY, PEER REVIEWED
Volume 24 No. 6
June 2024
PUBLISHED BY AFRICAN SCHOLARLY SCIENCE COMMUNICATIONS TRUST
ISSN 1684 5374

villages in West Ugenya and 28 villages in Kisa North in order to give a total of 87 villages. The expected sample size of 696 (calculated using Cochran's formula at 95% confidence interval and 5% marginal error) was divided proportionally 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.

Data collection procedures

The questionnaires were pretested on 70 children (10% of the sample size) in 3 villages each in Kisa North, West Yimbo and West Ugenya. This was to assure the validity and reliability of the data collection instruments. These villages were not included in the main study. The mothers in the pretest areas had similar characteristics as those of the actual study area. The researcher collected quantitative data using semi-structured interviewer administered questionnaires which included the household demographic and economic characteristics. Qualitative data collection methods (FGDs and KIIs) were conducted to find out if there were any edible insects used for complementary feeding, if there were specific edible insects for specific age groups, perception on use of edible insects for complementary feeding and commonly consumed edible insects

Maternal perception on 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. A 24-hour dietary recall and a seven-day Food Frequency Questionnaire were 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. A dietary score of four times or more from the eight food groups was indicative of the Minimum Dietary Diversity (MDD) of the children [19].

Data Analysis

Quantitative data were coded, entered, cleaned and exported into Statistical Package for Social Sciences (SPSS) version 25 as descriptive and inferential statistics were presented using tables and graphs. Univariate analysis was used to describe the distribution of each of the variables in the study objective. Data on children's anthropometrics were analyzed using ENA for SMART software (https://smartmethodology.org/) while data on complementary feeding practices were analyzed using the Nutri-survey software (https://www.nutrisurvey.de/ (nutrisurvey2007.exe)). The information from FGDs and KIIs that were recorded using digital recorders were analyzed after transcribing and coding through content

Since 2001 ajfand AFRICAN JOURNAL OF FOOD, AGRICULTURE, NUTRITION AND DEVELOPMENT
SCHOLARLY, PEER REVIEWED
Volume 24 No. 6
June 2024
PUBLISHED BY AFRICAN SCHOLARLY SCIENCE COMMUNICATIONS TRUST
ISSN 1684 5374

analysis objectively by determining the common and main findings on maternal perceptions in response to the main areas of focus. Chi-square test of independence at 0.05 level of significance was used to determine if there was a relationship between household socio-economic and demographic characteristics, maternal perceptions, complementary feeding practices and nutrition status of children 6-23 months.

Ethical Considerations

The study obtained ethical approval from Kenyatta University Graduate School and the Ethics Committee of Kenyatta University [KUERC No: PKU/2130/11274]. The study was also approved and licensed by the National Commission for Science, Technology and Innovation [NACOSTI License No: NACOSTI/P/20/5939]. 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. The researcher and research assistants explained the purpose of the research, the risks and benefits to the respondents. Mothers who agreed to participate in the study were consented using a written consent. The mothers were assured of privacy and confidentiality of the data they provided to the researchers. The children were assigned serial numbers, and any information about a household's identity was kept separately and securely.

RESULTS AND DISCUSSION

Socio-demographic and Socio-economic characteristics of the study population

A total of 98.0% (n=580) of the mothers and 98.3% (n=582) of the household heads were aged 15-49 years**.** Overall, a total of 62.5% (n=370) of the mothers and 51.2% (n=303) of the household heads had attained primary education**.** Majority 81.8% (n=484) of the mothers were married**.** About 87.0% (n=514) of the households were male-headed**.** The average household size was 5±0.13 in Kisa North, 6±0.16 in West Ugenya and 5±0.12 in west Yimbo. The findings of this study are similar to studies by Ochieng *et al*. [20] who stated that the decisions made in a household are greatly influenced by the age of the household head.

Majority of the roofing materials 100.0% (n=526) were made of iron sheets. More than half 71.6% (n=424) of the household walls were made of mud. More than half 63.5% (n=376) of the floors were earthen floors. Majority of the household heads 100.0% (n=158) were casual laborers. About a third 31.3% (n=185) of the mothers engaged in farming. The mean household monthly income was Ksh 6002±8486 in Kisa North, Ksh 9352±10434 in West Ugenya and Ksh 4928±6515 in West Yimbo.

Since 2001 ajfand AFRICAN JOURNAL OF FOOD, AGRICULTURE, NUTRITION AND DEVELOPMENT
SCHOLARLY, PEER REVIEWED
Volume 24 No. 6
June 2024
PUBLISHED BY AFRICAN SCHOLARLY SCIENCE COMMUNICATIONS TRUST
ISSN 1684 5374

A study by Sekhampu [21] reported that the more the monthly income, the more the amount spent on the wellbeing of a child (Table 2).

Maternal Perceptions

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 half (8.3%, 16.6% and 16.4%) of the respondents in Kisa North, West Ugenya and West Yimbo agreed while 16.7% in Kisa North, 16.0% 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/caregivers 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. This information was echoed by the Key Informant who stated: "*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).

In general, the majority (38.7%) of the mothers among the three wards were negative about the use of edible insects for complementary feeding. In West Yimbo, the majority (39.3%) of the respondents were positive because they believed that edible insects were more nutritious than other food sources (Table 3). This finding concurs with studies by Megido *et al.* [22] and Geertsen [23] who determined the perceptions on edible insects' consumption and found that the formulations that had high acceptance among the population were based on their flavors, crispy textures and previous experience with the edible insects.

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, only1.4% 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 less than half (21.3%, 22.9% and 17.4%) in Kisa North, West Ugenya and West Yimbo strongly disagreed (Table 3).

Since 2001 ajfand AFRICAN JOURNAL OF FOOD, AGRICULTURE, NUTRITION AND DEVELOPMENT
SCHOLARLY, PEER REVIEWED
Volume 24 No. 6
June 2024
PUBLISHED BY AFRICAN SCHOLARLY SCIENCE COMMUNICATIONS TRUST
ISSN 1684 5374

In the focus group discussions, the two schools of thought also came up whereby 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. These findings contradict those of Huis [13] who concluded that consumers with no experience in edible insect consumption often perceive it as a source of fear or disgust and, therefore, they strongly reject them as a part of their diet and neglect their high nutritive value.

Maternal Perception on Edible Insects Having Better Taste than Other Foods

About 2% 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, nearly a third of the mothers in Kisa North (29.2%), West Ugenya (30.9%), and West Yimbo (20.9%) 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 3). The results from the focus group discussions showed that a few people 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, "… *They are also delicious when roasted. The downside is if you eat too much, you might have a running stomach*." Sifuyo KII, 2019. These findings are contrary to those of a study by Lensvelt & Steenbekkers [24] in Australia and the Netherlands who stated that natural foods such as edible insects have better consumer acceptance because of their better taste and better appearance.

Maternal Perception on Children's Dislike of Edible Insects

A small proportion of the mothers (9.7% in Kisa North, 5.7% in West Ugenya and 4% in West Yimbo) strongly agreed that their children did not like consuming edible insects. However, majority of the respondents, that is, 45.8% in Kisa North, 45.7% in West Ugenya and 46.3% in West Yimbo were neutral about their children disliking edible insects (Table 3). These data were complemented by information from Key Informant Interviews. During the interview, it was evident that very young children do not consume/are not given edible insects as the key informant said:

Since 2001 ajfand AFRICAN JOURNAL OF FOOD, AGRICULTURE, NUTRITION AND DEVELOPMENT
SCHOLARLY, PEER REVIEWED
Volume 24 No. 6
June 2024
PUBLISHED BY AFRICAN SCHOLARLY SCIENCE COMMUNICATIONS TRUST
ISSN 1684 5374

"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. This finding relates to findings from a research by Chow *et al.* [25] in Denmark who stated that most children were not able to consume edible insects because of neophobia from both parents and the children. The researcher, therefore, came up with a participatory 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 the incorporation of edible insects in complementary food.

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

About 13% of the mothers in Kisa North, 12.6% in West Ugenya and 11.4% in West Yimbo strongly agreed that they were contented with feeding their children other foods, rather than edible insects. On the other hand, most of the respondents, 57.0% in Kisa North, 36% in West Ugenya and 49.3% in West Yimbo were satisfied in feeding their children with edible insects (Table 3). A study by Thielen *et al*. [26] suggested that continuous positive exposure to edible insects increases awareness and could encourage their consumption. Further, Han *et al.* [27] added that incorporating edible insects in already-familiar foods may be more viable in curbing insect phobia than providing insects directly as a food option.

Maternal Perception on Influence of Religion on Consumption of Edible Insects

In this study, less than 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 (48.0%) 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 religious beliefs (Table 3). This finding is similar to Geertsen [23], who stated that among the mixed aspects that determine acceptability or rejection of consumption of edible insects is societal influence such as negative talk from others.

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

ajfand Since 2001 AFRICAN JOURNAL OF FOOD, AGRICULTURE, NUTRITION AND DEVELOPMENT
SCHOLARLY, PEER REVIEWED
Volume 24 No. 6
June 2024
PUBLISHED BY AFRICAN SCHOLARLY SCIENCE COMMUNICATIONS TRUST
ISSN 1684 5374

acceptable in their culture. Nearly 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. Only about 0.5% of the mothers in Kisa North, 2.3% in West Ugenya and 3.0% in West Yimbo strongly disagreed on the consumption of edible insects being acceptable in their culture (Table 3).

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 days 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). This finding is similar to that of a study by Ayieko *et al*. [14] in Western Kenya who found a positive correlation between cultural orientation and consumer perception of edible insects' products.

Complementary feeding practices of children 6-23 months

a) Minimum Dietary Diversity

About 39.4% of children from Kisa North, 33.1% from West Ugenya and 28.4% in West Yimbo had consumed foods of a minimum of 4 food groups from the WHO recommended 8 food groups (inclusive of breastfeeding) in the past 24 hours prior to the study. Overall, more than half (66.5%, 55.8% and 62.1%) of the children 6-23 months from Kisa North, West Ugenya and West Yimbo attained the MDD (Table 4). There was, however, still an opportunity to enrich the complementary foods with edible insects. This finding is similar to that of Saaka *et al.* [28] in a study in Kuria West, Migori County who reported that 63.7% of the children had achieved the MDD.

b) Minimum Meal Frequency (MMF)

In Kisa North, over three-quarters of children achieved the MMF: 89.4% of those aged 6-8 months, 94% of those aged 9-12 months, and 98% of those aged 12-23 months. Majority 81.1%, 78.7% and 83.3% of the children aged 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. In West Ugenya, a significant majority of children achieved the minimum meal frequency: 80.6% of those aged 6-8 months, 97.4% of those aged 9-12 months, and 93.1% of those aged 12-23 months. Almost a fifth (19%) of the children 6-8 months did not attain the MMF compared to children in other age groups (Figure 1). These findings are consistent with the literature as it is purported that meal frequency increases with an increase in age

ajfand Since 2001
AFRICAN JOURNAL OF FOOD, AGRICULTURE, NUTRITION AND DEVELOPMENT
SCHOLARLY, PEER REVIEWED
Volume 24 No. 6
June 2024
PUBLISHED BY AFRICAN SCHOLARLY SCIENCE COMMUNICATIONS TRUST
ISSN 1684 5374

[12]. These findings are in agreement with Korir [29], who reported that over 90% of the children in a study done in Nairobi County attained MMF. Another study in Migori County, Kenya by Nyakundi *et al.* [30] reported that all the breastfed children 6-8 months and 78.4% of those 9-23 months attained MMF.

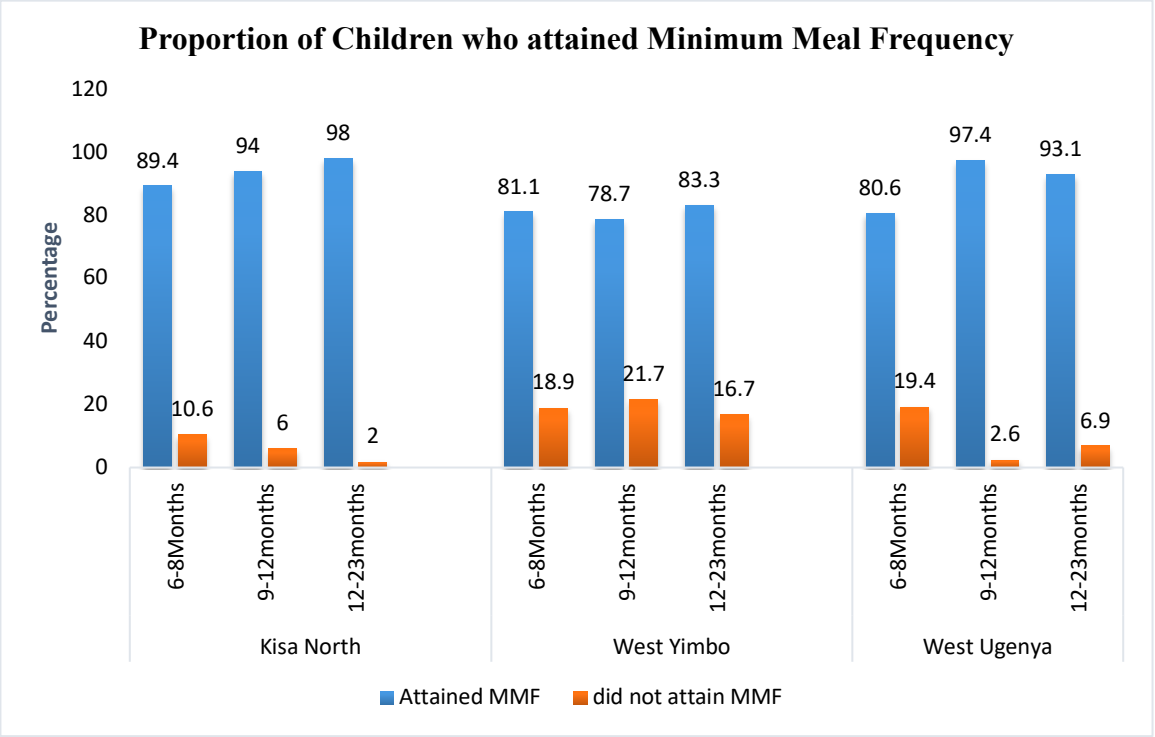

Figure 1: **Minimum Meal Frequencies of Children 6-23 Months in Kisa North, West Yimbo and West Ugenya**

c) Minimum Acceptable Diet (MAD)

The proportion of children aged 6-23 months who attained the Minimum Acceptable Diet among the three wards of study are as shown in Figure 2. MAD was calculated as the percentage of children with satisfactory MDD and MMF, and who were either breastfed or had ≥2 non–human milk feeds in the previous 24 h. 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. The proportion of children who achieved the MAD was higher than that reported by Nyakundi *et al.* [30] 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.* [28] it was 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.* [31] and 44.1% achieved a minimum acceptable diet in Pakistan [32].

Since 2001 ajfand AFRICAN JOURNAL OF FOOD, AGRICULTURE, NUTRITION AND DEVELOPMENT
SCHOLARLY, PEER REVIEWED
Volume 24 No. 6
June 2024
PUBLISHED BY AFRICAN SCHOLARLY SCIENCE COMMUNICATIONS TRUST
ISSN 1684 5374

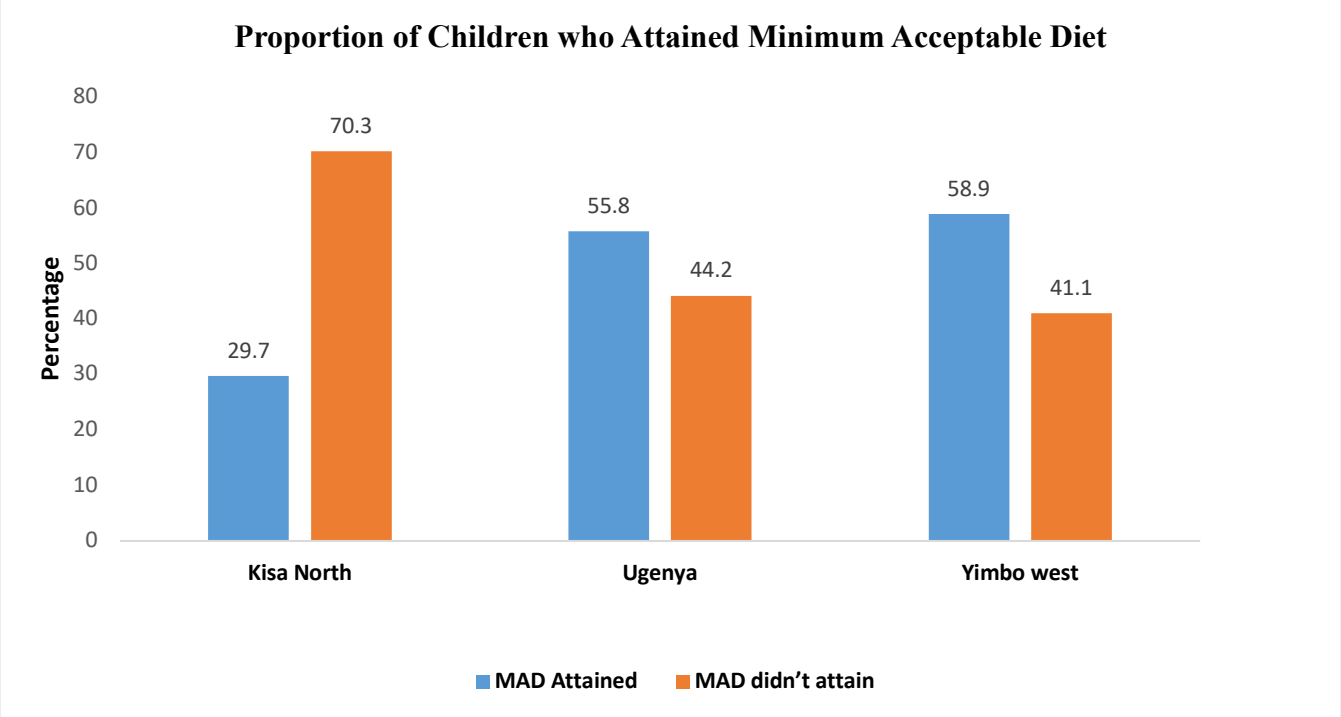

Figure 2: Proportion of Children who Attained Minimum Acceptable Diet

Food consumption patterns of the children 6-23 months

Grains, roots and tubers were the most frequently consumed foods by 97.0% of the children in Kisa North, 94.7% in West Yimbo and 96.5% in West Ugenya. The second frequently consumed foods were vitamin A rich fruits and vegetables by 75.0% of the children in Kisa North, 60.6% in West Yimbo and 64.0% in West Ugenya. This was followed by dairy products (61.0% in Kisa North, 50.2% in West Yimbo and 44.8% in West Ugenya). The least consumed foods were flesh foods such as beef and fish (29.0% in Kisa North, 41.5% in West Yimbo and 30.2% in West Ugenya), legumes and nuts (18.0% in Kisa North, 27.0% in West Yimbo and 33.2% in West Ugenya), other fruits and vegetables (23.0% in Kisa North, 20.9% in West Yimbo and 23.3% in West Ugenya) and lastly eggs were the least consumed by the children (3.3% in Kisa North, 2.9% in West Yimbo and 3.5% in West Ugenya) among the three study sites (Figure 3). The low consumption rates of the eggs could have been attributed to the myths and misconceptions that when their children are fed on eggs their speech will delay. These values for egg consumption were lower than those of a study by Mwangi *et al.* [33] in Kirinyaga County, Kenya who reported that 7.0% of the children 6-23 months had consumed eggs. About 83.0% of the children in Kisa North, 78.6% in West Yimbo and 76.7% of the children in West Ugenya were being breastfed at the time of the study. These findings were in agreement with a study by Mwangi *et al.* [33] in Kirinyaga County, who similarly reported a high consumption of cereals, roots and tubers in porridge

ajfand Since 2001
AFRICAN JOURNAL OF FOOD, AGRICULTURE, NUTRITION AND DEVELOPMENT
SCHOLARLY, PEER REVIEWED
Volume 24 No. 6
June 2024
PUBLISHED BY AFRICAN SCHOLARLY SCIENCE COMMUNICATIONS TRUST
ISSN 1684 5374

form. The higher consumption of vitamin A rich fruits and vegetables in this study were contradictory to studies by Wolle [34] in Addis Ababa, Marinda *et al.* [35] in Zambia, and Mwangi *et al.* [33] in Kirinyaga who reported lower consumption rates of vitamin A rich fruits and vegetables. The low consumption rates of iron rich and iron fortified foods in flesh foods in this study were compatible with findings from studies by Gatahun [36] in Southern Ethiopia and Mwangi *et al.* [33] in Kirinyaga County. The percentage of children who were breastfeeding in the current study was slightly higher than the national data [12]. The breastfed children in this study were more likely to attain the Minimum Acceptable Diet compared to those non-breastfed, consistent with the findings done by Kenya Demographic and Health Survey in 2022 [12].

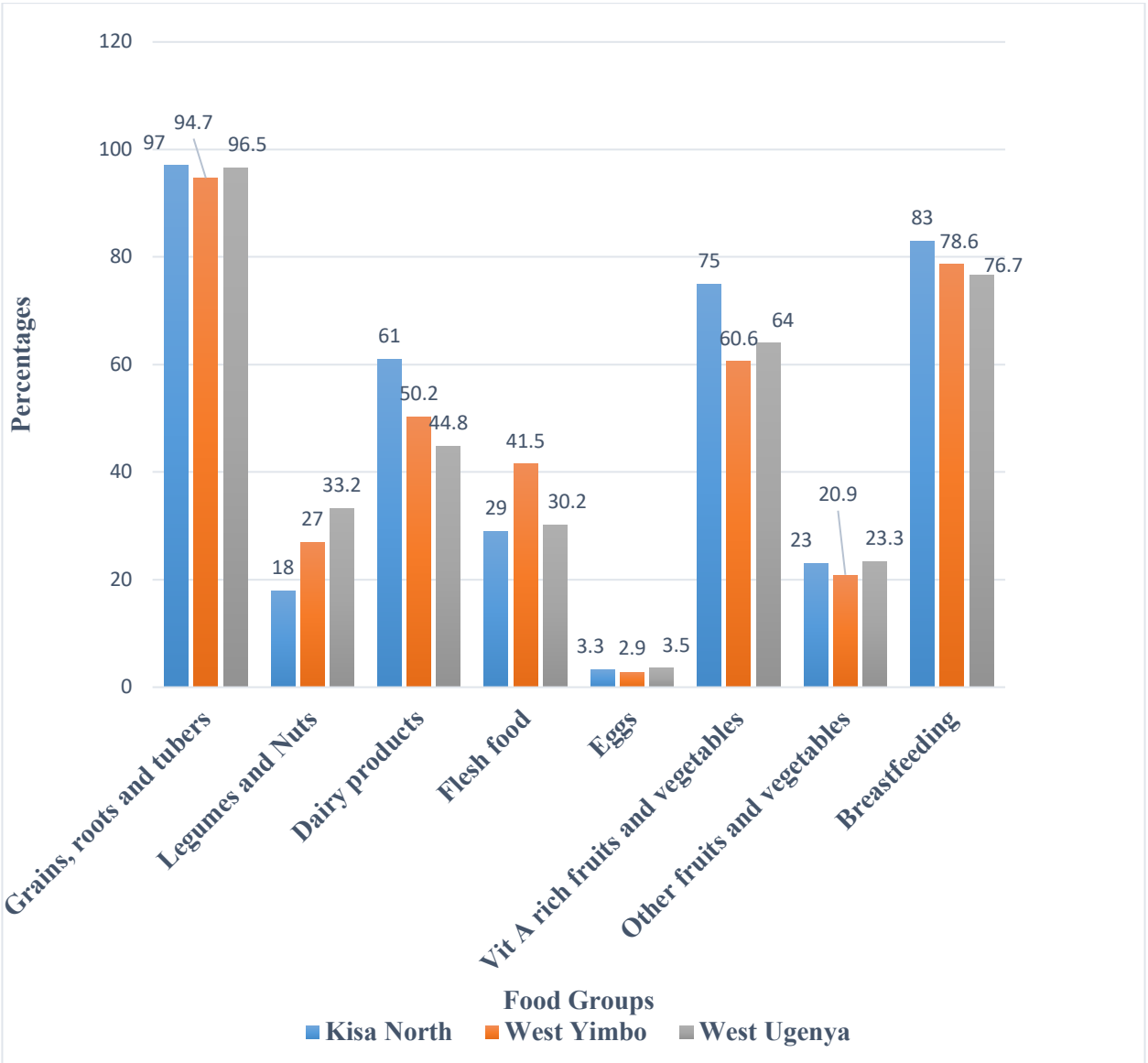

Figure 3: Food consumption patterns of the children 6-23 months

Since 2001 ajfand AFRICAN JOURNAL OF FOOD, AGRICULTURE, NUTRITION AND DEVELOPMENT
SCHOLARLY, PEER REVIEWED
Volume 24 No. 6
June 2024
PUBLISHED BY AFRICAN SCHOLARLY SCIENCE COMMUNICATIONS TRUST
ISSN 1684 5374

Status of Edible Insect Consumption

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 7). However, the few that had consumed the edible insects had consumed them as a snack but not as part of complementary foods. 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.* [37] who discovered that 95% of the respondents in Limpopo area occasionally consumed edible insects while only 28% did so in Kwazulu-Natal.

Nutritional status

Wasting

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 6). These findings are slightly higher than those of a study by Ojuro [38] done in Siaya County who reported that 3.1% of the children were wasted.

Stunting

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

ajfand Since 2001 AFRICAN JOURNAL OF FOOD, AGRICULTURE, NUTRITION AND DEVELOPMENT
SCHOLARLY, PEER REVIEWED
Volume 24 No. 6
June 2024
PUBLISHED BY AFRICAN SCHOLARLY SCIENCE COMMUNICATIONS TRUST
ISSN 1684 5374

stunted (<-3SD). The average height-for-age z-scores were -1.00±1.65 for West Ugenya, -0.81±1.71 for West Yimbo and -0.64±2.30 for Kisa North (Table 7). This finding was lower than that of a study by Wekesa [39] conducted in Kakamega and Siaya Counties who reported that 20% of the children were stunted.

Underweight

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 average weight-for-age z-scores were -0.37±1.37 for West Ugenya, -0.27±1.23 for West Yimbo and -0.15±1.46 for Kisa North (Table 8). This finding was slightly lower than that of a study by Wekesa [39] who reported that the prevalence of underweight rates among the children 6-59 months was 7.8% and that of Ochola [40] in a study done in Kahawa West a low-income suburb of Nairobi where the underweight rates were 16.8%. This could be due to food insecurity as evidenced by low dietary intake of flesh foods.

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

A significant positive association was found between respondent's ward of residence (χ^2=16.86, p=0.030), respondent's marital status (χ^2=11.14, p=0.025), main source of income for the household head (χ^2=33.35, p=0.007) and the highest education level of the household head (χ^2=48.67, p=0.009) and the maternal perception on use of edible insects for complementary feeding of the children. High education level is associated with better chances of formal employment, income, and access to knowledge which in turn affects the purchasing power [33]. In Mongolia, children from wealthier households had the advantage of attaining the MDD, as compared to children who came from poor households [41].

CONCLUSION, AND RECOMMENDATIONS FOR DEVELOPMENT

The researcher found out that the marital status of the mother, the ward of residence, the main source of income of the household head and the education level of the household head were among the key factors that greatly influenced the maternal perception on use of edible insects for complementary feeding. The nutritional status of the children was relatively good in that few children were wasted. The researcher recommends the need to improve dietary diversity in

complementary feeding through incorporation of edible insects as alternative flesh foods to the children's diet.

DATA AVAILABILITY

The data is available and can be obtained from the corresponding author upon request.

CONFLICT OF INTEREST

The authors declare that they have no competing interests.

AUTHORS' CONTRIBUTIONS

All the authors designed the study, first author conducted the data collection process, analysis and preparation of draft manuscript while second and third authors participated in technical writing and review of manuscript before publication. All authors approved the manuscript for publication.

FUNDING STATEMENT

This study was funded by VLIR-OUS from Belgium.

ACKNOWLEDGEMENTS

The researcher acknowledges the Department of Food, Nutrition and Dietetics in the School of Public Health and Applied Human Sciences and Kenyatta University together with the County Governments of Kakamega and Siaya, and all participants who voluntarily participated in the study. Acknowledged also is the technical support received from Ghent University VLIR research team specifically Prof. Hans Steur and Maryam Imbumi.

ajfand Since 2001
AFRICAN JOURNAL OF FOOD, AGRICULTURE, NUTRITION AND DEVELOPMENT
SCHOLARLY, PEER REVIEWED
Volume 24 No. 6
June 2024
PUBLISHED BY AFRICAN SCHOLARLY SCIENCE COMMUNICATIONS TRUST
ISSN 1684 5374

Table 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)
Total	216(100.0)	175(100.0)	201(100.0)	592(100.0)
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)
Total	216(100.0)	175(100.0)	201(100.0)	592(100.0)
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)
Total	216(100.0)	175(100.0)	201(100.0)	592(100.0)
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	13(6.0)	4(2.3)	7(3.6)	24(4.1)
(college and university)				
Total	216(100.0)	175(100.0)	201(100.0)	592(100.0)
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)
Total	216(100.0)	175(100.0)	201(100.0)	592(100.0)
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)
Total	216(100.0)	175(100.0)	201(100.0)	592(100.0)
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)
Total	216(100.0)	175(100.0)	201(100.0)	592(100.0)
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	11(5.1)	5(2.9)	2(1.0)	18(9.0)
college and university)				
Total	216(100.0)	175(100.0)	201(100.0)	592(100.0
d) Average household size	5±0.13	6±0.16	5±0.12	

ajfand Since 2001
AFRICAN JOURNAL OF FOOD, AGRICULTURE, NUTRITION AND DEVELOPMENT
SCHOLARLY, PEER REVIEWED
Volume 24 No. 6
June 2024
PUBLISHED BY AFRICAN SCHOLARLY SCIENCE COMMUNICATIONS TRUST
ISSN 1684 5374

Table 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(7.0)	34(19.4)	17(8.5)	66(100.0)
Iron sheets	201(93.0)	141(80.6)	184(91.5)	526(100.0)
Total	216(100.0)	175(100.0)	201(100.0)	**592(100.0)**
b) Wall type				
Mud	193(89.4)	127(72.6)	104(51.7)	**424(71.6)**
Bricks	12(5.6)	30(17.1)	91(45.3)	133(22.5)
Iron sheet	11(4.6)	18(10.3)	6(3.0)	35(5.9)
Total	216(100.0)	175(100.0)	201(100.0)	592(100.0)
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)	57(28.4)	**376(63.5)**
Total	216(100.0)	175(100.0)	201(100.0)	**592(100.0)**
d) Average monthly household income (Ksh)	6002±8486	9352±10434	4928±6515	
e) Main source of income for the household head				
Farming	47(21.8)	48(27.4)	24(11.9)	119(100.0)
Casual labour	77(35.6)	42(24.0)	39(19.4)	**158(100.0)**
Business	32(14.8)	45(25.7)	55(27.4)	132(100.0)
Employment	43(19.9)	24(13.7)	18(9.0)	85(100.0)
Other (e.g. fishing)	17(7.9)	16(9.1)	65(32.3)	98(100.0)
Total	216(100.0)	175(100.0)	201(100.0)	592(100.0)
f) Main source of income for the mother				
None(housewives)	43(19.9)	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(12.1)	22(12.6)	61(30.3)	109(18.4)
Business	34(15.7)	39(22.3)	71(35.3)	144(24.3)
Employment	6(2.8)	5(2.9)	5(2.5)	16(2.7)
Total	216(100.0)	175(100.0)	201(100.0)	592(100.0)

Since 2001 ajfand AFRICAN JOURNAL OF FOOD, AGRICULTURE, NUTRITION AND DEVELOPMENT
SCHOLARLY, PEER REVIEWED
Volume 24 No. 6
June 2024
PUBLISHED BY AFRICAN SCHOLARLY SCIENCE COMMUNICATIONS TRUST
ISSN 1684 5374

Table 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 (%)
a) **Maternal Perception on use of edible insects for complementary feeding**				
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)
b) **Maternal Perception on satiety in feeding children other foods rather than edible insects**				
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)
c)**Maternal Perception on better nutrient content in edible insects**				
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)
d) **Maternal Perception edible insects having better taste than other foods**				
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)
e) **Maternal Perception on children's dislike on consumption of edible insects**				
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)
f) **Maternal religion perception on consumption of edible insects**				
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)
g) **Maternal Cultural perception on consumption of edible insects**				
Strongly disagree	1(0.46)	4(2.3)	6(3.0)	11(1.9)
Neutral	2(0.93)	2(1.1)	5(2.5)	9(1.5)
Agree	103(47.7)	**86(49.1)**	**108(53.7)**	**297(50.2)**
Strongly agree	**109(50.5)**	83(47.4)	83(41.3)	275(46.5)

Since 2001 ajfand AFRICAN JOURNAL OF FOOD, AGRICULTURE, NUTRITION AND DEVELOPMENT
SCHOLARLY, PEER REVIEWED
Volume 24 No. 6
June 2024
PUBLISHED BY AFRICAN SCHOLARLY SCIENCE COMMUNICATIONS TRUST
ISSN 1684 5374

Table 4*:* 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 (%)	Total
Average number of food groups consumed				
1	7(3.3)	7(4.1)	6(2.9)	20(3.4)
2	12(5.7)	24(14.0)	32(15.9)	68(11.5)
3	56(25.8)	45(26.1)	39(19.4)	140(6.8)
4	**85(39.4)**	**58(33.1)**	**57(28.4)**	**200(33.8)**
5	42(19.4)	32(18.5)	56(27.9)	130(22.0)
6	12(5.7)	9(5.2)	10(5.0)	31(5.2)
7	2(0.7)	0	1(0.5)	3(0.5)
Attained MDD	**141(65.3)**	**99(56.6)**	**124(61.7)**	**364(61.5)**
Did not attain MDD	75(34.7)	76(43.4)	77(38.3)	228(38.5)

Table 5: Status of Edible Insect Consumption

No. of days	West Ugenya	West Yimbo	Kisa North	Total
Never n (%)	138(78.9)	194(96.5)	132(61.1)	464(78.4)
1-2 days n (%)	23(13.1)	2(1.0)	57(26.4)	82(13.9)
3-4 days n (%)	4(2.3)	2(1.0)	15(6.9)	21(3.5)
>5 days n (%)	10(5.7)	3(1.5)	12(5.6)	25(4.2)

ajfand Since 2001
AFRICAN JOURNAL OF FOOD, AGRICULTURE, NUTRITION AND DEVELOPMENT
SCHOLARLY, PEER REVIEWED
Volume 24 No. 6
June 2024
PUBLISHED BY AFRICAN SCHOLARLY SCIENCE COMMUNICATIONS TRUST
ISSN 1684 5374

Table 6: 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	**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**	

ajfand Since 2001
AFRICAN JOURNAL OF FOOD, AGRICULTURE, NUTRITION AND DEVELOPMENT
SCHOLARLY, PEER REVIEWED
Volume 24 No. 6
June 2024
PUBLISHED BY AFRICAN SCHOLARLY SCIENCE COMMUNICATIONS TRUST
ISSN 1684 5374

Table 7: 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**	

Table 8: 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±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±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±SD	**-0.15±1.46**	

REFERENCES

1. **Naseem R, Majeed W, Rana N, Koch EB de A and MR Naseem** Entomophagy: an innovative nutritional and economic navigational tool in race of food security. *Int J Trop Insect Sci.* 2021; **41(3)**: 2211–21. https://link.springer.com/article/10.1007/s42690-020-00284-8 *Accessed December 2023.*

2. **Rumpold BA and OK Schlüter** Nutritional composition and safety aspects of edible insects. *Mol Nutr Food Res.* 2013; **57(5)**: 802–23. http://doi.wiley.com/10.1002/mnfr.201200735

3. **Mlcek J, Rop O, Borkovcova M and M Bednarova** A comprehensive look at the possibilities of edible insects as food in Europe - A Review. *Polish Journal of Food and Nutrition Sciences.* 2014; **Vol. 64:** p. 147–57. Polish Academy Sciences.

4. **Barennes H, Phimmasane M and C Rajaonarivo** Insect Consumption to Address Undernutrition, a National Survey on the Prevalence of Insect Consumption among Adults and Vendors in Laos. Schooling CM, editor. *PLoS One*. 2015; **10(8)**: e0136458. https://dx.plos.org/10.1371/journal.pone.0136458

5. **Zielińska E, Baraniak B, Karaś M, Rybczyńska K and A Jakubczyk** Selected species of edible insects as a source of nutrient composition. *Food Res Int.* 2015; **77**: 460–6. https://www.sciencedirect.com/science/article/pii/S0963996915301824 *Accessed July 2019.*

6. **Manditsera FA, Lakemond CMM, Fogliano V, Zvidzai CJ and PA Luning** Consumption patterns of edible insects in rural and urban areas of Zimbabwe: taste, nutritional value and availability are key elements for keeping the insect eating habit. *Food Secur.* 2018; **10(3)**: 561–70. https://link.springer.com/article/10.1007/s12571-018-0801-8 *Accessed September 2021.*

7. **Alemu MH, Olsen SB, Vedel SE, Pambo KO and VO Owino** Consumer acceptance and willingness to pay for edible insects as food in Kenya: the case of white winged termites. 2015. https://www.econstor.eu/handle/10419/204390 *Accessed September 2021.*

8. **Kinyuru JN, Konyole SO, Roos N, Onyango CA, Owino VO and BO Owuor** Nutrient composition of four species of winged termites consumed in western Kenya. *J Food Compos Anal.* 2013; **30(2)**:120–4. https://www.sciencedirect.com/science/article/pii/S0889157513000409 *Accessed July 2019.*

9. **Kimiywe J and P Chege** Complementary feeding practices and nutritional status of children 6-23 months in Kitui County, Kenya. *J Appl Biosci.* 2015; **85(1)**: 7881. http://www.ajol.info/index.php/jab/article/view/113599

10. **Shiriki D, Igyor MA and DI Gernah** Nutritional Evaluation of Complementary Food Formulations from Maize, Soybean and Peanut Fortified with Moringa oleifera Leaf Powder. *Food Nutr Sci.* 2015; **6:** 494–500. https://doi.org/10.4236/fns.2015.65051

11. **de Onis M and F Branca** Childhood stunting: a global perspective. *Matern Child Nutr*. 2016; **12:** 12–26. http://doi.wiley.com/10.1111/mcn.12231

12. **KDHS**. Demographic and Health Survey 2022. *Demogr Heal Surv* 2022. 2022; 1–23. Kenya National Bureau of Statistics (KNBS).

13. **van Huis A** Edible insects are the future? *Proc Nutr Soc.* 2016; **75(3)**: 294–305. https://www.cambridge.org/core/product/identifier/S0029665116000069/type/journal_article *Accessed June 2019.*

14. **Ayieko M, Oriaro V and I Nyambuga** Processed products of termites and lake flies: improving entomophagy for food security within the Lake Victoria region. *African J Food, Agric Nutr Dev.* 2010; **10(2)**. https://doi.org/10.4314/ajfand.v10i2.53352

15. **Homann A, Ayieko M, Konyole S and N Roos** Acceptability of biscuits containing 10% cricket (Acheta domesticus) compared to milk biscuits among 5-10-year-old Kenyan schoolchildren. *Journal of Insects as Food and Feed.* 2016; **3(2**): 95-103. https://www.wageningenacademic.com/ *Accessed July 2019.*

16. **WHO-FAO.** Sustainable healthy diets- Guiding principles. Sustainable healthy diets. 2019. 1–44 p

17. **KDHS**. Kenya 2014 Demographic and Health Survey Key Findings. KDHS. 2014; 6:24. https://www.dhsprogram.com/pubs/pdf/SR227/SR227.pdf *Accessed June 2019.*

18. **Pambo KO, Okello JJ, Mbeche R and JN Kinyuru** Consumer Acceptance of Edible Insects for Non-Meat Protein in Western Kenya. 2016. https://ageconsearch.umn.edu/record/246317/ *Accessed July 2019.*

19. **WHO**. (2014). WHO | Strengthening action to improve feeding of infants and young children 6-23 months of age in nutrition and child health programmes. WHO. https://www.who.int/maternal_child_adolescent/documents/9789241597890/en/ *Accessed June 2019.*

20. **Ochieng J, Afari-Sefa V, Lukumay PJ and T Dubois** Determinants of dietary diversity and the potential role of men in improving household nutrition in Tanzania. van Wouwe JP, editor. *PLoS One*. 2017; **12(12)**: e0189022. https://dx.plos.org/10.1371/journal.pone.0189022

21. **Sekhampu TJ** Association of Food Security and Household Demographics in a South African Township. undefined. 2017.

22. **Caparros Megido R, Sablon L, Geuens M, Brostaux Y, Alabi T and C Blecker** Edible Insects Acceptance by Belgian Consumers: Promising Attitude for Entomophagy Development. J Sens Stud. 2014; **29(1):** 14–20. http://doi.wiley.com/10.1111/joss.12077

23. **Geertsen A** Are edible insects the new black? [Internet]. Master Thesis Series in Environmental Studies and Sustainability Science. 2019. http://lup.lub.lu.se/student-papers/record/8968902 *Accessed January 2021.*

24. **Lensvelt EJS and LPA Steenbekkers** Exploring Consumer Acceptance of Entomophagy: A Survey and Experiment in Australia and the Netherlands. *Ecol Food Nutr.* 2014; **53(5)**: 543–61. Available from: http://www.tandfonline.com/doi/abs/10.1080/03670244.2013.879865 *Accessed July 2019.*

25. **Chow CY, Riantiningtyas RR, Sørensen H and M Bom Frøst** School children cooking and eating insects as part of a teaching program – Effects of cooking, insect type, tasting order and food neophobia on hedonic response. *Food Qual Prefer.* 2021; **87**: 104027.

26. **Van Thielen L, Vermuyten S, Storms B, Rumpold B and Van L Campenhout** Consumer acceptance of foods containing edible insects in Belgium two years after their introduction to the market. 2018; **5(1)**: 35–44. https://doi.org/103920/JIFF20170075

27. **Han R, Shin JT, Kim J, Choi YS and YW Kim** An overview of the South Korean edible insect food industry: challenges and future pricing/promotion strategies. *Entomol Res.* 2017; **47(3)**: 141–51. https://onlinelibrary.wiley.com/doi/full/10.1111/1748-5967.12230 *Accessed July 2019.*

28. **Saaka M, Wemakor A, Abizari AR and P Aryee** How well do WHO complementary feeding indicators relate to nutritional status of children aged 6-23 months in rural Northern Ghana? *BMC Public Health.* 2015; **15(1)**.

29. **Korir J** Determinants of complementary feeding practices and nutritional status of children 6-23 months old in Korogocho slum, Nairobi County, Kenya. 2013;(July):1–129.

30. **Nyakundi LN, Chege P and I Ogada** Maternal socio-economic status, complementary feeding practices and nutrition status of children ages 6-23 months in Kuria West, Migori County, Kenya. *Int J Heal Sci Res.* 2019; **9:** 12. www.ijhsr.org *Accessed December 2019.*

31. **Molla A, Egata G, Getacher L, Kebede B, Sayih A and M Arega** Minimum acceptable diet and associated factors among infants and young children aged 6–23 months in Amhara region, Central Ethiopia: community-based cross-sectional study. *BMJ Open.* 2021; **11(5)**: e044284. https://bmjopen.bmj.com/content/11/5/e044284 *Accessed September 2021.*

32. **Ariff S, Saddiq K, Khalid J, Sikanderali L, Tariq B and F Shaheen** Determinants of infant and young complementary feeding practices among children 6–23 months of age in urban Pakistan: a multicenter longitudinal study. *BMC Nutr.* 2020; **6(1)**: 1–9. https://bmcnutr.biomedcentral.com/articles/10.1186/s40795-020-00401-3 *Accessed September 2021.*

33. **Mwangi T, Ogada I, Parker W-A, Chege P and W Kiboi** Complementary Feeding Practices of Children 6-23 Months of Age Whose Fathers Consumed Illicit Alcohol in Kirinyaga County, Kenya. *Int J Heal Sci Res.* 2018; **8(7)**: 271. www.ijhsr.org *Accessed July 2021.*

34. **Wolle, Abdulazize, Hirvonen, Kalle, de Brauw, Alan, Baye, Kaleab and GT Abate** Household food consumption patterns in Addis Ababa, Ethiopia - Wolle, Abdulazize, Hirvonen, Kalle, de Brauw, Alan, Baye, Kaleab, Abate, Gashaw T. - Google Books. 2020. https://books.google.co.ke/books? *Accessed January 2021.*

35. **Marinda PA, Genschick S, Khayeka-Wandabwa C, Kiwanuka-Lubinda R and SH Thilsted** Dietary diversity determinants and contribution of fish to maternal and underfive nutritional status in Zambia. *PLoS One.* 2018; **13(9)**.

36. **Gatahun EA** Dietary Diversity Feeding Practice and Determinants among Children Aged 6-23 Months in Kemba Woreda, Southern Ethiopia Implication for Public Health Intervention. 2015. https://agris.fao.org/agris-search/search.do?recordID=US2016B00228 *Accessed January 2021.*

37. **Hlongwane ZT, Slotow R and TC Munyai** Indigenous Knowledge about Consumption of Edible Insects in South Africa. *Insects*. 2020; **12(1)**: 22. Available from: https://www.mdpi.com/2075-4450/12/1/22/htm *Accessed September 2021.*

38. **Ojuro M** Dietary Practices and Nutritional Status of Malaria-Infected and Non-Infected Children of Age 6-36 Months in Bondo District, Siaya County, Kenya. 2014. https://ir-library.ku.ac.ke/handle/123456789/11089 *Accessed June 2022.*

39. **Wekesa BN** Fruit consumption and nutritional status of children aged 6-59 months across agro-ecological strip connecting Kakamega and Siaya Counties, Kenya. 2017. https://ir-library.ku.ac.ke/handle/123456789/17967 *Accessed June 2022.*

40. **Ochola SA, Kimwele A and S Ochola** Complementary Feeding and the Nutritional Status of Children 6-23 Months Attending Kahawa West Public Health Center,Nairobi Nutrition internantional View project Development of a Competency-Based Education Model for Strengthening Training in Human Nutrition. *IOSR J Nurs Heal Sci.* 2017; **6(2)**: 17–26. www.iosrjournals.orgwww.iosrjournals.org *Accessed September 2021.*

Since 2001 ajfand AFRICAN JOURNAL OF FOOD, AGRICULTURE, NUTRITION AND DEVELOPMENT
SCHOLARLY, PEER REVIEWED
Volume 24 No. 6
June 2024
PUBLISHED BY AFRICAN SCHOLARLY SCIENCE COMMUNICATIONS TRUST
ISSN 1684 5374

41. **Janmohamed A, Luvsanjamba M, Norov B, Batsaikhan E, Jamiyan B and JL Blankenship** Complementary feeding practices and associated factors among Mongolian children 6–23 months of age. *Matern Child Nutr.* 2020; **16(S2):** e12838. https://onlinelibrary.wiley.com/doi/full/10.1111/mcn.12838 *Accessed September 2021.*