

Research Article

Household Food Security and Complementary Feeding Practices Among Children 6-23 Months Old in Lungalunga, Kwale County, Kenya

Naomi Shume^{*} , Sophie Ochola , Eunice Njogu 

Department of Food, Nutrition and Dietetics, Kenyatta University, Nairobi, Kenya

Abstract

Globally, undernutrition is among the top causes of morbidity and mortality among children 6-23 months old. In Lungalunga, Kwale County, Kenya, similarly to many parts of the county, only 30.4% of children aged 6–23 months receive appropriate complementary feeding (Minimum Acceptable Diet (MAD)); a composite indicator of Minimum Dietary Diversity (MDD) and Minimum Meal Frequency (MMF). Kwale County is a semi-arid land (ASAL) and experiences chronic food insecurity. This study therefore, sought to establish the state of household food security and how it is related to complementary feeding practices among children 6–23 months old in Lungalunga, Kwale County. The study used a cross-sectional analytical research design and to select the study participants, multistage random sampling was used. In-person interviews were conducted at the household to collect information on complementary feeding practices and household food security. For analysis, the study used Statistical Package for Social Sciences (SPSS) version 27. Chi-square test, Fisher's exact, linear by linear and logistic regression were used to establish the association between the variables. A statistical significance level (p-value) of <0.05, corresponding to a 95% confidence level was used. About one-tenth (8.1%) of the households experienced severe hunger, 34.7% moderate hunger and 57.1% experienced little to no hunger. All (100%) of the children had received soft, semi-solid or solid meals based on a twenty-four recall. Around three-quarters (76.8%) of the children achieved MMF, 24.1% attained MDD, and only 21.6% had MAD. Significant relationships were observed between all the three indicators of complementary feeding practices (MMF, MDD and MAD) and household food security at a $p < 0.01$. Children from households that experienced moderate hunger had 30% higher odds ($OR = 1.298$, 95% $CI = [1.118, 1.753]$, $p = 0.011$) of attaining MMF than those experiencing severe hunger, those experiencing 'little to no hunger' were 87% more likely ($OR = 1.87$, 95% $CI = [1.173, 2.473]$, $p < 0.01$) to achieve MDD than those experiencing severe hunger and those that experienced 'little to no hunger' had 19% higher odds ($OR = 1.191$, 95% $CI = [1.075, 1.488]$, $p = 0.001$) of meeting the MAD than those in severe hunger category. Breastfeeding among children, wealth index, caregivers' occupation and level of education and household food security were significant predictors of complementary feeding. Therefore, addressing household food security in Lungalunga will significantly improve the complementary feeding practices of children 6-23 months old.

Keywords

Household Food Security, Under-nutrition, Complementary Feeding, Minimum Meal Frequency, Minimum Dietary Diversity, Minimum Acceptable Diet

*Corresponding author: shume.naomi@gmail.com (Naomi Shume)

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1. Introduction

Household food security occurs when a household has physical and financial access to adequate meals that meet each household member's nutritional requirements [1-3]. Globally, food insecurity has remained a concern. Food and Agriculture Organization (FAO) demonstrated that 28.9% (2.33 billion) of individuals globally were food insecure in 2023; 10.7% being severely food insecure. In Africa the prevalence of food insecurity was almost double as 58.0% of its people presented with average to dire food insecurity [4].

The household food security situation in Kenya is said to have deteriorated, especially among the households in the rural areas following a rise in food cost [5]. Kipkorir's report in 2024 showed that the situation has been worsening since 2015, as the population increased, with average food insecurity rising from 35.7% to 46.6% and dire food insecurity on the rise from 15.0% to 32.9% in 2023 with prospects of continued increase in 2024 [6].

In Kenya, malnutrition has continued to be a concern. Nationally, stunting is at 18%, wasting at 5%, and underweight at 10%, whereas in Kwale County prevalence of stunting is 23%, wasting at 6%, and underweight at 14% among children below five years [7]. Kwale County recorded a rise in the proportion of underweight and wasted children from the previous Kenya Demographic and Health Survey (KDHS) conducted in 2014, even though there was a general improvement in nutrition among the children below five years age nationally [8].

When infants attain 6 months of age, their nutrient needs are more than what breast milk can provide [9-11]. Giving children solid and other types of feeds at this age is key to preventing deficiencies that could cause under nutrition [12]. The adverse consequences of malnutrition are mainly as a result of sub-optimal nutrition during the first one thousand days of their early life: this includes inappropriate breastfeeding and complementary feeding practices. Approximately, 100,000 deaths could be prevented if appropriate complementary practices were to be scaled up to almost universal levels [13, 14].

Indicators of complementary feeding include: timely initiation of complementary feeds, minimum meal frequency, minimum dietary diversity and minimum acceptable diet [15]. Globally, fewer than 50% of children aged 6-23 months receive MMF, only a ¼ were fed the MDD, and approximately one in six children received MAD [16]. The KDHS (2022) documented that nationwide, 37% of children in the 6-23 months age group received MDD, 71% attained MMF, and 52% of non-breastfed children received a minimum of two milk feeds. Only 31% of children achieved MAD. These findings indicate that many children aged 6-23 months nationally did not receive the required quality of diet [7]. At the national level, micronutrient deficiencies were reported to be very common amidst children below five years because of the

inadequate consumption of nutritious diet [6]. Only 30.5% of children aged 6-23 months in Kwale county attained MAD. Among these, 46% met MDD, meaning they received four or more food groups, and 56.7% attained the MMF. The findings also showed that while the mothers possessed knowledge of recommended complementary feeding practices and held positive attitudes towards them, this never translated to actual practice [17].

Globally, an increase in undernutrition was seen to be related with an increase in food insecurity. According to a research carried out in Mexico, in their fight against hunger, the findings showed that households relied on less expensive foods, limited the portion sizes during meal times, and also skipped some meals [18]. In 2020, a study by the Famine Early Warning Systems Network (FEWS NET) showed that the households in the marginal agricultural areas like Kwale faced food insecurity forcing them to increase their coping strategies to maintain their food consumption score [19]. The strategies included reducing the portion of food that people ate per meal, how many times they eat daily and the types of food taken. These coping strategies directly affect the frequency and diversity of meals among those households.

Studies conducted in Ghana and Bangladesh indicated that there was a relationship between household food security and IYCF practices [20, 21]. Another study conducted in Kenya's Nairobi informal settlement area showed that infant feeding practices were significantly related to household food security [22]. Other studies done in Kenya showed that the main contributing factor to under nutrition was household food insecurity [23-25]. Other studies including a study conducted in Isiolo and another in Nairobi informal settlements highlighted a number of determinants of complementary feeding practices. These determinants included; caregiver's knowledge, age and level of education and child's sex and age [26, 27].

Kwale County's food security situation and malnutrition among children has continued to be inappropriate [28]. Limited studies have examined the relationship between household food security and complementary feeding practices in Kwale. Despite the demonstrated determinants of complementary feeding practices, this study examined household food security and complementary feeding practices in Lunga-Lunga, Kwale County, and the relationship between them.

2. Materials and Methods

2.1. Study Design

A cross-sectional analytical design was used. This design was appropriate because it allows one-time data collection on both household food security and complementary feeding practices [29].

2.2. Study Area

This study was conducted in Lungalunga Sub-County, Kwale County, which comprises four wards: Mwereni, Vanga, Dzombo, and Pongwe Kikoneni. This sparsely populated area is characterized by poor infrastructure and housing, and is prone to climate change including extremely short rain seasons and delayed rainfall onset. The region is classified as semi-arid within Kwale County [30]. Additionally, the area reports low nutrition status among children [7].

2.3. Sample Size

Fisher's formula was applied to calculate the sample size [31]. This formula is used in cross sectional studies as it provides a sufficient sample size to estimated population prevalence with good precision at a specified confidence level [32]. The calculation yielded a sample size of 359 children, using a 95% confidence level, 30.5% prevalence of appropriate complementary feeding (MAD) based on Knowledge, Attitudes, Beliefs and Practices (KABP) Survey Report of Kwale County in 2017 [17] and allowing for 10% none response.

2.4. Sampling Technique

The research employed a multistage sampling technique. In the first stage, Lungalunga Sub-County, was purposively selected because it is prone to prolonged drought seasons [30]. In the second stage, two Wards were selected by simple random sampling using a table of random numbers. In the third stage, two Community Health Units (CHU) were randomly selected from each ward: In the fourth stage, two villages were randomly selected from each CHU. This was followed by proportionate stratified random sampling for households with children aged 6-23 months old with 42-45 households selected per village.

2.5. Validity and Reliability

The study used a validated questionnaire, and the supervisors reviewed it to confirm that the tool accurately assessed the intended variables.

The research employed a test-retest method to verify the reliability of the questionnaire. The tool was tested on the same group of people one week apart. The results for both were compared to determine the correlation coefficient. SPSS was used and a correlation coefficient of .72 was generated, which was within the acceptable level [33, 34].

2.6. Data Collection Techniques

Information from caregivers was collected through structured in-person interviews in a one-time household visit. Data on the household's socio-demographic and economic factors, complementary feeding, and household food security were solicited.

2.7. Data Analysis and Presentation

Statistical Package for Social Sciences (SPSS) version 27 software was used. Household food security was analyzed using household hunger scale (HHS). Complementary feeding practices were analyzed based on the main indicators which are: MDD, MMF and MAD. Inferential statistics, Chi-Square test, Linear by linear, Fisher's test and logistic regression investigated the relationships among the categorical variables [35]. For the statistical significance, a p-value of <0.05 was used and a confidence level of 95% was set [36]. The analyzed data is presented in tables, charts and graphs [37].

2.8. Ethical Consideration

The authority to conduct the research was obtained from the Kenyatta University Graduate School and the ethical clearance was granted by Kenyatta University Ethical Review Committee (PKU/2380/11517). Permission to conduct the research was sought from the National Commission of Science, Technology, and Innovation (NACOSTI/P/22/15736). Approval to conduct the research in Lungalunga Sub-County of Kwale County was given by the Ministry of Health, Kwale County (KWL/6/5/CEC/39/Vol.1/45).

All those that participated in the research gave informed voluntary consent. They were taken through the objective of the research and how it was to be conducted and were given the freedom to decide. They were assured of no harm and that their data would be handled with absolute confidentiality. Numbers were used on the data collection instrument instead of their names.

3. Results

3.1. Socio-demographic and Economic Characteristics of the Study Population

In this study, data was collected from 348 households and information on 357 children in the same households resulting in a 99.4% response rate. Majority (78%) of the children 6-23 months old were between the ages of 9-23 months. Regarding the caregivers ages, 15.4% were below 20 years of age, 56.4% were between 20-29 years old, 17.6% were between 30-39 years while only 10% were 40 years old and above. Most caregivers (66%) had attained primary school education, 11% had secondary school education, and approximately 12% had attained a tertiary level education; however, 11% reported no formal education.

Findings indicated that most fathers (84%) were engaged in informal employment, while 15% were in formal employment, and only 1% were unemployed. In contrast, over half of the mothers (66%) were unemployed, with 24% being in informal employment and 11% in formal employment. Eighty-eight (88.2%) of the households owned agricultural land. Wealth index was calculated using principle component analysis from

the household characteristics. The findings indicated that about 37% of the households were in the lowest wealth quin-

tile whereas only 8% were in the highest wealth quintiles (Table 1).

Table 1. Socio-demographic and economic characteristics of the study population.

Variables (N = 357)	n	%	M (IQR)
Caregivers age			
< 20 years	55	15.4	
20 - 29 years	201	56.4	
30 - 39 years	63	17.6	
≥ 40 years	38	10.6	
Mean (SD) age of caregivers	27 ± 8		
Median age of Caregivers			24 (10)
Caregiver's education level			
Primary	236	66.1	
Secondary	40	11.2	
Tertiary	43	12	
No formal education	38	10.6	
Caregivers' marital status			
Married	286	80.1	
Divorced	43	12.1	
Never Married	28	7.8	
Mean (SD) age of children (In months)	14 ± 5		
Median Age of Children (In Months)			13 (10)
Children's Age group			
6 - 8 Months	78	21.8	
9 - 23 Months	279	78.2	
Children's gender			
Female	196	54.9	
Male	161	45.1	
Households owning agricultural land	315	88.2	
Father's Occupation			
Informal Employment	234	83.5	
Formal Employment	43	15.4	
Unemployed	3	1.1	
Mother's Occupation			
Unemployed	223	65.8	
Informal Employment	80	23.6	
Formal Employment	36	10.6	
Household Wealth Index			
Lowest	131	36.7	

Variables (N = 357)	n	%	M (IQR)
Second lowest	43	12	
Middle	63	17.6	
Fourth	91	25.5	

M (IQR) = Median and Interquartile Range; n = frequency

3.2. Food Security Status of the Households

Households' food security was determined using household dietary diversity score (HDDS) (Figure 1) and household hunger scale (HHS) (Figures 2 and 3). The HDDS was assessed based on a 24-hour recall of the food taken by the household and HHS was based on a one-month recall on the food availability condition of the household.

3.2.1. Household Dietary Diversity Score

The food group which was consumed the most was cereal (100%); followed by spices, condiments and beverages (80%); sea foods (71%) and sugar and honey (70%) while the food

groups which were consumed less were eggs (5%), roots and tubers (9%), meats, poultry and offal (11%), dairy products (22%), and pulse, legumes and nuts (23%).

The sum of food groups consumed were converted into dietary diversity levels according to a study done in rural Bangladesh in 2022 [38]: low (for households that consumed between 1 – 3 groups); medium (for households that consumed 4 - 6 groups) and high (for households that consumed 7 groups and above). The median score was 5 with an interquartile range of 2. Over two thirds of the households (69%) were in medium diversity, followed by 23% in high diversity and only 9% in low diversity.

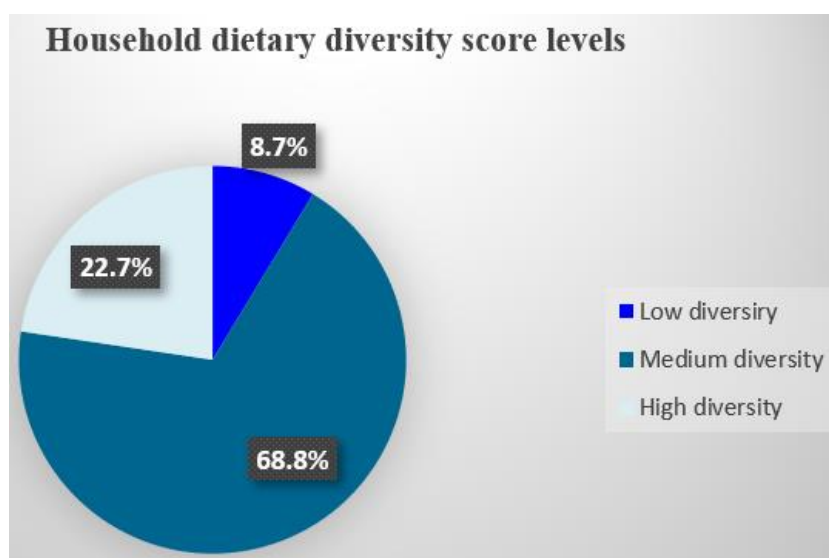


Figure 1. Household dietary diversity score levels.

3.2.2. Household Food Security Status by Household Hunger Scale

Household hunger scale uses frequency-of-occurrence questions from three frequency categories ("Rarely", "Sometimes" and "Often") for over a period of one month. The questions included: if any of the household members ever

lacked food at all, went to sleep hungry at night or spent the entire day and night hungry. As shown in Figure 2, the findings indicated that nearly half of the households (47%) ever lacked food at all, while 41% reported going to bed hungry and 31% experienced hunger throughout the entire day and night.

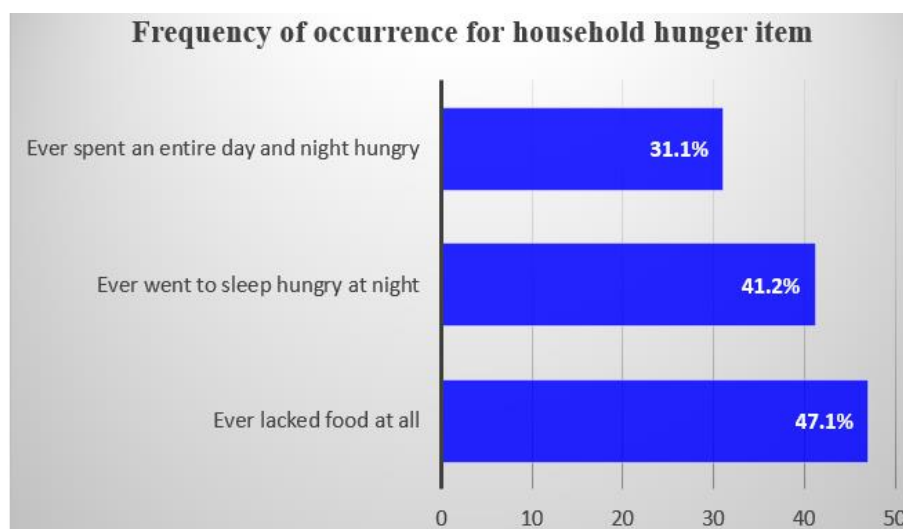


Figure 2. Frequency of occurrence for household hunger item.

The assessment of household food security status indicated that over half of the households (57%) experienced little hunger, followed by slightly more than a third (35%) who

experienced moderate hunger and only 8% faced severe hunger, as indicated in Figure 3.

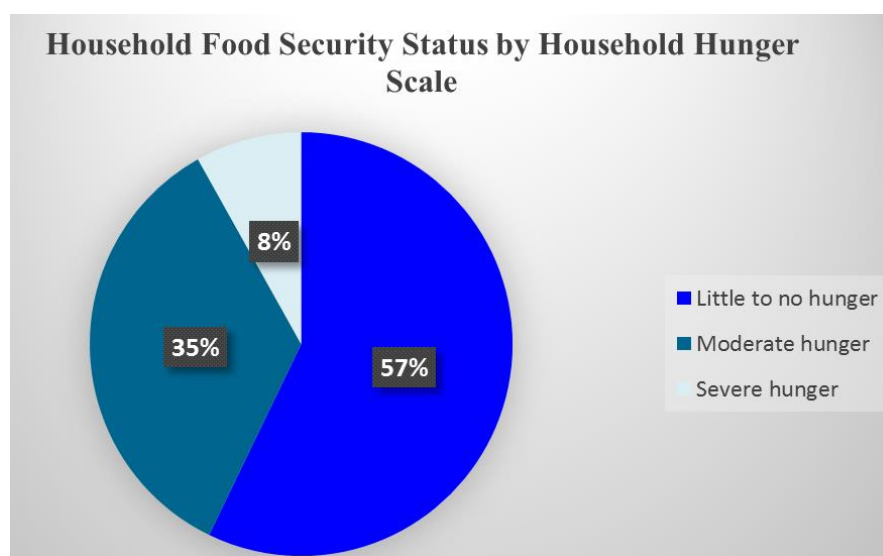


Figure 3. Household Food Security Status by Household Hunger Scale.

3.3. Complementary Feeding Practices of Children 6 - 23 Months Old

3.3.1. Introduction of Complementary Feeding

All children aged 6-8 months were reported to have taken food in the day before the survey, implying that introduction to complementary feeding was timely for all the children. Thirty-one percent (31%) of the children were reported to have been started complementary feeding before they were six months old.

3.3.2. Minimum Meal Frequency (MMF)

MMF, which represents the percentage of children 6–23 months old that ate food and took the minimum milk feeds for non-breastfed children the least acceptable times during the preceding day before the study, was relatively high. Slightly more than three-quarters (77%) met the minimum meal frequency.

Results indicate that a substantial percentage of children (75%) had been breastfed the day before data collection. Among those who had not been breastfed, 4.5% were between the ages of 6–8 months, while 96% were aged 9–23 months.

Of the non-breastfeeding children, only 30.7% had received any milk feeds in the past 24 hours and only 21.6% had met the minimum milk feeding frequency.

Among the children who met the MMF, 72% were breastfeeding and aged 6–8 months, 58% were breastfeeding and were 9 – 23 months old, and 64% were non-breastfeeding and were in the whole group of 6 to 23 months.

3.3.3. Minimum Dietary Diversity (MDD)

The results showed that among the children 6-23 months old, the foods groups with high consumption were grains, roots and tubers (98%), breast milk (74.5%), vitamin A rich food (56%) and flesh foods (54% while the least consumed were eggs (4%).

About 24% of the children met the MDD requirements. This implies that, they consumed at least five food groups during the preceding day, out of the total identified food groups (eight food groups).

3.3.4. Minimum Acceptable Diet (MAD)

MAD indicator combines both MMF and MDD, and it comprises of children who met the MDD the minimum mealtimes, with the added condition that children not being breastfed met a minimum milk feeding frequency.

The minimum acceptable diet was achieved by 22% of 6-23 months old children; among these, 28% were breastfeeding, whereas only 1% of non-breastfed children met this standard as shown in Table 2.

Table 2. Complementary feeding practices.

Variables	n	%
Breastfeeding (At the time of data collection) (N = 357)		
Yes	269	75.4
No	88	24.6
Minimum Meal Frequency (MMF)		
Breastfed children aged 6-8 Months consuming 2* times (N=78)	56	71.8
Breastfed children aged 9-23 Months consuming 3* times (N = 279)	162	58.1
Non-breastfed children aged 6-23 Months consuming 4* times (N = 88)	56	63.6
Overall Minimum Meal Frequency (MMF) (N=357)	274	76.8
Overall Minimum Dietary Diversity (MDD) (N=357)	86	24.1
Minimum Acceptable Diet (MAD)		
Breastfed children aged 6-23 Months (N =269)	76	28.3
Non-breastfed aged children 6 - 23 Months with at least 2 milk feeds (N=88)	1	1.1
Overall MAD (N=357)	77	21.6
* Consuming food and / or milk feeds for non-breastfed		

3.4. Association Between Socio-demographic and Economic Factors and Complementary Feeding Practices

3.4.1. Socio-demographic Factors and Complementary Feeding Practices

Table 3. Socio-demographic factors and complementary feeding practices.

Socio-demographic factors (N=357)	Complementary feeding practice		Fisher's Exact value	P-value
	n (%)	n (%)		
	Minimum Meal Frequency (MMF)			
	Did not attain MMF	Attained MMF		

Socio-demographic factors (N=357)	Complementary feeding practice		Fisher's Exact value	P-value
	n (%)	n (%)		
Education Level				
Primary school	57 (24.2)	179 (75.8)		
Secondary school	12 (30.0)	28 (70.0)	23.97	<0.01
Tertiary	0	43 (100)		
No formal education	14 (36.8)	24 (63.2)		
Marital status				
Married	71 (24.8)	76 (26.6)		
Divorced	9 (20.9)	2 (4.7)	2.863	0.233
Not married	3 (10.7)	8 (28.6)		
Minimum Dietary Diversity (MDD)				
Did not attain MDD		Attained MDD		
Education Level				
Primary school	201 (85.2)	35 (14.8)		
Secondary school	29 (72.5)	11 (27.5)	122.246	<0.01
Tertiary	3 (7.0)	40 (93.0)		
No formal education	38 (100)	0		
Marital status				
Married	210 (73.4)	215 (75.2)		
Divorced	41 (95.3)	34 (79.1)	12.22	0.002
Not married	20 (71.4)	25 (89.3)		
Minimum Acceptable Diet (MAD)				
Did not attain MAD		Attained MAD		
Education Level				
Primary school	203 (86.0)	33 (14.0)		
Secondary school	29 (72.5)	11 (27.5)	83.798	<0.01
Tertiary	10 (23.3)	33 (76.7)		
No formal education	38 (100)	0		
Marital status				
Married	219 (76.6)	67 (23.4)		
Divorced	41 (95.3)	2 (4.7)	10.223	0.006
Not married	20 (71.4)	8 (28.6)		

Fisher's exact test of independence was used to establish the associations between socio-demographic factors and complementary feeding practices. Except for minimum meal frequency and marital status, all other associations between socio-demographic factors and complementary feeding practices were statistically significant, all p-values<0.05 (Table 3).

3.4.2. Wealth Index and Complementary Feeding Practices

Fisher's exact test of independence was done to establish the wealth index's relationship with complementary feeding indicators (Table 4). A statistically significant relationship was found, all p-values<0.01.

Table 4. Wealth Index and complementary feeding practices.

Wealth Index (N=357)	Complementary feeding practice		Fisher's Exact value	P-value
	n (%)	n (%)		
	Minimum Meal Frequency (MMF)			
	Did not attain MMF	Attained MMF		
Lowest	45 (34.4)	86 (65.6)		
Second	14 (32.6)	29 (67.4)		
Middle	9 (14.3)	54 (85.7)	27.593	<0.01
Fourth	15 (16.5)	76 (83.5)		
Highest	0	29 (100)		
	Minimum Dietary Diversity (MDD)			
	Did not attain MDD	Attained MDD		
Lowest	131 (100)	0		
Second	40 (93.0)	3 (0.7)		
Middle	47 (74.6)	16 (25.4)	131.01	<0.01
Fourth	40 (44.0)	51 (56)		
Highest	13 (44.8)	16 (55.2)		
	Minimum Acceptable Diet (MAD)			
	Did not attain MAD	Attained MAD		
Lowest	131 (100)	0		
Second	40 (93.0)	3 (7.0)		
Middle	52 (82.5)	11 (17.5)	121.023	<0.01
Fourth	44 (48.4)	47 (51.6)		
Highest	13 (44.8)	16 (55.2)		

3.4.3. Complementary Feeding Practices and Caregivers' Occupation

Chi-square or Fisher's exact test of independence was conducted to determine the association between caregivers'

occupation and Complementary feeding practices. There was a statistically significant relationship between caregivers' occupation and Complementary feeding practice (Table 5).

Table 5. Caregivers Occupation and Complementary feeding practices.

Caregivers employment status	Complementary feeding practice		Chi-sq. / Fisher's Exact value	P-value
	n (%)	n (%)		
	Minimum Dietary Diversity (MDD)			
	Did not attain MDD Attained MDD			
Unemployed	199 (89.2)	24 (10.8)	102.851	<0.01
Informal Employment	49 (61.2)	31 (38.8)		
Formal Employment	5 (13.9)	31 (86.1)		
	Minimum Meal Frequency (MMF)			
	Did not attain MMF Attained MMF			
Unemployed	65 (29.1)	158 (70.9)	15.972	<0.01
Informal Employment	15 (18.8)	65 (81.2)		
Formal Employment	0	36 (100)		
	Minimum Acceptable Diet (MAD)			
	Did not attain MAD Attained MAD			
Unemployed	199 (89.2)	24 (10.8)	73.961	<0.01
Informal Employment	53 (66.3)	27 (33.8)		
Formal Employment	10 (27.8)	26 (72.2)		

3.5. Household Food Security and Complementary Feeding Practices

3.5.1. Household Food Security Status by Household Hunger Scale and Complementary Feeding Practices

To relate household food security status by household hunger scale and complementary feeding practices, Chi-square or Fisher's exact test of independence was conducted, (Table 6). The analysis revealed a significant relationship, because all p-values were below 0.01.

Logistic regression also showed that children from households that experienced moderate hunger had 30% higher odds (OR = 1.298, 95% CI = [1.118, 1.753], $p=0.011$) of attaining MMF than those experiencing severe hunger, those in the 'little to no hunger' food security category were 87% more likely (OR = 1.87, 95% CI = [1.173, 2.473], $p < 0.01$) to achieve MDD than those with severe hunger and those that experienced 'little to no hunger' had 19% higher odds (OR = 1.191, 95% CI = [1.075, 1.488], $p = 0.001$) of meeting the MAD than those in severe hunger category. None of the households that experienced severe hunger met MDD or MAD while more households that met the MDD and MAD experienced little to no hunger.

Table 6. Household food security status by household hunger scale and complementary feeding practices.

Household Hunger Scale (N=357)	Complementary feeding practice		Chi-Sq./ Fisher's Exact value	P-value
	n (%)	n (%)		
	Minimum Meal Frequency (MMF)			
	Did not attain MMF Attained MMF			
Little to no hunger	38 (18.6)	166 (81.4)	13.864	<0.01
Moderate hunger	30 (24.2)	94 (75.8)		

Household Hunger Scale (N=357)	Complementary feeding practice		Chi-Sq./ Fisher's Exact value	P-value
	n (%)	n (%)		
Severe hunger	15 (51.7)	(48.3)	51.135	<0.01
	Minimum Dietary Diversity (MDD)			
	Did not attain MDD	Attained MDD		
Little to no hunger	128 (62.7)	76 (37.3)		
Moderate hunger	114 (91.9)	10 (8.1)		
Severe hunger	20 (100)	0		
	Minimum Acceptable Diet (MAD)		40.49	<0.01
	Did not attain MAD			
	Attained MAD			
Little to no hunger	137 (67.2)	67 (32.8)		
Moderate hunger	114 (91.9)	10 (8.1)		
Severe hunger	29 (100)	0		

3.5.2. Household Dietary Diversity Score and Complementary Feeding Practices

Chi-square or Fisher's exact test of independence was conducted to determine the relationship between household food accessibility by HDDS and complementary feeding practices (Table 7). A Statistically significant relationship

was found with a p-value < 0.01 for MDD and MAD and p-value of 0.013 for MMF. None of the households that had the lower HDDS met MMF, MDD or MAD while more households that met the MDD and MAD had a higher household dietary diversity score.

Table 7. Household dietary diversity score and complementary feeding practices.

Household Dietary Diversity	Complementary feeding practices		Fisher's Ex- act value	P-value
	n (%)	n (%)		
	Minimum Meal Frequency (MMF)		8.581	0.013
	Did not attain MMF	Attained MMF		
Low diversity	31 (100)	0		
Medium diversity	205 (83.7)	40 (16.3)		
High diversity	65 (80.2)	16 (19.8)		
	Minimum Dietary Diversity (MDD)		131.548	<0.01
	Did not attain MDD	Attained MDD		
Low diversity	31 (100)	0		
Medium diversity	219 (89.4)	26 (10.6)		
High diversity	21 (25.9)	60 (74.1)		
	Minimum Acceptable Diet (MAD)		95.969	<0.01
	Did not attain MAD	Attained MAD		
Low diversity	31 (100)	0		

Household Dietary Diversity	Complementary feeding practices		Fisher's Exact value	P-value
	n (%)	n (%)		
Medium diversity	219 (89.4)	26 (10.6)		
High diversity	30 (37.0)	51 (63.0)		

3.6. Predictors of Complementary Feeding Practices

Multiple logistic regression was performed to assess the predictors of complementary feeding practices, from those variables that had associations from Univariate analysis. The model contained three independent variables (Wealth index, Food security, breastfeeding and Caregiver's occupation) that were statistically significantly related to the complementary feeding practices in univariate analysis. After controlling for

the effects of caregiver's occupation, the full model containing all predictors was statistically significant, χ^2 (1, n=357) = 25.270, p-value=0.003 for MDD; χ^2 (1, n=357) = 28.35, p-value<0.01 for MMF and χ^2 (1, n=357) = 31.23, p-value<0.01 for MAD, indicating that the model could distinguish between 6-23 months old children that attained MDD, MMF and MAD and those who did not.

From the Multiple logistic regression analysis examining predictors of MMF, MDD and MAD in Tables 8, 9 and 10, wealth index, breastfeeding status of the child and food security status were established to be statistically significant.

Table 8. Predictors of Minimum Meal Frequency.

Variables	AOR	95% CI		P-value
		Lower	Upper	
Minimum Meal Frequency				
Wealth Index				
Lowest	1.541	0.685	3.470	0.296
Second	0.231	0.208	0.352	0.012
Middle	0.759	0.298	0.913	0.031
Fourth	0.890	0.659	1.014	0.115
Highest	REF			
Breastfeeding status of the child				
Yes	2.443	1.437	4.152	0.001
No	REF			
Food Security				
Little to no hunger	0.627	0.331	1.188	0.152
Moderate hunger	1.298	1.118	1.753	0.011
Severe hunger	REF			
Caregivers' occupation				
Informal Employment	3.039	0.862	2.711	0.084
Formal Employment	4.211	0.775	4.671	0.353
Unemployed	REF			
REF = Reference point; * means significant 5% level				

Table 9. Predictors of Minimum Dietary Diversity.

Variables	AOR	95% CI		P-value
		Lower	Upper	
Minimum Dietary Diversity				
Wealth Index				
Lowest	0.021	0.015	1.034	0.995
Second	0.122	0.025	0.594	0.009
Middle	0.262	0.077	0.894	0.032
Fourth	0.608	0.194	1.906	0.393
Highest	REF			
Breastfeeding status of the child				
Yes	3.072	1.510	6.246	0.002
No	REF			
Food Security				
Little to no hunger	1.87	1.173	2.473	<0.01
Moderate hunger	0.015	0.011	1.016	0.998
Severe hunger	REF			
Caregivers' occupation				
Informal Employment	0.890	0.304	2.606	0.831
Formal Employment	1.070	0.348	3.296	0.906
Unemployed	REF			
REF = Reference point; * means significant 5% level				

Table 10. Predictors of Minimum Acceptable Diet.

Variables	AOR	95% CI		P-value
		Lower	Upper	
Minimum Acceptable Diet				
Wealth Index				
Lowest	0.011	0.010	1.012	0.995
Second	0.121	0.025	0.575	0.008
Middle	0.260	0.178	0.869	0.029
Fourth	0.490	0.159	1.514	0.215
Highest	REF			
Breastfeeding status of the child				
Yes	3.459	3.211	4.421	<0.01
No	REF			
Food Security				

Variables	AOR	95% CI		P-value
		Lower	Upper	
Little to no hunger	1.191	1.075	1.488	0.001
Moderate hunger	0.556	0.411	1.045	0.998
Severe hunger	REF			
Caregivers' occupation				
Informal Employment	1.124	0.386	3.275	0.830
Formal Employment	1.196	0.392	3.647	0.753
Unemployed	REF			
REF = Reference point; * means significant 5% level				

4. Discussion

This study was conducted to determine the food security status of the households, complementary feeding practices among children in those households and the relationship between the two variables in Lungslunga, Kwale County.

More than half of the caregivers were in the age bracket of 20-29 years. The caregivers' and children's median ages were 24 years and 14 months respectively. Most caregivers had only completed primary school education, and many did not have formal education. Additionally, many of the mothers were not employed and fully dependent on their spouses. Above half of the spouses had informal employment. The results in this research on the respondents' characteristics were similar to those of researches done in Nairobi slums, Kwale and Marsabit [27, 28, 39].

Majority of households had ownership of agricultural land. These results were in agreement with those from other rural areas including a study done in Kitui County in 2017 [40]. Ownership of agricultural land did not translate to household being food secure. Additionally, the observations of this research revealed that caregiver's education level attained and occupation of either of the mother or the spouse were significantly related to complementary feeding practices that would consequently affect the children's nutrition status. This finding agrees with those of a study done in Kwale County where maternal education level and wealth index were associated with meeting MDD in Kinango and Matuga Sub-Counties [41].

According to this study, households with mothers in formal employment had a higher chance of their children attaining an acceptable diet. This agreed with the case study done in Matuga Sub-County in Kwale County where after the mothers were empowered economically they improved in their household food security [42]. Most of the households were poor with the majority within in the lowest, second and mid-

dle wealth quintiles. These results were different from another research done in Ethiopia which indicated that most households were within the fourth and highest quintiles [43].

Wealthiest households demonstrated a greater likelihood of children 6-23 months old getting appropriate complementary feeds. These observations were in consensus with a research done in Ethiopia where socioeconomic status of households was significantly related to the children's complementary feeding practices [43].

The findings of this study affirmed the need for improving household economic status by better acquisition of education which will enhance maternal employment. Improved social economic status would enhance food access leading to optimal complementary feeding practices among the children in those households.

4.1. Complementary Feeding Practices

4.1.1. Introduction of Complementary Feeding

For optimal nutrition, a child needs to be initiated to complementary food upon attaining six months old. This study's findings showed that most of the children 6-8 months old were initiated to complementary feeding at the appropriate age, just a few being initiated earlier than the recommended age. These findings concur with those of a study conducted in a Nairobi informal settlement [27].

The findings of this study however, were not in agreement with those of the knowledge, attitude, beliefs and practice (KABP) survey conducted in 2017 in Kwale [17] where only around three quarters of children 6-8 months old in the study had received complementary food in the past 24 hours prior to the survey. The difference could be due to the time lapse between the two studies with changes in some of the complementary feeding practices. Similar findings are those of a study done in Marsabit where only around a half of the children in that age bracket had consumed complementary foods the past 24 hours [39]. This difference could be attributed to

the fact that Marsabit is an arid area.,

4.1.2. Minimum Dietary Diversity

A diverse range of micronutrients have a vital role in the healthy growth and development of children. This indicator therefore measures the adequacy of the micronutrient density in the foods consumed by the child. When a child meets the MDD, consuming at least 5 out of the 8 recommended food groups, it indicates that they have taken food at least from an animal source and a fruit or a vegetable apart from the staples [7, 44].

The findings of this research indicated that the most commonly consumed foods among children 6-23 months old were grains, roots and tubers. Very few children were reported have had eggs in their meals. Only a small proportion of children met the MDD. These results concur with those of other studies done in Tanzania and Ethiopia and even in Kenya where grains were the most consumed foods [39, 45, 46]. The low percentage of children who met MDD was also in agreement with the 2022 KDHS report and a review for the Sub-Saharan Africa [7, 47] and many other studies in Kenya [27, 39]. This study's results on the MDD were lower than those the 2017 KABP survey in Kwale, although then, the mark of attaining MDD was consuming at least 4 of the 7 identified food groups the preceding day. This showed a deterioration in the diet variety among children in the complementary feeding age group in Kwale County [17]. The MDD rate was higher than that reported by Chepkirui in 2023 in which nearly one in every ten 6-23 month old children met the MDD in Kwale County [41].

According to the findings of this study, low MDD was the highest contributor to the low MAD prevalence since MMF was well performing. Inadequate diet variety compromises the micronutrient intake among the children 6-23 months which contributes to the persistent low nutritional status of the under-fives in Kwale County.

4.1.3. Minimum Meal Frequency

Meeting energy requirement is essential for an optimal child's growth. Due to their small gastric capacity, children can only accommodate little food at a time, to meet their high nutrient and energy needs. Children aged 6-23 months therefore require to eat food besides breast-milk or formula frequently per day [7, 48].

This study found that nearly 8 in every 10 children met the MMF. These results are in agreement with those of a study done in Ethiopia where MMF was the well performing indicator of complementary feeding with almost three quarters of the children that participated in the study attaining it [49]. This research's findings were way higher than those of 2017 during the MIYCN knowledge, attitude, beliefs and practice (KABP) survey in Kwale County [17]. This showed a significant improvement in the MMF among the 6-23 months children. The findings of this study were similar to those from other KDHS 2022 where MMF was found to perform well

among the other indicators [7].

In contrast, this study's findings were different from those of another research conducted in Marsabit in 2021 where less than a quarter of the children achieved MMF [39]. Despite the environment differences between Marsabit (an arid zone) and Kwale (a semi-arid zone), other observations of this studies were similar where they indicated that breastfeeding children had higher chances of meeting MMF. The findings of this research further indicated that HDDS and food security in a household were significant predictors of MMF. This was in agreement with several other studies [27, 39].

4.1.4. Minimum Acceptable Diet

For a child 6 to 23 months old to have adequate diet for their optimal growth and development, they must have adequate nutrient density and energy needs. MAD is a composite indicator of MDD and MMF [7, 44].

The findings of this research indicated that only one in every 5 children 6-23 months old achieved MAD. This was a low percentage and this was largely due to the small proportion of children that attained MDD. This finding is in agreement with the findings of several studies [7, 22, 50]. However, this finding is in contrast to another study's finding done in Marsabit that indicated MMF contributed more to the MAD since it was the worst performing complementary feeding indicator [39]. The inappropriate complementary feeding practices indicated by the low MAD prevalence contributed to the sub optimal nutrition among this age group in Kwale.

The findings of this research on the rate of MAD was lower than that of the KABP survey in 2017 [17]. In this study it was found that the food security status in a household was a significant predictor of MAD. This result agreed with those of other studies including one done in rural Bangladesh [38].

4.2. Relationship Between Household Food Security and Complementary Feeding Practices

In terms of HDDS which measured food access, this research indicated that only slightly more than a quarter of the households had a highly diverse diet. This showed that the accessibility dimension of food security among households in Lunga-Lunga was deficient. These findings agree with those of Kipkorir [6] which showed that food accessibility had a higher contribution to the food security in Kenya. None of the children from households that had a lower HDDS met MDD and MAD but the ones from households that had a higher HDDS had a high likelihood of having appropriate complementary feeding practices. No households in the fourth and highest wealth quintiles had a lower HDDS because of the higher purchasing power. This showed that households with higher HDDS had higher access to food which is a determinant for appropriate complementary practices and eventually having improved nutrition status. The results are comparable to the ones from another study done in Bangladesh [38] and

agreed with another one done by Swindale and Bilinsky in 2006 [51] which suggested that a higher dietary diversity brings about appropriate diet in households.

Almost half of the households were food insecure as they had either moderate or severe hunger according to household hunger scale. These results agreed with a study that was done to assess the food security situation across Kenya in 2022 and 2024. These studies found out that a half of the population that had been surveyed were facing food insecurity [6, 52]. Majority of those that experienced little to no hunger had a much higher dietary diversity score showing that they had more access to food hence more appropriate diet. These research findings were as well similar to those of another study where only 19.5% of the households in Nairobi urban informal settlements were food secure. It further indicated that infants from households facing food insecurity had a significantly less likelihood of attaining appropriate feeding practices than the ones from food secure households [22].

The results of this study indicated that there was a significant relationship between food security status and complementary feeding practices. These results agreed with a study done in Ethiopia in 2022 [43] where key among the factors significantly related to complementary feeding practices was household food security status. A study done in rural Zambia which studied association between household food security and complementary feeding also found out that children in households experiencing food insecurity had a less likelihood of attaining appropriate complementary feeding practices even after confounding factors were controlled for [53].

As a conclusion, this study's findings affirmed the need to have adequate household food security so as to experience appropriate complementary feeding practices among the children in this age group for optimal nutrition.

4.3. Predictors of Complementary Feeding Practices

This study also investigated the predictors of complementary feeding using multiple logistic regression with the variables that showed a relationship using the univariate analysis. Household food security, wealth index, caregivers' occupation and breastfeeding were the significant predictors of complementary feeding practices. These results were in agreement with several studies including one that was done in Indonesia and one done in Kitui, Kenya in 2014 where households' income was a predictor of complementary feeding [54, 55]. Many other studies including that done in Nairobi's Urban informal settlements showed household food security as a determinant of complementary feeding [27].

5. Conclusions

This study showed that household food security has continued to be a major concern in Lungalunga, Kwale County, Kenya, with most of the households facing different levels of

food insecurity. Complementary feeding practices among children aged 6-23 months were also inappropriate especially in the aspects of MDD and MAD although MMF was relatively better. The findings also showed a significant relationship between household food security and complementary feeding practices indicators emphasizing the association between household food security and nutrition outcomes. Further, wealth index indicated that majority of the households belonged to the lower socioeconomic categories, and this was linked to inappropriate complementary feeding practices. It was also identified that apart from household food security; wealth status, child's breastfeeding status, and caregivers' occupation and level of education were key predictors of complementary feeding practices.

These findings therefore imply that scaling up complementary feeding practices in Lungalunga, Kwale County needs more than just nutrition education. Strategies to improve it must target both food security and sociodemographic and economic factors that hinder the caregivers from giving appropriate diets to their children. Multisectoral interventions that work to improve household food security by enhancing household socioeconomic status through income-generating initiatives, improving agricultural outcomes and general women empowerment would have a direct impact on complementary feeding practices of children 6-23 months old. Additionally, emphasis on continued breastfeeding to two years and beyond and supporting maternal education will improve appropriate complementary practices.

In conclusion, addressing childhood undernutrition through appropriate feeding practices in areas facing food insecurity like Lungalunga in Kwale County, Kenya requires integrated strategies that have both nutrition specific and nutrition sensitive approaches. Improving food security and caregivers' socioeconomic characteristics are key in ensuring optimal complementary feeding practices and ultimately good nutrition and health outcomes.

Strengths of the study

One of the major strengths of this study was the triangulation of household food security status by the use of two validated tools to measure two dimensions of food security. It used household dietary diversity scale (HDDS), which measured the ability of a household to access a variety of foods. It also used household hunger score (HHS), which looked into the experience of hunger or food insufficiency in the households, resulting in more valid and reliable findings.

Limitations of the study

This study used a cross sectional design hence it only gave a reflection of the household food security and complementary feeding practices at a point in time. Seasonal variations in food security of the households and its effect on complementary feeding practices were not captured in this study.

Abbreviations

CHU Community Health Unit

DD	Dietary Diversity
FAO	Food and Agriculture Organization
HDDS	Household Dietary Diversity Scale
HHS	Household Hunger Scale
IYCF	Infant Young Child Feeding
KABP	Knowledge, Attitudes, Beliefs and Practices
KDHS	Kenya Demographic Health Survey
MAD	Minimum Acceptable Diet
MDD	Minimum Dietary Diversity
MIYCF	Maternal Infant and Young Child Feeding
MMF	Minimum Meal Frequency
MOH	Ministry of Health
WHO	World Health Organization

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Author Contributions

Naomi Shume: Conceptualization, Data curation, Formal Analysis, Funding acquisition, Investigation, Methodology, Project administration, Resources, Software, Validation, Visualization, Writing – original draft, Writing – review & editing

Sophie Ochola: Conceptualization, Supervision, Writing – review & editing

Eunice Njogu: Supervision, Writing – review & editing

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Data Availability Statement

The data supporting the outcome of this research work has been reported in this manuscript.

Conflicts of Interest

The authors declare no conflicts of interest.

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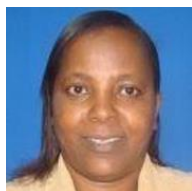
Biography



Naomi Shume is a master's degree in Food Nutrition and Dietetics student at Kenyatta University and holds a bachelor's degree in the same from Kisii University, (2017).



Sophie Ochola is a Professor of Public Health Nutrition in the Department of Food, Nutrition and Dietetics at Kenyatta University, Kenya. She has a PhD in in Nutritional Sciences from the Stellenbosch University, Capetown and MSc in Applied Human Nutrition from University of Nairobi, Nairobi Kenya. Her area of expertise includes Infant and Young Child Feeding particularly in Humanitarian contexts; where she has conducted a lot of research to identify the drivers of acute malnutrition, evaluated programmes and made recommendations for programme improvement. Sophie has published widely on the area of infant and Young child feeding and drivers of child acute malnutrition.



Eunice Njogu is a Senior Lecturer in the Department of Food, Nutrition and Dietetics at Kenyatta University. She received her PhD and MSc Degrees in Food, Nutrition and Dietetics and a B.Ed Degree in Home Economics from Kenyatta University, Kenya. Her area of specialization is community nutrition in relation to farming. She has published widely in peer reviewed journals of which she is also a reviewer. Dr. Eunice does gardening for Ecotherapy a strategy to promote physical and mental well-being.

Research Field

Naomi Shume: Food security, Maternal and Child health and nutrition.

Sophie Ochola: Maternal and Young Child Nutrition particularly in humanitarian context, Overweight and Obesity and the accompanying Non- Communicable Diseases, Adolescent Nutrition, evaluation and designing of programmes.

Eunice Njogu: Food and nutrition security and health, maternal and child nutrition and nutrition throughout the lifecycle.