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Maternal Knowledge and Complementary Feeding Practices and Their Relationship with Nutritional Status Among Children 6-23 Months Old In Pastoral Community of Marsabit County, Kenya: A Cross-Sectional Study

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Abstract

Appropriate complementary feeding practices have positive impact on health and growth of children aged 6-23 months. Little is known about complementary feeding practices among the pastoralists. The aim of this study was to document the influence of maternal knowledge on child feeding and complementary practices on the nutritional status of children aged 6-23 months amongst a pastoral community in Kenya. A WHO standard validated questionnaire was used to collect data from 289 randomly selected mothers/primary caregivers and their children aged 6-23 months. The interviews were conducted through face-to-face in a one-time household visit. The findings showed that half (50.2%) of the children received complementary foods at the age of six months. The proportion of breastfed and non-breastfed children that achieved the recommended Minimum Meal Frequency (MMF) was 28.7% and 2.6% respectively. About one-quarter (23.9%) achieved the recommended Minimum Dietary Diversity (MDD). A total of 5.9% achieved the Minimum Acceptable Diet (MAD). Majority of the mothers/caregivers (95.1%) knew that children should be encouraged to feed while 61.6% knew that children should be fed more frequently during and after illness. The timing of introduction of complementary feeding ([OR]=0.307, P=0.001) and child's dietary diversity ([OR]=3.112, P=0.020 were predictors of wasting among the children while timing of introduction of complementary feeding

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([OR]=0.226, P=0.000) and maternal knowledge on the duration of breastfeeding ([OR]=6.359, P=0.012) predicted child underweight. Complementary feeding practices are not optimal and the nutritional status of the children is poor. Complementary feeding practices predicted child nutritional status whereas maternal/caregivers' knowledge on complementary feeding practices had limited impact on child nutrition status.

Introduction

Infant and young child feeding is critical for child's health and development since it has direct influence on how a child grows. World Health Organization (WHO) recommends that mothers be empowered and supported to initiate breastfeeding within one hour of birth, practice exclusive breastfeeding for the first six months of life and continue breastfeeding until the child is two years old or more in addition to appropriate complementary feeding.[1]

Malnutrition in young children is majorly a result of poor practices of complementary feeding.[2] Complementary feeding practices have direct effects on child nutritional status and impacts child growth, development and survival.[3] The effects of inappropriate feeding practices include poor mental and social development and reduced productivity.[4] The first two years of a child's life are critical for ensuring appropriate growth, health and development through optimal feeding. Improving infant and young child feeding practices during this period when they are most vulnerable is therefore crucial.[1] Promoting appropriate practices in infant and young child feeding for children below two years is therefore recommended to improve their health and development.[3]

Children from the developing countries are more affected by poor growth that occurs due to inappropriate complementary feeding practices than those from developed countries. Compromised child growth and development peak during the period when complementary foods are initiated and when breast milk consumption decreases. Poor child feeding practices are considered as one of the major causes of malnutrition. In particular, lack of knowledge on appropriate child feeding practices and cultural practices contribute to poor child nutritional status. Some of the inappropriate feeding practices include too early or too late introduction of complementary foods, lack of dietary diversity and inadequate quantity of food.[5]

Appropriate complementary feeding depends on accurate information on child feeding among the caregivers. Inadequate or limited maternal knowledge on what to feed a child on, when and how to feed a child is often a major cause of malnutrition compared to food unavailability.[4] In addition, lack of knowledge about the risks associated with poor child feeding practices and the outcome on children's health, development and survival has resulted to limited actions and interventions to promote optimal practices.[6] Nutrition education targeting caregivers on child feeding practices can result into improved child nutritional status and child survival.[7] Findings of a research conducted in rural China, for example, showed that nutrition education activities conducted by healthcare providers have the potential to effectively and positively transform caregivers' practices on complementary feeding and to promote infants' growth and development.[8]

In Kenya, 16% of children are given pre-lacteals before initiation of breastfeeding and 61% of those below six months of age are exclusively breastfed. Initiation of complementary feeding starts before the recommended age of six months for many children. By the age of 4-5 months, 58% of breastfeeding children are fed on semi-solid foods. Less than half (41%) of children 6-23 months of age receive diets with minimum dietary diversity.[9]

There is limited information with regard to complementary feeding practices and their relationships with nutritional status of children among the pastoralists in Kenya. The residents of Laisamis Sub-county in Marsabit County, the study site, are majorly pastoralists. There are many developmental and humanitarian organizations implementing nutrition and nutrition-related activities

in partnership with the County government with the goal of reducing acute malnutrition among the under-fives. Despite these efforts the prevalence of acute malnutrition remains high. The major aim of nutrition surveys conducted in the study area is to establish the prevalence of malnutrition rather than investigating the drivers of malnutrition. Furthermore, there is limited scientific data on maternal knowledge on complementary feeding and the practice of complementary feeding among children 6-23 months old among pastoralist communities in Kenya. The aim of this study therefore was to establish maternal knowledge on complementary feeding and the practices of complementary feeding and their relationships with child nutritional status in a pastoralist community.

Materials and Methods

Study Design

This was a community-based cross-sectional study to investigate the relationship between complementary feeding practices and nutritional status of children 6-23 months old in Laisamis sub-county, Marsabit County.

Study Area

The study was conducted in Laisamis sub-county of Marsabit county, northern Kenya. Majority of the inhabitants (89.9%) are pastoralists with insignificant practices of crop farming and fishing in a few areas. The sub-county lies in an arid and semi-arid (ASAL) area and experiences chronic food insecurity due to unreliable rainfall.

Inclusion Criteria for Study Participants

An inclusion criterion was mothers/primary caregivers and children aged 6-23 months pairs were recruited into the study because the mothers/caregivers were able to provide information about the child feeding practices. Secondly, the mothers/primary caregivers were included in the study if they together with their children had lived in Laisamis sub-county for at least six months before the study. This period was considered adequate for the mothers/caregivers and their children to have had adequate experience living in the study area to influence the complementary feeding practices.

Exclusion Criteria

Children 6-23 months old with congenital malformation such as cleft palate, limb deformities and chronic diseases were excluded from the study because these conditions can have adverse effects on complementary feeding practices and nutritional status of the children.

Sample Size and Sampling Technique

A random sample of 289 mother/caregiver child pairs was enrolled into the study.

A two-stage cluster sampling technique was used to select the study population. In stage one, two out of five wards in Laisamis sub-county were randomly selected to participate in the study. In stage two, a total of 23 villages from the two wards were randomly selected based on proportion to population size. At the village, simple random sampling was used to select households to be visited among those with children 6-23 months old.

Data Collection Instruments and Data Collection Methods

A semi-structured researcher-administered questionnaire was used to collect data in a one-time household face-face interview with mothers/primary caregivers of children 6-23 months old. The questionnaire consisted of questions that solicited information on the socio-demographic characteristic of mothers/caregivers as well their knowledge on complementary feeding and on practices of complementary feeding. The WHO standard and validated questionnaire on Infant and Young Child Feeding Practices which is widely used in Kenya and other similar circumstances for studies on infant and young child feeding practices was used to collect data in this study.[10] Complementary feeding practices were determined based on 24-hour recall in accordance with the WHO recommendations. The questionnaire was contextualized to the study objectives and translated from English to the local language (Samburu) that is commonly spoken in the study site. The questionnaire was back translated to English to ensure accurate translation. The questionnaire was pretested for content validity and reviewed based on the feedback.

Weight and length measurements were taken from the children using bathroom scale (SECA model) and length board. Weight was measured twice and the mean taken if the two measurements were within acceptable margin of error and to the nearest 0.1kg. Child's length was also measured twice and mean

of the two measurements taken if they were within the acceptable margin of error and to nearest 0.1cm.

Questionnaire Validity and Reliability

To ensure that data collection instruments measured what they purported to measure, questionnaire was presented to experts in nutrition department of Kenyatta University to establish content validity. The data collection instruments were then reviewed based on the feedback given. Test-retest reliability of the research instrument was established during pretesting. Two pretest sessions with a difference of four days were conducted among 10 caregivers selected from one of the villages not sampled for data collection. Test retest reliability was established by examining the consistency of pre-test responses and reliability co-efficient calculated. The reliability co-efficient was 0.87 and therefore the questionnaire was considered reliable.

Data Analysis

Anthropometric data was entered and analyzed using ENA for SMART Software version 2010 and then exported to SPSS version 20 for cross analysis with other variables. Descriptive statistics (frequency, mean, median, standard deviation and percentages) were used to describe socio-demographic and economic characteristics of the study population, complementary feeding practices and maternal knowledge on feeding practices. Chi –square test was used in univariate analyses to test for association between nominal variables. Logistic regression was used in multivariate analysis to identify the predictors of nutritional status.

Definition of complementary feeding practices and nutritional status

- Complementary feeding – Refers to the process of giving solid, semi-solid or soft foods to infants in addition to breast milk. The period for complementary feeding is 6-23 months of age even though breast feeding should continue to two years or beyond.[1]
- Dietary diversity – Refers to food variety consumed from various food groups over a particular period of time. To meet the recommended dietary diversity, children aged 6-23 months old need to be given foods from at least four out of seven food groups.[1]
- Nutritional status – In this study nutritional status refers to anthropometric indices; weight for height Z-score (acute wasting), height for age Z-score (stunting) and weight for age Z-score (underweight). Children with <2 Z-score from median reference were termed as wasted, stunted or underweight.[3]
- Meal frequency – Refers to the number of times a breastfed and non-breastfed child aged 6-23 receives solid, semi-solid or soft foods during the previous 24 hours. This includes milk feeds given to non-breastfeeding children.[10]
- Minimum acceptable diet – It is a composite indicator that shows children 6-23 months who receive both minimum dietary diversity and the minimum meal frequency during the previous 24 hours.[10]

WHO Indicators of Complementary Practices

- Timing of introduction of complementary foods – Refers to introduction of solid, semi-solid or soft foods to children at the age of 6-8 months.[10].
- Minimum meal frequency (MMF) – This is the proportion of breastfed and non-breastfed children 6-23 months who receive solid, semi-solid or soft foods the minimum number times or more.[10]
- Minimum dietary diversity (MDD) – It is the proportion of children 6-23 months of age who receive foods from four or more food groups out of the seven recommended food groups.[10]
- Minimum acceptable diet (MAD) – It is a composite indicator that combines the proportion of children 6-23 months who receive both minimum dietary diversity and minimum meal frequency. This is an indicator of the quality diet.[10]

Ethical Considerations

The study received ethical approval from Kenyatta University, Nairobi. Ethical Clearance Committee (Application Number PKU/313/1289). The respondents gave informed consent by either signing or thumb printing before being recruited to participate in the study.

Table 1: Demographic and socio-economic characteristics of mothers/caregivers and household heads

Maternal/caregivers and household head characteristics	N= 289	
	N	%
Maternal/caregivers age (years)		
<20 years	13	4.5
20-29 years	186	64.4
30-39 years	76	26.3
40 years and above	14	4.8
Marital status		
Single	8	2.8
Married	270	93.4
Separated	8	2.8
Widowed	3	1
Occupation of the mother/caregiver		
Employed (salaried)	8	2.8
Petty trade	15	5.2
Casual labour	7	2.4
House wife	253	87.5
Trader	6	2.1
Occupation of the household head		
Employed	10	3.6
Merchants/trader	18	6.5
Small scale trading	15	5.4
Casual labour	44	15.8
Fishing	10	3.6
Pastoralists	175	63
None	6	2.1
Education level		
No education	219	75.8
Primary	43	14.9
Secondary	15	5.2
College	9	3.1
Tertiary	2	0.7
University	1	0.3
Family's main source of income		
Employed (formal)	16	5.5
Casual labor	41	14.2
Sale of livestock	190	65.7
Small scale business	42	14.5
How food is obtained		
Farming	12	4.2
Buying	85	98.6
Food aid	45	15.6
Domestic animal products	177	61.2
Fishing	7	2.4
Estimated %ge of income allocation to food		

≥70%	173	59.9
(30-69)%	58	20.1
≤30%	30	10.4
No specific allocation	28	9.7
Household size (mean)	**5.39 (±2.0)**	

Results

Socio-Economic and Demographic Characteristics of The Mothers/Caregivers and Household Heads

A total of two hundred and eighty nine (289) mothers/primary caregivers representing the same number of households were interviewed during the study. Majority of mothers (64.4%) were aged 20-29 years with those aged above 40 years being 4.8%. Most of them (93.4%) were married and 87.5% were house wives and not engaged in any form of income generating activities. Only 2.8% were formally employed (Table 1).

Majority (63%) of the household heads was pastoralists and 15.8% were casual labourers (Table 1). Only 3.6% were in formal employment. Three quarters (75.8%) of the household heads had no formal education whereas 14.9% had primary level of education. About two-thirds (65.7%) of the households depended on sale of livestock as the main source of income whereas 14.5% were involved in small scale businesses. Almost all the families (98.6%) obtained their food through purchase, 61.2% from domestic animal products and 15.6% from food aid. A large proportion of households (59.5%) allocated 70% of the total income to food (Table 1).

Characteristics of the Children

Both sexes were almost equally represented with 52.2% males and 47.8% females. More than a third (36.0%) of the children were aged between 12 – 17 months, 33.6% were aged 6 – 11 months while the proportion of those aged 18 – 23 months was 30.4%. The mean age was 14.73 (±4.97) months.

Table 2: Prevalence of under nutrition among the children 6-23 months old

	All n = 289	Boys n = 151	Girls n = 138
Wasting	(63) 21.8 % (14.7 - 31.1 95% C.I.)	(39) 25.8 % (13.9 - 42.9 95% C.I.)	(24) 17.4 % (12.3 - 24.0 95% C.I.)
Stunting	(75) 26.0 % (16.3 - 38.7 95% 95% CI.)	(48) 31.8 % (19.3 - 47.5 95% 95% CI.)	(27) 19.6 % (10.9 - 32.5 95% C.I.)
Underweight	(73) 25.3 % (20.0 - 31.3 95% C.I.)	(44) 29.1 % (20.2 - 40.0 95% C.I.)	(29) 21.0 % (13.8 - 30.7 95% C.I.)

Nutrition Status of the Children

About a fifth of the children (21.8%) were wasted with more boys (25.5%) being wasted than girls (17.4%). Overall 26.0% of the children were stunted with a higher percentage (31.8%) of boys being stunted than girls (17.4%). A similar scenario was observed for underweight children, 25.5% with 29.1% boys and 21.0% girls underweight respectively (Table 2).

Complementary Feeding Practices

About half (50.2%) of the children received complementary foods at the age of 6 months (Table 3). The proportion of breastfed and non-breastfed that achieved the recommended Minimum Meal Frequency (MMF) per day was 28.7% and 2.6% respectively. Less than a quarter (23.9%) attained the Minimum Dietary Diversity (MDD) and

only 5.9% attained Minimum Acceptable Diet (MAD) (Table 3).

Maternal knowledge on Complementary Feeding Practices

A large majority of the mothers (95.1%) knew that children should be encouraged to eat even when they have low appetite; 79.2% knew the correct age when children should be introduced to complementary feeding and the lowest knowledge exhibited was about feeding children more frequently during and when recovering from an illness as reported by 61.6% of the mothers/caregivers (Table 4).

Relationships between Complementary Feeding Practices and Child Nutritional Status

A chi-square test revealed significant relationships between the time of initiation of complementary feeding and the three indicators of nutrition status; underweight, wasting and stunting (Chi-square test = 23.33, p=0.000, Chi-square test =12.428, p=0.002 and Chi-square test =10.823, p=0.004 respectively (Table 5).

Association between Maternal Knowledge on Complementary Feeding and Child Nutritional Status

Mothers who reported that the duration of breastfeeding should be two years and beyond were less likely to have children who were underweight (Chi-square test =7.323, p=0.017) compared to those who stated otherwise. The children of those mothers who knew that children should be fed more frequently and given food more frequently during and after illness were less likely to have underweight children (Chi-square test =12.028, p=0.002). Mothers who responded positively that complementary feeding before six months poses health risk to the child were less likely to have stunted children (Chi-square tests =8.025, p= 0.033) than those who responded negatively. Mothers who stated that introduction of complementary feeding should start after a child attains six months of age were more likely to have underweight children (Chi-square test 6.542, p= 0.030) than those who knew that children should be introduced to complementary feeding at 6 months (Table 6).

Table 3: Complementary feeding practices

	N= 289	
	N	**%**
Timing of complementary feeding		
Not yet introduced	15	5.2
Early (before 6 months)	15	5.2
Timely introduction (6 months)	145	50.2
After 6 months	114	39.4
Minimum meal frequency (MMF)		
Breastfed		
6-23 months N=251		
Achieved	72	28.7
Non-breastfed		
6-23 months N= 38	1	2.6
Achieved		
Minimum Dietary Diversity (MDD)	64	23.9
Minimum Acceptable Diet (MAD)	17	5.9

Table 4: Maternal knowledge on various aspects of complementary feeding practices

	N= 289	
	N	**%**
Complementary feeding should start when a child attains 6 months		
Yes	229	79.2
No	51	17.7
Don't know	9	3.1
Introduction of complementary feeds before 6 months poses health risk to child		
Yes	207	71.6
No	65	22.5
Don't know	17	5.9
Late introduction of complementary foods can result to poor nutrition status of the child		
Yes	224	77.5
No	50	17.3
Don't know	15	5.2
Complementary foods refer to solid and semi-solid foods		
Yes	234	81
No	35	12.1
Don't know	20	6.9
Breastfed children 6-23 months old should take 2-3 meals with snacks in between the meals		
Yes	259	89.6
No	21	7.3
Don't know	9	3.1
Children 6-23 months old should take variety of foods		
Yes	257	88.9
No	24	8.3
Don't know	8	2.8
Breastfeeding should continue up to two years and beyond		
Yes	244	84.4
No	30	10.4
Don't know	15	5.2
Children should be encouraged to feed even if they have low appetite		
Yes	275	95.1
No	12	4.2
Don't know	2	0.7
Children should be fed more times during and after illness		
Yes	178	61.6
No	105	36.3
Don't know	6	2.1
It is important to enrich children's food to make it energy and nutrient dense		
Yes	265	91.7
No	18	6.2
Don't know	6	2.1

Table 5: Relationship between complementary feeding practices and child nutritional status

	N= 289		**Chi-square P-Value**
	Childs nutrition status		
Timing of complementary Feeding	**Underweight**		
	Underweight	Normal	0.000
Not yet introduced	6(40.0%)	9(60.0%)	
Early (Before 6 months)	4(26.7%)	11(73.3%)	
Recommended time (6 Months)	19(13.1%)	126(86.9%)	
Late (After 6 months)	44(38.6%)	70(61.4%)	
	Wasting		
	Wasted	Normal	0.002
Not yet introduced	4(26.7%)	11(73.3%)	
Early (Before 6 months)	2(13.3%)	13(86.7%)	
Recommended time (6 Months)	19(13.1%)	126(86.9%)	
Late (After 6 months)	35(30.7%)	79(69.3%)	
	Stunting		
	Stunted	Normal	0.023
Not yet introduced	0(0%)	0(0%)	
Early (Before 6 months)	7(41.2%)	10(58.8%)	
Recommended time (6 - 8 Months)	28(18.0%)	128(82.0%)	
Late (After 8 months	39(84.8%)	7(15.2%)	
Minimum meal frequency (MMF)	**Wasting**		
	Wasted	Normal	0.011
Achieved MMF	12(16.4%)	61(83.6%)	
Did not achieve MMF	44(20.4%)	172(79.6%)	
	Stunting		
	Stunted	Normal	0.028
Achieved MMF	8(10.9%)	65(89.1%)	
Did not achieve MMF	39(18.1%)	177(81.9%)	
	Wasting		
Minimum dietary diversity (MDD)	Wasted	Normal	0.005
Achieved MDD	6 (10%)	54(90.0%)	
Did not achieve e MDD	63(27.5%)	166(72.5%)	
	Stunting		
Achieved Minimum Acceptable Diet	Stunted	Normal	0.035
Did not achieve MDD	11(14.9%)	63(85.1%)	
	58(27%)	157(73%)	

Table 6: Maternal knowledge on complementary feeding and child nutritional status

	N= 289			Chi-square P-Value
		Childs nutrition status		
Maternal knowledge		**Underweight**		
		Underweight	Normal	0.017
Breastfeeding should continue up to two years and beyond	Yes	56(19.4%)	188(65.1%)	
	No	14(4.8%)	16(5.5%)	
	Don't know	3(1.0%)	12(4.2%)	
		Underweight		
		Underweight	Normal	0.002
Children should be fed more during and after illness.	Yes	33(11.4%)	145(50.2)	
	No	39(13.5%)	66(22.8%)	
	Don't know	1(0.4%)	5(1.7%)	
		Underweight		
		Underweight	Normal	0.030
Complementary feeding should start when child attains six months of age	Yes	50(21.8%)	179(78.2%)	
	No	20(39.2%)	31(60.8%)	
	Don't know	3(33.3%)	6(66.7%)	
		Stunting		
		Underweight	Normal	0.033
Initiation of complementary foods before six months of age poses health risk to the child.	Yes	61(29.5%)	146(70.5%)	
	No	12(18.5%)	53(81.5%)	
	Don't know	1(5.9%)	16(94.1%)	

Table 7: Predictors of nutritional status

Predictors of child nutritional status			
	Odds ratio	**95% CI**	**P value**
		Complementary feeding practices	
		Underweight	0.000
Timing of complementary feeding	0.226	0.111-0.457	
Timing of complementary feeding		**Wasting**	0.001
	0.307	0.152-0.618	
Minimum dietary diversity		**Wasting**	0.02
	3.112	1.198-8.080	
		Maternal knowledge on complementary feeding	
		Underweight	0.012
Breastfeeding should continue up to two years old and beyond	6.359	1.133-5.687	

Predictors of Child Nutritional Status

Factors that had significant relationship with child nutritional status in bivariate analysis (chi-square test) were subjected to a multinomial logistic regression analysis to establish the predictors of child nutritional status (Table 7). In terms of complementary feeding practices, timing of the introduction of complementary feeding was a predictor of underweight and wasting whereas minimum dietary diversity was a predictor of wasting. Maternal knowledge was also a predictor of nutritional status of children. Maternal/caregivers' knowledge about the duration of breastfeeding was a predictor of underweight (Table 7).

Discussion

Prevalence of Undernutrition

The prevalence of stunting in the study site was high (26%) an indication of chronic malnutrition among the children. The stunting rate compares with that of the findings of nutrition survey conducted in Marsabit.[11] A higher percentage of boys were stunted compared to the girls and this finding also compares with findings of a nutrition survey conducted in Isiolo County, a neighbouring ASAL region whose residents are also pastoralists.[12] The prevalence of underweight was high (25.3%) and this was in agreement with nutrition survey findings for Turkana County and a similar study conducted in Aceh Besar District, Indonesia.[13,14] The underweight rate was however lower compared to that of Marsabit County.[11] The study results revealed higher prevalence of underweight among the boys than girls concurring with the results of nutrition surveys conducted in Turkana and Samburu counties in northern Kenya.[13,15] The prevalence of wasting was also high among the children; with a higher prevalence among the boys as demonstrated in surveys conducted in the neighbouring ASAL counties of Isiolo and Samburu.[12,15] The higher prevalence of underweight, stunting, and wasting among boys than girls in this study is consistent with the national rates in Kenya.[9] Studies in other African countries have also demonstrated similar findings, for example, a study conducted in Nigeria by Ekerette *et al.,*[2]

The high malnutrition prevalence in Laisamis sub-county could be attributed to the chronic food insecurity due to its dry climatic conditions and consequently affecting nutritional status of children. For improved nutritional status to be achieved among children 6-23 months old in Laisamis sub-county, interventions should also address food availability and accessibility since this has been reported to be a major limitation to appropriate child feeding practices in the Knowledge, Attitudes, Practices and Beliefs (KAPB) surveys conducted in Marsabit.[16]

Complementary Feeding Practices

In this study, majority (86.9%) of the children 6-23 months old were still breastfeeding and this is comparable to the Kenya national rate.[9] The percentage still breastfeeding was however higher than that reported in a KAPB survey conducted in Marsabit county (69.0%) and Samburu county (41.1%).[16,17] A study conducted at Lahore in Pakstani by Hasnain *et al.,* showed that majority of children 6-23 months of age were still being breastfed alongside complementary feeding.[18]

Initiation of adequate and safe complementary foods at the appropriate time is essential for optimal health and improved child nutritional status especially during the period of increased nutritional needs.[19] In the current study, half of the children were appropriately initiated to complementary foods at the age of 6 months. This percentage was double that reported in a study conducted in Nigeria2 but similar to those of researches done in Indonesia and Napel.[14,20] The percentage of children who were introduced timely to complementary feeding in this study was higher than that reported in KAPB surveys conducted in other arid and semi-arid (ASAL) areas in Kenya; Marsabit County (44.3%), Samburu County (47.9%) and Turkana County (36.0%)[16,17,21] but lower than that of a similar study done in the informal settlement in Nairobi, Kenya.[22.] More than one third of the children in this study were introduced to complementary foods late (after six months) concurring with findings of a KAPB survey for Turkana County and a similar study done in Pakistan.[21,23] This implies that many children were not getting the right quantity and quality of nutrients for their growth and development because breastmilk is not adequate to provide all the required nutrients from 6 months of age.

Minimum Meal Frequency (MMF) is considered a proxy for energy intake from foods other than breastmilk. Majority (74.7%) of the children in this study did not achieve MMF unlike that reported in a

study conducted in Jigjiga, Ethiopia, a town that lies in a region where about 85% of population depends on pastoralism or agro-pastoralism for livelihood.[24] The findings of this study differed with those of a KAPB survey conducted in Marsabit County, (Laisimis sub-county the study site is part of the Marsabit County) that showed that close to half of the children 6-23 months old attained minimum meal frequency.[16] This difference could partly be attributed to the fact that in Marsabit County there are some regions that have favourable climatic conditions for crop farming and therefore have better food security status and accessibility to a wider variety of foods. Laisamis sub-county is mainly arid with no significant practice of crop farming.

Growth, development and survival of all infants from the age of six months onwards depends largely on additional provision of foods supplied through complementary foods in order to help them grow into healthy and active adults. They need to be fed on an appropriate diet that provides all the nutrients and energy required for normal growth and vitamins and minerals to alleviate their hidden hunger and keep them strong.[23] The findings of this study showed poor complementary feeding in terms of dietary diversity with less than one-quarter of the children having attained the Minimum Dietary Diversity (MDD). Studies have shown varying rates in the achievement of MDD among children. Some studies have shown high rates of MDD among children such as those conducted in Nigeria and Ethiopia.[25,26] In contrast, studies such as that conducted in Nigeria by Ekertte have demonstrated low rates of MDD among children.[2] The finding of this study in regard to MDD was similar to that of a KAPB survey done in Samburu County, Kenya.[17]

Researches conducted in ASAL regions have shown low MDD. Nutrition surveys for Marsabit and Turkana Counties revealed low MDD of 15.5%, and 19.5% respectively.[16,21] The low MDD could be attributed to the issue of food insecurity leading to poor food unavailability and inaccessibility.

In this study, a very small proportion (5.9%) of the children achieved Minimum Acceptable Diet (MAD), implying low quality diet consumed by a majority of the children. This is similar to findings of a study done in Ethiopia.[26] This low rate of the attainment of MAD compares to those of the nutrition survey findings conducted in Laisamis (5.4%) and North Horr (4.8%) sub-counties of Marsabit County.[16] The finding however differs with that of the larger Marsabit County that reported a higher proportion (15.6%) of children 6-23 months having achieved MAD16. In this study, the low MAD may be attributed to the consumption of diet with low diversity of foods and low feeding frequency probably due to prolonged food insecurity in the region.

Some cultural beliefs have also been identified as hindrances to appropriate child feeding practices. KAPB surveys conducted in Marsabit and Samburu counties in Kenya reported that some foods are not fed to children below two years of age because they are associated with delayed speech and ill health.[16,17] Appropriate child nutrition messages (including those addressing cultural hindrances) should be developed and up-scaled through behavior change communication.

Maternal Knowledge on Complementary Feeding and Child Nutritional Status

Accurate information on complementary feeding is crucial for improved child feeding practices. In addition, focused support from the family and community members together with a well-established health care system can positively contribute to improved practices and behaviors around child feeding.[4] This study revealed high maternal knowledge regarding complementary feeding that does not necessarily translate into appropriate complementary feeding practices and consequently improved child nutritional status. This finding compares to those of surveys and studies conducted in other parts of Kenya as well as Pakistan.[17,21,22,23] A study conducted in Jigjiga town in Ethiopia also demonstrated high maternal knowledge on complementary feeding.[24] In this study the proportion of mothers/primary caregivers who knew that late introduction of complementary feeding could result to child malnutrition was higher compared to that of a study done in Nigeria25. Maternal knowledge on child feeding frequency was consistent with that of a study conducted in Lahore, Pakistan that revealed lower maternal knowledge on child feeding frequencies18. The reason for high maternal knowledge on complementary feeding practices in Laisamis sub-county could probably be

due to the presence of many Non-Governmental Organizations (NGOs) and Community Based Organizations (CBOs) that implement nutrition programmes focusing on behavioral change in collaboration with the County government. The behaviour change communication focuses on the promotion of optimal infant and young child feeding practices.

As a whole, only one aspect of maternal knowledge (the correct duration of breastfeeding) was associated with child nutritional status. Knowledge is a pre-requisite for optimal practices in child feeding. The results of this study has demonstrated that despite the high maternal knowledge on complementary feeding practices – this knowledge did not to a large extent lead to optimal practices, implying that factors other than knowledge influenced complementary feeding practices to a greater extent. Similar findings have been shown in many studies investigating the relationship between maternal knowledge and complementary feeding practices. KAPB surveys conducted in, Marsabit, Samburu and Turkana Counties in Kenya revealed high maternal knowledge on complementary feeding practices that had limited positive effects on child nutritional status.[16,17,21] A study in Ethiopia by Yimer also revealed high maternal knowledge with no significant association with complementary feeding practices.[24] Some studies have however demonstrated the contrast, that maternal knowledge has a positive effect on child nutritional status. A study done in Nairobi, Kenya indicated that maternal knowledge on complementary feeding had positive effect on child feeding practices and nutritional status.[22]

Predictors of Nutritional Status

The main predictors of poor child nutritional status were inappropriate child feeding practices. Correct timing of initiation of complementary feeding and minimum dietary diversity were predictors of wasting and underweight among the children. These findings are in line with those of other studies conducted in Kenya[22,27] and also reported in Cross River State, Nigeria by Ekerette *et al.,*[2] The findings of this study are however not similar with those of a study done in Indonesia that revealed no relationship between complementary feeding and child nutritional status.[14] Maternal knowledge was not a major predictor nutritional status. The findings of this study demonstrate the need to address context-specific factors in the promotion of appropriate child feeding practices because there is no one-fix for all the challenges experienced.

The major strength of this study is its contribution to the body of knowledge of complementary feeding practices among pastoralist communities which has hitherto received limited attention in research.

The major limitation of the study is that, being a cross-sectional study design, the findings do not reflect the effect of seasonality on complementary feeding practices in the study area.

Conclusions

The complementary feeding practices in the area of study are not optimal and the nutritional status of the children 6-23 months old is poor. Mothers'/ caregivers' knowledge in regard to complementary feeding is high but with no positive impact on nutritional status of children in Laisamis sub-county. Efforts to improve nutritional status of the children in Laisamis sub-County should go beyond imparting knowledge on appropriate feeding practices to tackling household food insecurity which is the major reason for inappropriate complementary feeding practices as reported in other studies conducted in the semi-arid regions such as the study area.

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Conflict of interest

The authors declare that no conflict of interest in this article.

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