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Nutrition Quality of the Child Feeds and Child Feeding Practices of Children Aged Between 6 and 24 Months in Marsabit County, 2023

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Abstract

Child feeding practices are considered one of the determinants of malnutrition in under-fives. Inadequate feeding practice is often a greater factor of malnutrition than lack of food. Globally, 1 in 3 children under five are not obtaining adequate nutrition and thus are not growing well. In ASAL regions of Kenya, the main driver of acute malnutrition is poor dietary intake coupled with inappropriate feeding practices. In Marsabit County, undernutrition prevalence varies in different sub-counties. There are areas where malnutrition is very high whereas other areas are relatively low. In the same setting, however, there are children with good health and nutritional status. Therefore, this study aimed to determine the nutrition quality of the child feeds used among children aged 6 to 24 months in Marsabit County. This study adopted an experimental design for laboratory analysis of the food samples. The snowballing technique was used to select 9 women groups with children aged 6-24 months for participatory assessment of child feeding practices. Focus Group Discussion guides were used to obtain qualitative data.

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A child food sample collection guide was used during the collection of child feeds for laboratory analysis. Univariate analysis was used to obtain the frequency distribution of nutrition quality of the child feeds. Laboratory analysis results on the nutrient content of child foods indicated high nutrient levels, especially for foods that have gone through fermentation, germination, roasting, drying, and frying processes. The study concludes that the nutritional quality of feeds has a significant effect on child-feeding practices in Marsabit County, Kenya. Based on the findings this study recommends that the Marsabit County government should promote traditional food processing methods, such as fermentation, germination, roasting, drying, and frying, through community nutrition programs to enhance the nutrient content of child foods. These programs should focus on educating mothers and caregivers on how to effectively apply these methods to local foods to improve their nutritional value.

Keywords: Nutrition Quality of the Child Feeds, Children Aged 6 to 24 Months in Marsabit County

Introduction

Globally, 1 in 3 children under the age of five are not obtaining adequate nutrition and thus are not growing well (UNICEF, 2019). Data indicate that the burden of malnutrition is much higher in South Asia and Africa relative to other parts of the world (World Bank, 2023). Inadequate infant and young child feeding practices contribute to high rates of malnutrition in Kenya (USAID, 2018). In ASAL regions as well, the main driver of acute malnutrition is poor dietary intake exacerbated by reduced milk production and consumption, which forms the main diet for children (Integrated Phase Classification, 2021). Childhood malnutrition results from several factors that are related to sub-optimal nutrition and recurrent infectious diseases such as diarrhea and acute respiratory infection (UNICEF, 2013). Nutrition and health outcomes of a child depend on the level of nutrients consumed in daily food intake. Consumption level is determined by the quality and quantity of a meal. High quality and enough quantities to meet body needs results in good health whereas consumption of poor quality and inadequate quantity results in health deficits (Goldbohm et al., 2016).

Over the years, child malnutrition at the population level has received attention and recognition in developing countries, especially in resource-limited settings. Poor areas are often considered to be lacking food resources, ASAL regions in Kenya for instance. Poor nutrition status reported across the ASAL counties is mostly due to poor dietary intake coupled with inappropriate feeding practices. Marsabit County, in particular, poor feeding practices as a result of food insecurity brought about by prolonged drought contribute to the

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limited availability of varieties of food in the community. Such situations continue to undermine the health and nutrition status of young children. Although exclusive breastfeeding rates are very high in Marsabit, (84.54%), malnutrition rates are still very high. According to Standardized Monitoring and Assessment of Relief and Transitions (SMART) survey findings conducted annually in the county, varying trends of undernutrition prevalence have been reported in different sub-counties. There are areas where malnutrition is very high whereas other areas are relatively low. In the year 2022 for instance, severe acute malnutrition prevalence in Laisamis was 5.5%, in North Horr it was 4.4%, in Moyale it was 2.2% and in Saku Sub County it was 1.2%. However, in the same sub-counties, within the same environment, there are children with optimal health and nutrition status. This could be attributed to caregivers successfully applying positive deviant child-feeding practices that the caregivers of undernourished children are not practicing. Therefore, this study aimed to determine the nutrition quality of the child feeds used among children aged 6 to 24 months in Marsabit County.

Methods

A cross-sectional study design was used to collect data. Both quantitative and qualitative approaches were employed.

Analytical food samples were calculated according to Cochran, 1977 as follows:

$$n = \frac{\sigma^2 z^2}{e^2}$$

Where;
n = sample size (unit)
σ= standard deviation of the sample (σ = 15)
e = acceptable sampling error ≈ (±5%)
z = z value at the reliability level or significance level is 1.96 corresponding to 95%
Therefore,

$$n = \frac{15^2 \; x \; 1.96^2}{5^2} = 35 \text{ samples}$$

However, according to Cochran (1977), the cost of sampling can be included in the equation as well. Therefore, a suitable number of samples based on the available cost estimates for nutrient analysis in the laboratory was:
Cost of one sample = Ksh 30,800,
Available total cost for nutrient analysis= 460,000,
Therefore, the final samples to be analyzed = $\frac{460000}{30800}$ = 15 samples.

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Qualitative data were collected through free uninterrupted conversations between the women during focus group discussions. The FGDs were based on narrative interviews that were recorded in totality for later transcription. The FGD discussants were identified through the snowball sampling technique, with the entry point being the women groups from various communities in the county. A total of 9 women groups were included in this process. The women from the 9 groups provided child feed samples for laboratory analysis. A total of 10 samples were collected. This is shown in Table 1.

Table 1: Sample foods for laboratory analysis

No	Women Group	Child foods collected for Nutrient content analysis
	Jiru Dansa Women Group	1. Koche: Dried mix (Barley, goat meat-mix of mandazi eggs, flour, milk, sugar, water, oil, ghee, cardamom urgo, sugar
	Sakuye Cultural Group	1. Porridge mix: maize, beans (little amount), peanuts (roasted), cassava, sorghum palm/pearl millet, omena (sardines)
	Dub Goba Women Group	1. Porridge mix: Cassava Omena (sardines), wheat, groundnut, sorghum, millet, barley, salt
	Biftu Cultural Group	1. Porridge mix: sorghum, omena (sardines), amaranth seeds/ rafu, peanut, fenugreek, barley, cardamom, teff, maize, beans 2. Koche: Meat, ghee, barley, sugar
	Kayolaida Women Group	1. Qaboth: Maize, barley, sorghum (Germination process)
	Star Women Group	1. Porridge mixture (for 6-12 months' child) with pumpkin flesh 2. Porridge mixture (1yr-5yrs): Unique here are the pumpkin seeds which are dense in antioxidants and micronutrients
	Fin Horacha Women Group	1. Paw Paw jam 2. Dried kales (Sukuma wiki)

Qualitative data from recorded FGDs was transcribed to texts by a local translator. The transcripts were then translated back to English. Two coders read the text files and then developed codes from the patterns found in the data independently. Differences in coding were discussed and resolved by consulting other researchers with experience in qualitative research. Codes were cleaned and those with similar patterns were grouped into themes depending on the research questions. Coding and thematization were used to

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explain child nutrient quality and feeding practices. The resulting data was presented textually to demonstrate the findings.

Data was managed using SPSS version 25 (IBM Corp, 2017). Descriptive data was analyzed using means, standard deviations, frequencies, and percentages. Inferential statistics was conducted using correlation and regression analysis to show the relationship between the independent variables and the dependent variable.

Results

The objective of this study was to determine the nutrition quality of the child feeds used among children aged 6 to 24 months in Marsabit County. The respondents were requested to rate their level of agreement on various statements relating to the nutrition quality of the child feeds used among children aged 6 to 24 months in Marsabit County. The results are as indicated in the following sub-sections.

Child feeding Practices

Indigenous local knowledge is largely input into the feeding of children. Common child foods were porridge, potatoes, pumpkin, butternut, meat stew, moringa leaves, *'koche'*(deep fried meat mainly camel meat mixed with mandazi and roasted barley), *'ugali'*(made from maize flour), goat meat, *'qita'*(Fresh maize pounded and fried in cooking oil), *'chapati'*(wheat product shallow fried), *'mandazi'*(Wheat product deep fried), spinach, kales, beans, rice, spaghetti, tea, *'injera'*(prepared from fermented teff flour), camel milk, goat milk and cow's milk in a small extent. Porridge fed to children is prepared from a mixture of flour (dried maize, dried sorghum, dried millet, roasted barley, roasted beans, roasted omena, roasted groundnuts, roasted fenugreek-medicinal, amaranth seeds, dried cassava). Porridge is offered to a child interchangeably with other foods at least 2-3 times a day. Mothers perceive that the porridge mixture is highly nutritious.

"Since we started giving our children this porridge, there is no malnourished child in our group"

FGD 3

Macronutrients and Energy (per 100g)

The results indicated a provision of 70 and 85 percent of the RDA for children aged 6-12 months and 13-24 months respectively as in Table 2. This is in relation to the average feeding frequency indicated by the women, as 4 times in 24 hours.

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Table 2: Macronutrient Lab Analysis Results

Sample ID	Energy(kcal)	Protein %	Carbohydrates	Fat %	Fiber %
Infants reference (6-12 months) per day	700	11g	95g	30g	5g
Children reference (13-24 months) per day	1300	13g	150g	39g	14g
Fermented porridge mix (6-24) Star	347.09	12.41	62.1	5.45	2.92
Non - fermented porridge mix (6-24) Star	367.26	11.31	67.77	5.66	2.92
Fermented porridge mix (2-6 yrs) Star	351.17	10.18	65.53	5.37	1.93
Non-fermented porridge mix (2-6 yrs) Star	368.38	11.28	72.22	3.82	2.71
Fermented porridge mix (Dub-Goba)	369.04	11.11	71.07	4.48	1.47
Non- Fermented porridge mix (Dub-Goba)	374.35	9.71	73.28	4.71	1.49
Fermented porridge mix (Sakuye)	330.39	8.49	70.8	1.47	1.55
Non- Fermented porridge mix (Sakuye)	366.21	8.04	75.57	3.53	1.65
Qaboth (Kayolaidha) (Germinated)	363.91	8.13	75.76	3.15	1.55
Marqa	370.73	2.53	85.02	2.45	1.55
Koche (Jiru)	404.05	61.72	8.31	13.77	2.51
Koche (Biftu)	515.94	22.31	40.93	29.22	0.91
Pawpaw jam	304.99	0.79	74.94	0.23	0.69
Dried Sukuma wiki	292.59	19.88	47.44	2.59	8.88
Butter (Milk fat)	868.17	1.35	4.26	93.97	0.55

On foods that were considered snacks, *Biftu Koche* consisting of *roasted and pound barley, dried and pound meat, ghee and grounded sugar*, has higher nutritional content as compared to the *Jiru Koche consisting of a mixture of roasted barley, deep-fried meat, mandazi* -made from a mix of *eggs, flour, milk, sugar, water, oil, ghee cardamom and urgo*, as a result of the variation in ingredients and value addition processes. Dried vegetables are also important in the provision of energy, proteins and fiber, during the dry seasons, as compared to a complete absence of vegetables.

With reference to butter (milk fat), this is a good source of energy, with the provision of 868.17 Kcal per 100g, and when available, can be used in small amounts to boost the energy requirements of complementary feeding.

Both the fermented and non-fermented porridge mix from the Dub-Goba group have a higher provision of energy, proteins, and carbohydrates, as compared to the porridge mixes of the Star women group (Uvji). This is due to the variation of ingredients and mixing ratio, where the star porridge mix has fewer carbohydrate food sources.

Micronutrients and Antioxidant Stimulants

The sampled foods were analyzed to determine the content of Vitamin A, Iron, Zinc, and Vitamins of B group. The results are as indicated in Table 3.

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Table 3: Micronutrient Lab Analysis Results

Sample ID	Vit A	Vit. C mg	Vit B1	Vit B2	Vit B3	Vit B6	Vit B9	Fe (mg/kg)	Zn (mg/kg)	Cu (mg/kg)	Total phenolic Content (mg/100g)
Infants reference (6-12 months) per day	-	50	0.3	0.4	6	0.3	80	11	20	220microg	
Children reference (13-24 months) per day		15	0.5	0.5	10	0.5	150	7	20	340micg	
Fermented porridge mix (6-24) Star	0.03		15.21	1.47	65.26	1.72	0.96	131.5	22.58	2.95	
Non - fermented porridge mix (6-24) Star	0.04		64.34	0.61	66.95	2.43	0.26	80.34	14.19	3.09	
Fermented porridge mix (2 – 6 yrs) Star	0.03		17.18	2.22	75.44	0.71	1.28	148.82	26.84	2.67	
Non-fermented porridge mix (2- 6 yrs) Star	0.04		16.43	1.21	95.75	0.61	0.96	127.6	23.09	3.06	
Fermented porridge mix (Dub-Goba)	0.43		17.9	0.19	46.93	1.73	0.26	124.74	32.89	2.63	
Non- Fermented porridge mix (Dub-Goba)	0.11		16.43	1.91	77.67	1.86	1.28	122.48	33.27	3.40	
Fermented porridge mix (Sakuye)	1.96		13.93	0.67	39.17	3.70	0.55	82.6	25.73	2.54	
Non- Fermented porridge mix (Sakuye)	0.01		12.33	1.70	55.58	1.67	2.98	36.7	28.95	3.22	
Qaboth (Kayolaidha) (Germinated)	0.003		21.74	1.22	0.74	1.49	9.45	66.35	26.02	2.95	
Marqa	0.13		44.73	1.80	32.94	0.69	1.94	42.42	33.34	3.01	
Koche (Jiru)	0.99	7.97	132.0	0.75	26.20	1.79	2.36	78.99	52.76	3.00	67.13
Koche (Biftu)	0.76	17.35	67.02	0.59	28.60	1.37	15.98	86.97	35.21	BDL	41.59
Pawpaw jam	14.2 B-carotene	60.89	1.54	0.10	15.55	0.76	15.34	44.83	12.25	0.94	48.27
Dried Sukuma wiki								37.3	9.38	5.66	254.83
Butter (Milk fat)								7.34	3.75	BDL	42.75

* ND- Not done
* BDL – Below Detectable Limits

The results indicated an increased concentration of some of these micronutrients, in fermented porridge mixes than in non-fermented porridge mix and other feeds. This is a result of the removal of some nutrient inhibitors, which bind the micronutrients, reducing their bioavailability. The nutrients of concern are mainly Zinc and Iron. Zinc plays an important role in immunity buildup, while iron is vital for the transportation of oxygen.

For instance, the fermented porridge mixes for the Star and Dub-Goba groups had higher concentrations of iron than their non-fermented counterparts. Hence, fermentation is a food processing mechanism that is to be promoted.

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Correlation Analysis

This research adopted Pearson correlation analysis to determine how the dependent variable (child feeding practices in Marsabit County, Kenya) relates with the independent variable (nutrition quality), Table 4.

Table 4: Correlation Coefficients

		Child Feeding Practices	Nutrition Quality of Child Feeds
Child Feeding Practices	Pearson Correlation	1	
	Sig. (2-tailed)		
	N	278	
	N	278	
Nutrition Quality of Child Feeds	Pearson Correlation	.813**	1
	Sig. (2-tailed)	.001	
	N	278	278

From the results, there was a very strong relationship between the nutrition quality of food and child feeding practices in Marsabit County, Kenya (r = 0.813, p-value =0.001). The relationship was significant since the p-value of 0.001 was less than 0.05 (significant level). The findings are in line with the findings of Kasimba, *et al*, (2019) who indicated that there is a very strong relationship between nutrition quality and child-feeding practices.

Regression Analysis

Multivariate regression analysis was used to assess the relationship between the independent variable (nutrition quality of food) and the dependent variable (child feeding practices in Marsabit County, Kenya), Table 5.

Table 5: Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.877[a]	.769	.768	.10412

a. Predictors: (Constant), nutrition quality of food

The model summary was used to explain the variation in the dependent variable that could be explained by the independent variables. The r-squared for the relationship between the independent variables and the dependent variable was 0.769. This implied that 76.9% of the variation in the dependent variable (child feeding practices in Marsabit County, Kenya) could be explained by the independent variable (nutrition quality of food).

The ANOVA was used to determine whether the model was a good fit for the data. F calculated was 510.14 while the F critical was 2.405. The p-value was 0.002. Since the F-calculated was greater than the F-critical and the p-value 0.002 was less than 0.05, the model was considered a good fit for the data. Therefore, the model can be used to predict the influence of the nutrition quality of food on child feeding practices in Marsabit County, Kenya.

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Table 6: Analysis of Variance

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	102.028	1	25.507	510.14	.002[b]
	Residual	13.653	276	.0500		
	Total	115.681	277			

a. Dependent Variable: child feeding practices in Marsabit County, Kenya
b. Predictors: (Constant), nutrition quality of food

$$\mathbf{Y = 0.335 + 0.341X_1 + \varepsilon}$$

The regression model was as follows (Table 7):

Table 7: Regression Coefficients

	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
	B	Std. Error	Beta		
(Constant)	0.335	0.085		3.941	0.000
nutrition quality of Child Foods	0.341	0.091	0.340	3.747	0.003

Discussion

Indigenous local knowledge is largely input into the feeding of children in Marsabit County. Mothers also feed locally available traditional foods to their children for example teff, 'koche' and 'qita'. The WHO advocates that complementary food be based on: 'adequate amounts of indigenous foodstuffs and local foods' (WHO, 2003). Traditional foods from local environments have received global attention due to their potential to contribute to better quality and more sustainable diets (FAO, 2013).

In the feeding and nutrition process, macronutrients are the nutrients that are consumed in large quantities for the provision of energy. These include carbohydrates, proteins, and fats (Sparingly) In this case, the sampled foods were subjected to nutrient analysis, which was further compared with the Recommended Dietary Allowance (RDA) of children aged 6-12 months and 13-24 months respectively. The results indicated a provision of 70 and 85 percent of the RDA for children aged 6-12 months and 13-24 months respectively.

A study in Kenya showed that the nutrient composition of the indigenous cereals, legumes, oil seeds, vegetables, and fish are good sources of essential nutrients (Kunyanga et al., 2013).

Study findings indicated that foods that were considered a snack, *Biftu Koche* had higher nutritional content as compared to the *Jiru Koche,* as a result of the variation in ingredients. This was on the Energy, Proteins, and Fats. Findings indicated porridge mix from the *Dub-Goba* group both fermented and non-fermented had a higher provision of energy, proteins, and carbohydrates, as compared to the porridge mixes of the Star women group (Uvji). This is due to the variation of ingredients and mixing ratio, where the star porridge mix has fewer carbohydrate food sources.

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Micronutrients are those that are required in small quantities, with the function of building immunity in the body. These include vitamins and minerals. In any human growth and development, all micronutrients are important. However, in child feeding, Vitamin A, Iron, Zinc, and Vitamins of the B group are required in higher amounts. The study findings indicated an increased concentration of some of these micronutrients, in fermented porridge mixes than in non-fermented porridge mixes and other feeds. This is a result of the removal of some nutrient inhibitors, which bind the micronutrients, reducing their bioavailability. Fermentation has been shown to increase the bioavailability of iron and zinc while enhancing probiotic content, supporting gut health and immunity (Gabaza et al., 2018). Germination improves vitamin C levels and reduces phytates, enhancing mineral absorption critical for child growth and development (Platel & Srinivasan, 2017). Roasting and drying preserve food while maintaining nutrient density, crucial for food security in arid regions like Marsabit (Nkhata et al., 2018). Frying, when done appropriately, enhances energy density, making it beneficial for undernourished children who require high-calorie diets (WHO, 2021).

According to the results, the nutritional quality of food has a significant effect on child-feeding practices in Marsabit County, Kenya $\beta 1=0.341$, p value= 0.003). The relationship was considered significant since the p-value of 0.003 was less than the significant level of 0.05. The findings are in line with the findings of Kasimba, *et al*, (2019) who indicated that there is a very strong relationship between nutrition quality and child-feeding practices.

Conclusion

The study concludes that the nutrition quality of food has a significant effect on child feeding practices in Marsabit County, Kenya. Mothers feed their children food that they perceive is highly nutritious and prepared using techniques that improve the nutritional content of these foods. Laboratory analysis results on the nutrient content of child foods indicated high nutrient levels, especially for foods that have gone through fermentation, germination, roasting, drying, and frying processes. This agrees with the mothers' perception of these foods as of good quality.

Recommendation

The study recommends that the Marsabit County government promote traditional food processing methods-such as fermentation, germination, roasting, drying, and frying-through community nutrition programs to enhance the nutrient content of child foods. Evidence suggests that these methods improve the bioavailability of essential micronutrients, reduce antinutritional

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factors, and enhance food preservation, making them particularly valuable in resource-limited settings.

Community nutrition programs should focus on educating mothers and caregivers on how to effectively apply these methods to local foods, ensuring practical, culturally acceptable, and nutritionally beneficial dietary practices. Integrating laboratory findings with traditional knowledge ensures that children in Marsabit County receive high-quality, nutrient-dense diets, particularly in resource-constrained environments.

Furthermore, local health and agricultural authorities should support the dissemination of this knowledge through hands-on demonstrations, evidence-based nutritional guidelines, and collaborations with local women's groups and schools. Studies have shown that such community-driven interventions significantly improve maternal knowledge and child nutrition outcomes (Ruel et al., 2018). Reinforcing these methods at both household and community levels will maximize their impact on child health and food security.

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Data Availability: All data are included in the content of the paper.

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Declaration for Human Participants: Ethical approval for this study was obtained and all necessary permissions were acquired from the relevant authorities in Marsabit County, Kenya. Informed consent was obtained from all participants, and confidentiality was maintained throughout the study.

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