

## Original Research Article

# Effects of a nutrition education intervention on maternal nutrition knowledge, dietary intake and nutritional status among food insecure households in Kenya

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## ABSTRACT

**Background:** Malnutrition remains a major concern in the developing countries especially in food insecure populations. Maternal nutrition knowledge, among other factors, has been shown to improve nutritional status in children under the age of 5 years. The purpose of this study was to determine the effect of a nutrition education intervention on maternal nutrition knowledge, dietary intake, and nutritional status in Turkana County, Kenya.

**Methods:** Seventy-three mothers/female caretakers with children <5 years old from Nadapal village in Turkana County were included in the study. At baseline, maternal nutritional knowledge, maternal and child nutritional status, and dietary intake were assessed. During the intervention, participants were trained on breastfeeding, complementary feeding, hygiene and sanitation. The intervention was conducted for five days with two- three hour sessions each day. Six months after the intervention, a follow-up was done to assess the effect of the intervention.

**Results:** At baseline, 53% of the women were underweight (BMI<18.5 kg/m<sup>2</sup>), 24% of the children were stunted, 20.7% wasted, and 28.6% underweight. After the intervention, maternal knowledge on length of breastfeeding and composition of complementary foods improved. There were no significant changes in nutritional status in both women and children after the intervention.

**Conclusions:** Results from this study implied that nutrition education interventions may improve nutrition knowledge of the mothers/female caretakers. However, without provision of food, the effects of the gained nutrition knowledge may not reflect in the dietary intake or nutritional status and therefore future interventions need to include ways to reduce food insecurity.

**Keywords:** Nutrition education, Food insecurity, Malnutrition, Dietary intake, Intervention

## INTRODUCTION

Turkana is the poorest county in Kenya with 94% of the population living in absolute poverty.<sup>1</sup> Census data showed that in 2009 there were 855,399 people living in this county which constitutes 2.2% of the country's population.<sup>2</sup> The climatic condition of the region is semiarid which receives on average 300mm-400 mm of rainfall a year and the mean monthly temperature is

above 33° C which has led to changes in the Turkana lifestyle especially the diet.<sup>3,4</sup> While the main source of food for the Turkana people was traditionally milk and meat from their livestock, these diets have been replaced by more cereal based diets.<sup>5</sup> During periods of drought, the Turkana people rely on wild foods and food aid which with time gets depleted leading to increased levels of malnutrition and mortality, especially among children under the age of five years.<sup>6</sup>

The infant mortality rate of Turkana county is 60/1000 live births as compared to the global rate of 32/1000 livebirths.<sup>7</sup> The main cause of mortality and morbidity in this county has been identified as malnutrition.<sup>7</sup> Some of the determinants for child malnutrition that have been identified for this population are; food insecurity due to unreliable weather conditions, consumption of cereal based complementary foods introduced either too early or too late in the first year, and high incidences of infectious diseases such as diarrhea and respiratory tract infections.<sup>8-10</sup>

There are no documented studies that show the effects of maternal nutrition knowledge interventions on malnutrition in Turkana. Most of the documented interventional studies are unsustainable food aid based. For example, the Kenyan government, with assistance from non-governmental organizations mitigates food insecurity in Turkana by giving food aid to the food insecure families. However, food aid programs in this community are not sustainable as they are sometimes withdrawn abruptly as the donor organizations run out of funds leaving the community without alternative help.<sup>11</sup> To reduce maternal and child malnutrition in Turkana, interventions should focus on sustainable food security interventions and improvement of maternal nutrition knowledge and practice. Therefore, the purpose of this study was to conduct and assess the outcome of a nutrition education intervention among mothers/female caretakers of children under the age of five years in Turkana Kenya.

## **METHODS**

### ***Study setting and participants***

This was a longitudinal pretest-posttest study conducted over a period of one year between July 2014 and June 2015. Target population was mothers or female caretakers of children aged 0-5 years from Turkana county, Kenya. Nadapal village in Turkana was purposively selected for the study. Nadapal was selected as the study village due to its close proximity to the study center where the intervention education was provided, and the resources available to the researchers. Share International, a Faith Based Organization working in Turkana, assisted the researchers in recruitment of potential participants for the study. Oral recruitment scripts prepared by the investigators were translated to the local language and read to the community during community meetings and church gatherings. All women or female caretakers residing in Nadapal village were invited to participate in the study. All mothers or female caretakers with a child <5 years old were included in the study whereas those with children older than 5 years were excluded from the study. At baseline 146 participants (73 women and 73 children) were recruited into the study.

### ***Data collection***

Data were collected using questionnaires and anthropometric measurements. All questionnaires were translated to the Kiturkana language and were verbally administered to all the participants. All the questionnaires were administered by trained research assistants who were familiar with the local language while all the anthropometric measurements were conducted by the principal investigator.

Dietary intake for the mothers and children was assessed using 24-hour recall questionnaires. Administration of the 24-hour recall used the multiple-pass method.<sup>12</sup> The mother or caretaker completed her own 24-hour recall and another one for her child. Maternal nutrition knowledge was determined using a validated questionnaire developed to assess maternal nutritional knowledge in Indonesia.<sup>13</sup> These questions were used to assess the mother's knowledge on initiation and duration of breastfeeding, timing of the introduction of complementary foods, and care and feeding of a sick child. Nutrition status was determined through use of anthropometric measurements (weight and height). Weight was measured using Tanita HD-366 Digital Weight Scale to the nearest 0.1 kg. Height was measured using a portable stadiometer -Seca Model 213 to the nearest 0.1 cm. For those children who could not walk, length was measured using a length board sourced from the Ministry of Health dispensary in Turkana County.

### ***Intervention materials***

Development of the intervention training materials was based on the results from the baseline study. A training guide and three posters were developed by modifying a curriculum that had been developed for a similar low income population in Malawi.<sup>14</sup> The only modification made was replacement of the foods in the Malawi curriculum with those commonly consumed by the study population. The main topics covered by the training guide were; basic principles of nutrition, food preparation and preservation, breastfeeding, complementary feeding, and hygiene and sanitation. The posters included pictures and information on breastfeeding, complementary feeding and proper hygiene and sanitation. Face validity of the training materials was conducted among researchers at Texas Tech university and among four women leaders at Share International in Turkana.

### ***Intervention procedure***

The intervention was conducted in December 2014, six months after baseline data collection to allow time for preparation of training materials. All the women participants at baseline (n=73) were invited to participate in the intervention. Of all the invited participants, 62 were available for the intervention. The intervention training took place at the Share International office facilities in Nadapal.

The delivery of the intervention was informed by the social cognitive theory and social marketing approach. The lessons and demonstrations were developed to improve self-efficacy and behavioral capabilities of the participants by letting them participate fully in the activities such as the demonstrations. For observational learning, women leaders who had been trained by the researchers first did the demonstration activities such as preparation of food which let the participants learn from watching. In the social marketing approach, the researchers recognized that they were marketing new

behaviors and practices that the participants were not used to. The price they had to pay was change from what they were accustomed to. To address the price concept, the intervention was designed such that the recommended practices such as cooking healthier meals were within their economic and physical reach. All materials used for cooking demonstrations could be found in the local market at a price affordable to the participants. The trainers also emphasized the benefits of adopting healthier behaviors such as improved hygiene in terms of reduced susceptibility to diseases especially in children.

**Table 1: Nutrition education intervention activities.**

Day	Participants	Lesson	Activities
<b>Day 1</b>	Women leaders	Food preparation and preservation.	Train the trainers. Demonstrate on selecting, cleaning and cutting various vegetables and cereals. Preparation of various dishes consumed in the community using foods readily available in the market.
<b>Day 2</b>	Women leaders	Child feeding practices	Train the trainers. Training on appropriate feeding and care practices for mothers and children.
		Hygiene and sanitation	Training on importance of hand washing and proper human waste disposal.
<b>Day 3 Session 1</b>	Participants	Food preparation and preservation	Demonstrations on how to: <ul style="list-style-type: none"> <li>• Select foods from the market</li> <li>• Clean vegetables</li> <li>• Preserve excess vegetables through drying</li> <li>• Selecting cereals and legumes that are free from insects</li> </ul>
<b>Day 3 Session 2</b>	Participants	Cooking demonstrations	Demonstrations on cooking; <ul style="list-style-type: none"> <li>• Vegetables (kunde, terere, cabbage, murere) through steaming and stir frying</li> <li>• Legumes (beans, peas and green grams) through boiling and frying</li> <li>• How to make mixed dishes that are nutrient dense</li> </ul>
<b>Day 4 Session 1</b>	Participants	Mother and child care practices	Training on; <ul style="list-style-type: none"> <li>• Initiation of breastfeeding</li> <li>• Introduction of complementary foods</li> <li>• Importance of accessing ante natal care for pregnant women</li> <li>• Importance of accessing immunization and micronutrient supplementation.</li> </ul>
<b>Day 4 Session 2</b>	Participants	Cooking demonstrations	Demonstrations on <ul style="list-style-type: none"> <li>• Preparation of nutrient dense complementary foods such as enriched porridge and ugali</li> <li>• Demonstration on appropriate serving sizes for child meals</li> </ul>
<b>Day 5 Session 1</b>	Participants	Hygiene and sanitation	Training and demonstrations on <ul style="list-style-type: none"> <li>• The importance of proper handwashing techniques with limited water supply</li> <li>• Proper sneezing and coughing practices to avoid spread on flu and other air borne diseases</li> </ul>
<b>Day 5 Session 2</b>	Participants	Wrap up	<ul style="list-style-type: none"> <li>• Emphasis of the key messages from the training and demonstrations</li> <li>• Question and answer session</li> </ul>

The intervention was conducted for five days with two sessions each day. The first two days were used for training women leaders from Share International who assisted the researchers in training the participants and acted as the translators. The next three days were used to train the 62 participants with the developed teaching materials. Table 1 describes in detail the activities carried out every day for the five days. In brief, the intervention involved lectures and demonstrations on food selection and preparation, maternal and child care practices, and hygiene and sanitation.

Six months after administering the intervention, data were collected from the 48 returning subjects to assess any sustained change in maternal nutrition knowledge, child care practices, maternal and child dietary intake, and the nutrition status of women and children. This assessment was done at the same month and season that the baseline data was collected to minimize errors related to seasonality. The same questionnaires and anthropometric measuring tools used at baseline were used at post intervention.

### Data analysis

Data were summarized using descriptive statistics such as means, medians, range, and percentages. WHO-Anthro plus program was used to convert weight and height measurements of the children into Z-scores. All continuous data were tested for normality, and where normality was not achieved, transformations were made. The effect of the intervention on the nutritional status of the women and children, maternal nutritional knowledge, and child care practices was determined using paired t tests for continuous data and McNemar tests for categorical data. Non-parametric tests (Wilcoxon Rank sum test) were used for data that did not follow a normal distribution. Significance was considered at  $p < 0.05$ .

## RESULTS

### Demographic characteristics at baseline

At baseline, there were 146 participants (73 women and 73 children) were recruited for the study. Seventy-seven percent of the household heads had no formal education, and only 3% had some college education. The major source of income for most of the households (64.4%) was from making and selling brooms, baskets, charcoal, and firewood. Most (90%) households purchased food from the market, and about 6.8% (5) households relied on donations for food. On average, each household had six members. The average age of the mothers was  $34.7 \pm 13.9$  years, and the average age of the children was  $30.1 \pm 20.2$  months. Table 2 presents all the demographic characteristics of the households. Out of the 73 women who participated in the intervention, 48 returned for the six-month follow-up. There were no significant differences observed in the demographic characteristics

between the returning participants and those lost to follow-up.

**Table 2: Demographic characteristics of the study population.**

Nadapal n=73		
Household head	Frequency	%
Father	48	65.8
Mother	20	27.4
Grandmother	2	2.7
Grandfather	3	4.1
<b>Household size</b>		
Average	5.86	
<b>Education of household head</b>		
None	56	76.7
Primary	10	13.7
Secondary	4	5.5
College	3	4.1
<b>Source of income</b>		
Farming	13	17.8
Pastoralism	5	6.8
Formal employment	2	2.7
Small business	47	64.4
Donations	5	6.8
<b>Source of food</b>		
Own produce	1	1.4
Buying from market	66	90.4
Donations	5	6.8
Wild foods	1	1.4
<b>Own a farm</b>		
Yes	42	57.5
No	31	42.5
<b>Own livestock</b>		
Yes	45	61.6
No	28	38.4
<b>Source of drinking water</b>		
Borehole	42	57.5
Rain	3	4.1
River		
Well	23	38.4
<b>Type of cooking fuel</b>		
Wood	71	97.3
Kerosene	2	2.7

### Effect of intervention

#### Maternal nutrition knowledge

Maternal knowledge on the duration of exclusive breastfeeding significantly improved after the intervention ( $p=0.004$ ). At baseline, 68% of the 48 mothers were able to identify six months as the recommended period for exclusive breastfeeding while after the intervention, 91% of the mothers identified the recommended duration for exclusive breastfeeding. Similarly, knowledge on the recommended composition

of complementary foods improved after the intervention. At baseline, only 16% of the 48 mothers were able to identify a nutrient dense complementary food. This percentage significantly increased to 75% after the intervention ( $p<0.001$ ). Significantly more mothers were able to report that they would increase food and fluid intake of a child with diarrhea at follow-up (95.8%) as compared to baseline (66.7%;  $p<0.001$ ).

#### Maternal dietary intake

Calorie intake for the 48 mothers decreased at follow-up from a median of 1001 Kcal at baseline to 706 Kcal per day ( $p=0.05$ ). Intake of proteins and fats also decreased as shown on Table 3. However, maternal intake of vitamin A and calcium increased significantly ( $p=0.001$  and  $p=0.002$ , respectively), although the intake level was still below the estimated average requirements (EAR).

**Table 3: Change in calorie and nutrient intake of the mothers after the intervention.**

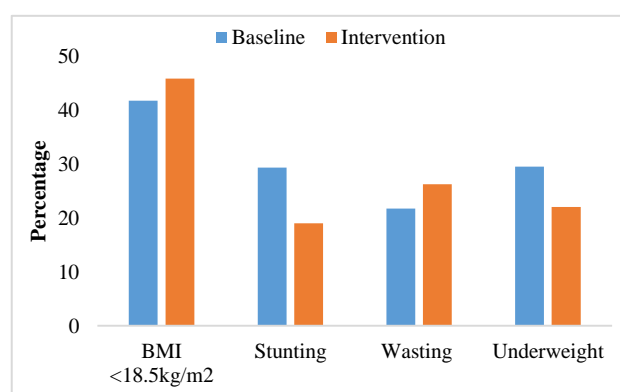
Nutrients	Baseline n=48 Median (25 <sup>th</sup> , 75 <sup>th</sup> )	Follow up n=48 Median (25 <sup>th</sup> , 75 <sup>th</sup> )	P value
Calories (Kcal)	1001.2 (605.6, 1228.6)	706.2 (613.2, 1063.4)	0.05
Protein (g)	25.2 (14.5, 40)	19.2 (12.0, 26.6)	0.01
Fat (g)	18.9 (6, 35.6)	11.9 (5.7, 19.2)	0.005
Carbohydrates (g)	174.4 (127, 236.7)	148.8 (120.9, 220.8)	0.169
Calcium (mg)	149.1 (15.4, 159.9)	223.9 (78.6, 375.4)	0.002
Iron (mg)	7.5 (2.9, 12.4)	5.9 (3.8, 9.3)	0.112
Zinc (mg)	4.6 (2.3, 5.8)	3.1 (2.3, 5.2)	0.176
Folate ( $\mu$ g)	457.6 (204.2, 882.9)	303.2 (225.2, 541.4)	0.013
Vitamin A ( $\mu$ g RE)	47.6 (0, 57.1)	28.6 (139, 219)	0.001
Vitamin C (mg)	70.5 (28.2, 91.8)	60.1 (28.4, 96.6)	0.599

**Table 4: Change in calorie and nutrient intake of the children after the intervention.**

Nutrients	Baseline n=45 Median (25 <sup>th</sup> , 75 <sup>th</sup> )	Follow-up n=45 Median (25 <sup>th</sup> , 75 <sup>th</sup> )	P value
Calories (Kcal)	755.4(528.9, 1063)	636.6 (446.1, 887.4)	0.261
Protein (g)	19.7 (9.7, 32.2)	14.7 (10.2, 23.5)	0.119
Fat (g)	16.5 (5.6, 23.1)	7.9 (4.3, 15.1)	0.082
Carbohydrates (g)	157.4 (98.7, 200.3)	128.6 (93.4, 170)	0.246
Calcium (mg)	74.6 (15, 149.1)	173.6 (75.5, 265.1)	0.001
Iron (mg)	6.2 (2.2, 9.7)	5.4(3.3, 8)	0.809
Zinc (mg)	2.9 (1.7, 4.7)	2.7 (2, 2.9)	0.612
Folate ( $\mu$ g)	339.4 (123.3, 638.6)	220.8(139.7, 402)	0.02
Vitamin A ( $\mu$ g RE)	28.6 (0, 47.6)	116.8 (20.4, 153.1)	0.001
Vitamin C (mg)	34.9 (22.0, 63.6)	35.2 (15.9, 55.9)	0.484

*Child dietary intake:* In children, calorie intake decreased insignificantly (636.6 Kcal) compared to baseline (755.4 Kcal). However, there was significant increase in calcium ( $p=0.001$ ) and Vitamin A ( $p=0.001$ ) intake in the children as shown on Table 4.

*Nutritional status:* As expected, due to the short duration post intervention, the levels of malnutrition did not change significantly after the intervention. In women underweight (BMI  $<18.5$  kg/m<sup>2</sup>) was 41.7% at baseline, and slightly increased to 45.8% after the intervention. Similarly, in children, wasting increased from 21.7% to 26%. However, stunting and underweight levels showed a non-significant decreasing trend from 29% to 19% in stunting and 29% to 22% in underweight as shown in Figure 1.



**Figure 1: Maternal and child nutrition status before and after the intervention (mothers n=48; children n=48).**



## DISCUSSION

The purpose of the intervention was to increase maternal nutrition knowledge on appropriate child care practices such as optimal breastfeeding, complementary feeding, and hygiene and sanitation. Ultimately, improved maternal nutrition knowledge was expected to improve maternal and child care practices. It was hypothesized that those improvements would lead to reduced maternal and child malnutrition in this population. Studies with similar populations in Ghana, Mozambique and Indonesia found that nutrition education had a potential to improve child nutrition status through improving maternal nutrition knowledge.<sup>15-17</sup>

Three key components of maternal nutrition knowledge that improved significantly ( $p < 0.05$ ) after the intervention include: understanding the recommended duration for exclusive breastfeeding, identifying the recommended composition of complementary foods, and understanding the importance of feeding food and fluids to a child who has diarrhea. Results observed in this study agreed with other studies that have used the same approach in similar populations.<sup>18-20</sup> For example, a study in western Kenya that included four nutrition education sessions with cooking demonstrations among 99 women with children between 6-17 months old, found a significant improvement in maternal nutritional knowledge on dietary diversity of complementary foods.<sup>18</sup> Similarly, a study conducted in Ethiopia among 200 mother-child pairs who received two bi-monthly education sessions on breastfeeding and preparation of complementary foods using locally available foods, showed an improvement in maternal nutrition knowledge scores, especially on preparation of complementary foods.<sup>19</sup>

After the intervention in this study, there was improved dietary diversity as indicated by increased consumption of vitamin A and calcium rich foods. Other studies have shown similar results especially in vitamin A, calcium, and zinc.<sup>17-19,21</sup> However, calorie intake did not change for both women and children. This was contrary to similar studies that found an increase in calorie intake along with improved dietary diversity.<sup>19</sup> Calorie intake was not expected to improve in this study because food availability in this population was very poor with almost all the households reporting to be food insecure.

Considering that calorie intake did not increase, nutritional status also remained the same as at baseline. Some similar studies did not find improvements in nutrition status even after improvements in dietary intake.<sup>22,23</sup> Change in food intake and hence nutritional status may need a safety net intervention that would provide additional foods to the families. Due to limitations in resources, that option was beyond the scope of this study. However, there are a few studies that found improvement in nutrition status especially in children. For example, an intervention study in Yatta district in

Kenya found improvements in wasting and underweight, but not stunting, in children seven months after the intervention. In that study, mothers were educated on complementary feeding of children using locally available foods as well as on hygiene and sanitation. The study also included food rations for the index child and the family. Improvement in knowledge was not measured, and it is therefore not possible to determine whether the improvement was due to the food rations or improved knowledge.<sup>24</sup>

The main strength of this study was the design of the intervention which was comprehensive and intense. Women were brought to the training center where they stayed for the three days, learning cultural relevant methods of feeding their families and general nutrition education. This arrangement ensured that they attended all the sessions for the three days. In addition, the intervention was interactive and had multiple components that included lectures, demonstrations and hands on activities. Data integrity was also ensured; all the anthropometric measurements were taken by the principal investigator, a trained nutritionist and dietitian, which minimized the measurement errors. Also, all the research assistants were adequately trained by the investigators before data collection at both baseline and follow up. Despite these strengths, there are some limitations that may limit generalization of the results. For example, dietary intake data were self-reported using 24-hour recall and food frequency questionnaires, which may have introduced social desirability bias, such as over or under reporting. In addition, although the original sample size was large, only 62 mothers were available for the three-day intervention and only 48 came back for follow up data collection.

## CONCLUSION

Findings from this study suggest that nutrition education interventions aiming to improve maternal knowledge and behavior especially in breastfeeding and complementary feeding among communities such as the Turkana should be based on the needs of the community. This is due to their changing lifestyles from pastoralism to sedentarism that may have influenced their dietary habits. Another implication from this study is that to succeed in reducing maternal and child malnutrition in a food insecure environment, sustainable safety net interventions are needed especially those that improve food security and health status of the women and children. In addition, longer studies with a larger sample size are needed to determine the retention of the gained nutrition knowledge and practice especially with changes in food security of the households.

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