

Evaluation of School Feeding Program for Malnourished Children in Isiolo Central: Kenya

Oscar Makokha*, Dr. Sophia Ngala, Dr. Angela Andago

Department of Food Science, Nutrition & Technology, University of Nairobi, Kenya.

*Corresponding Author: Oscar Makokha; oscar@unibrainkenya.co.ke

Abstract

Background: In Kenya, more than a quarter of children under the age of five, or two million children, have malnutrition, which commonly presents in the form of stunting, the most frequent form of under-nutrition among young children, and the school feeding programs have been providing meals comprising rice and beans or a maize meal with beans. From these programs, it has been noted that there is an increase in school enrollment due to the meals provided in schools. From the nutritional reviews done, it has been found that malnutrition levels in Isiolo (16.7%) are pretty high compared to the country at 4.1%. **Material and Methods:** The study was conducted among 190 primary school pupils selected from 17 different public primary schools and 17 teachers within the Isiolo Central District through a simple random sampling method, and a semi-structured interviewer-administered questionnaire was used to collect the data. For children selected for the study, consent was requested from the guardian before being included. ANOVA was used to compare baselines BMI, MUAC, and post BMI, MUAC after six months of intervention with fortified composite flour. **Results:** The mean age of the children in years was 11.23 ± 1.44 , with gender having male 55.3% and female 44.7%. 52.1% of the households had more than six members, 45.8% had 4-6, and 2.1% had 3. Income, casual labor had 30%, animal rearing 11.1%, farming 25.8%, and self-employment 20.5%, respectively. In nutritional status, 45.8% were underweight, 24.2% overweight, 17.4% normal, and 12.6% were obese. After six months of follow-up, the percentage of underweight respondents was 11.6%, which declined by 34.2%, the average level increased to 66.8%, and the obese percentage decreased by 4.7%. **Conclusion:** The study concluded that by having a school feeding program, there is a significant decrease in underweight children with an increase in healthy school-going ones.

Keywords: *Mid-upper arm circumference, Malnourishment, Body Mass Index, Isiolo County, School Feeding Program*

Introduction

School feeding programs have been implemented in Kenya since 1979 with varying degrees of success. It began in 1979 with a government-led and short-lived school milk program (Ministry of Agriculture, MoA, 2011). The ambitious initiative that provided free milk to 4.3 million primary school students failed due to high costs, low accountability, and poor road infrastructure (Adolph, 2016). School meal programs have been shown to play a pivotal role in diminishing hunger, enabling children to focus better on their studies. Due to the poor feeding among these pupils in these regions, malnutrition remains a significant public health concern where at least one in every three children under the age of five suffers from either undernourishment or being overweight (Shree & Narayana Murthy, 2021). Hence, these programs are instrumental in tackling micronutrient deficiencies prevalent among school-aged children (National et al. Policy, 2011).

The school feeding program has a combination of foods with one or more grains or both grains and vegetables, which store nutrients like vitamins, minerals, antioxidants, and dietary fiber to help combat malnutrition better. The program uses flour and ready-to-cook mixes that fall under this category, which occupy more than 70% of the food and health industry today and are recommended by most nutritional experts. Although undocumented, reports from

teachers' observations indicate that many pupils have been taking the hot meal home to share with their families. Food insecurity is critical and is mainly caused by prolonged drought that has caused loss of livestock and crop failure. Children in this county are brought to school not for education purposes but for food (Ann & Mwangi, 2019). Malnutrition levels in Isiolo, currently at 16.7%, are considerably higher than the national average of 4.1% (KNBS, 2022). This study aimed to evaluate the general impact of school feeding programs for the malnourished children in Isiolo Central County.

Methodology

Study design: This study involved two levels: children and teachers. We applied the longitudinal study method to collect quantitative data at enrollment for children. We evaluated it after six months of enrollment in the school feeding program supplementation for malnourished children in Isiolo Central. For teachers, we applied the cross-sectional method to evaluate their opinions of the school feeding program.

Study location: Isiolo County

Study Population: Public primary school pupils enrolled in 17 selected primary schools and the teaching staff affiliated with these

same 17 public schools located in Isiolo Central District. The data collection process involved the utilization of semi-structured interviewer-administered questionnaires to parents and pupils where teachers were.

Sampling method: Simple random sampling

Sample size determination: To determine the suitable sample size for this research, we will apply Fisher's equation, as elucidated by Fisher et al. (2002): $N = (z^2 * p * q) / d^2$. Using the prevalence of malnutrition in Isiolo as 14.9 %, we calculate the sample size as follows:

$$n = (1.96^2 * 0.149 * 0.851) / (0.05^2)$$

$$n \approx 190$$

Data Management: Quantitative data from completed questionnaires were coded and input into the Statistical Package for Social Sciences version 25 (SPSS). Statistical measures were employed to determine associations between independent and dependent variables, including central tendency, chi-square, t-tests, and correlation.

Ethical Considerations

This research proposal was subjected to an ethical review board and obtained clearance from the Kenyatta National Hospital University of Nairobi Ethical Research Committee (KNH - UoN ERC) P606|07|2023 and approval from the County government through the Deputy Sub County Officer of Education to grant consent for conducting the research in the County.

Results

1. Social demographic characteristics

A. Household characteristics for the study population in Isiolo County

There was a significant difference in the household heads; the Majority (84.7%) of the families had male family heads, while (15.3%) had female family heads (p=0.000). About (52.1%) of the households had more than six members, followed by 45.8% for 4-6 persons; three persons and below accounted for (2.1%) (p=0.000). Casual laboring as a source of income accounted for 30%, animal and animal product sales, self-employment, and salaried wage employment accounted for 11.1%, 25.8%, and 20.5%, respectively (p=0.000), as expressed in **Table 1**.

Table 1: Distribution of study children by household characteristics from Isiolo County

Household characteristics	Percentage/frequency N= 190	p-value
Child's sex		
Female	44.7% (85)	
Male	55.3% (105)	1.000
Total	100.0% (190)	
Child's religious affiliation		
Christian	48.9% (93)	
Muslim	51.1% (97)	0.828
Total	100.0% (190)	
How long child has been in a particular school		
Less than one year	32.6% (62)	
2-5 years	64.7% (123)	0.000
More than five years	2.6% (5)	
Total	100.0% (190)	
Sex of household head		
Male	84.7% (161)	
Female	15.3% (29)	0.000
Total	100.0% (190)	
Household size		
Three persons and below	2.1% (4)	
4-6 persons	45.8% (87)	0.000
More than 6	52.1% (99)	
Total	100.0% (190)	
The primary source of income		
Animal and animal product sales	11.1% (21)	
Crop sales/farming	2.6% (5)	
Trade	10% (19)	0.000
Casual labourer	30% (57)	
Salaried wage employment	20.5% (39)	
Self-employment	25.8% (49)	
Total	100% (100)	

B. Economic characteristics for the study population in Isiolo County

Many households bought food (93.2%), while homegrown and donation accounted for 6.3% and 0.5%, respectively (p=0.000). About 75.3% of the respondents reported having more than two

meals daily, and 20% had two (p=0.000). Food was equally distributed among 44.3% of the households, while 20% and 27% prioritized distribution to father and child, respectively (p=0.000), as presented in **Table 2**.

Table 2: Economic characteristics of the study population in Isiolo County

Socio-economic characteristics	Percentage/frequency N= 190	P value
The primary source of food		
Bought	93.2% (177)	
Homegrown	6.3% (12)	0.000
Donated	0.5% (1)	
Total	100% (190)	
Number of meals in a day		
One	4.7% (9)	
Two	20% (38)	0.000
More than two	75.3% (143)	
Total	100% (190)	
Source of drinking water		
Piped water	76.8% (146)	
Well unprotected	8.9% (17)	0.000
Well protected	8.9% (17)	
Stream	5.5% (10)	
Total	100% (190)	
Number of people living in the household		
1-3	1.1% (2)	
4-6	43.2% (82)	0.000
Seven and above	55.6% (106)	
Total	100.0% (190)	
Household distribution of food		
Equal	44.7% (85)	
Priority to father	20.0% (38)	0.000
Priority to child	27.4% (52)	
Priority to mother	7.9% (15)	
Total	100% (190)	

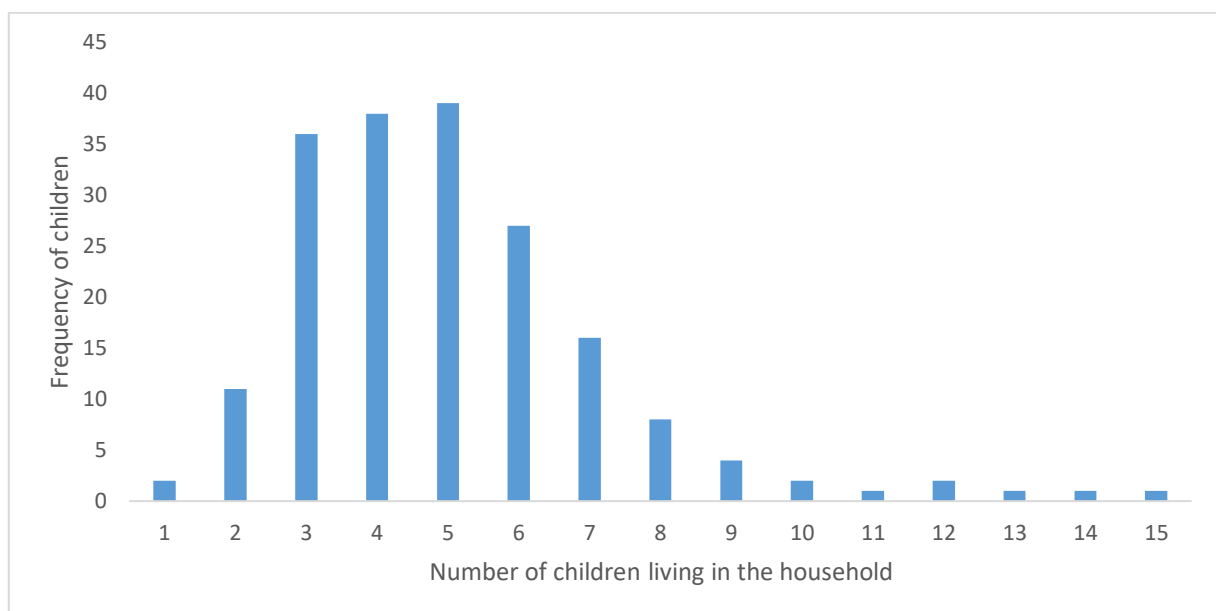


Figure 1: Number of children living in the household for Isiolo County

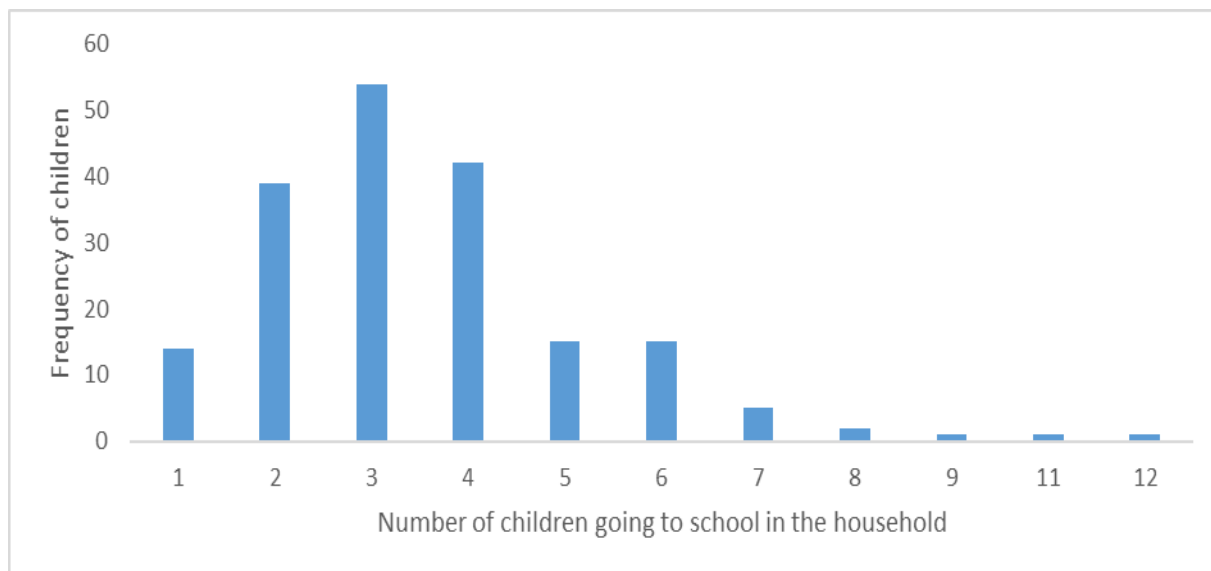


Figure 2: Number of children going to school in a household in Isiolo County

C. Anthropometric measures of study children in Isiolo County

There was a significant difference in the nutritional status, with slightly less than half (45.8%) of the respondents being underweight, higher than other indicators at baseline ($p=0.000$). This was followed

by (24.2%) overweight (17.4%), a healthy weight, and 12.6% obese when the study participants were initiated on feeding programs during the study period. **Table 3.**

Table 3: Anthropometric measures of study children in Isiolo County

BMI Range	Baseline (N=190)	After six months	P value
Underweight	45.8% (87)	11.6% (22)	
Healthy weight	17.4% (33)	66.8% (127)	
overweight	24.2% (46)	13.7% (26)	0.000
Obese	12.6% (24)	7.9% (15)	
Total	100.0% (190)	100% (190)	
Mid-upper arm circumference			
Green (Normal)	55.3% (105)	80.0% (152)	
Yellow (Moderate malnutrition)	36.8% (70)	15.3% (29)	
Red (Severe malnutrition)	7.9% (15)	4.7% (9)	0.000
Total	100% (190)	100.0% (190)	

D. Availability of food for the study population, the household in Isiolo County

Respondents categorized starchy foods (74.7%) as the most available food groups. In comparison, slightly less than half (43.2%)

and (41.6%) of the respondents reported medium and high availability of dark green leafy vegetables, respectively ($P=0.000$).

Table 4

Table 4: Availability of food for the study population household in Isiolo County

Starchy staple food	Percentage/frequency N= 190	P value
Absent	1.1% (2)	
Low	1.6% (3)	
Medium	22.6% (43)	0.000
High	74.7% (142)	
Total	100.0 % (190)	
Vitamin A-rich vegetables and tubers are available.		
Absent	6.3% (12)	
Low	19.5% (37)	
Medium	32.6% (62)	0.000
High	41.6% (79)	
Total	100.0 % (190)	
Dark green leafy vegetables		
Absent	2.1% (4)	
Low	13.2% (25)	
Medium	43.2% (82)	0.000
High	41.6% (79)	

Total	100.0 % (190)	
Vitamin A-rich fruit		
Absent	13.2% (25)	
Low	20.0% (38)	
Medium	30.0% (57)	0.000
High	36.8% (70)	
Total	100.0 % (190)	
Fleshy meat		
Absent	9.5% (18)	
Low	10.5% (20)	
Medium	23.2% (44)	0.000
High	56.8% (108)	
Total	100% (190)	
Legumes, nuts and seeds		
Absent	15.8 (30)	
Low	18.9 (36)	
Medium	44.7 (85)	0.000
High	20.5 (39)	
Total	100.0% (190)	
Eggs		
Absent	13.7% (26)	
Low	18.9% (36)	
Medium	27.9% (53)	0.000
High	39.4% (75)	
Total	100.0% (190)	

E. Accessibility of food for the study population household in Isiolo County

The majority (74.7%) of the respondents had high access to starchy foods, while only (20.5%) of the respondents had high access to

legumes. Only 1.1% of the respondents could not access starchy staple foods in their diet, as 39.4% could access eggs. Accessibility of vitamin A-rich vegetables and tubers was as follows: absent (6.3%), low (19.5%), (32.6%) medium, and 41.6% as high. **Table 5**

Table 5: Accessibility of food for the study population household in Isiolo County

Accessibility of food	Percentage/frequency N= 190	P value
Starchy staple food		
Absent	1.1% (2)	
Low	1.6% (3)	
Medium	22.6% (43)	0.000
High	74.7% (142)	
Total	100.0 % (190)	
Vitamin A-rich vegetables and tubers are available.		
Absent	6.3% (12)	
Low	19.5% (37)	
Medium	32.6% (62)	0.000
High.	41.6% (79)	
Total	100.0 % (190)	
Dark green leafy vegetables		
Absent	2.1% (4)	
Low	13.2% (25)	
Medium	43.2% (82)	0.000
High	41.6% (79)	
Total	100.0 % (190)	
Vitamin A-rich fruit		
Absent	13.2% (25)	
Low	20.0% (38)	
Medium	30.0% (57)	0.000
High	36.8% (70)	
Total	100.0 % (190)	
Fleshy meat		
Absent	9.5% (18)	
Low	10.5% (20)	

Medium	23.2% (44)	0.000
High	56.8% (108)	
Total	100% (190)	
Legumes, nuts and seeds		
Absent	15.8 (30)	
Low	18.9 (36)	
Medium	44.7 (85)	0.000
High	20.5 (39)	
Total	100.0% (190)	
Eggs		
Absent	13.7% (26)	
Low	18.9% (36)	
Medium	27.9% (53)	0.000
High	39.4% (75)	
Total	100.0% (190)	

F. Individual dietary diversity of the study population in Isiolo County

There was a significant difference in the dietary diversity of the study population, with a mean score of 5.15 ± 2.03 ($p=0.000$). Most

respondents were ranked to have a moderate (47.9%) and high (46.3%) dietary diversity. Only 5.8% of the respondents were ranked to have low dietary diversity. **Table 6**

Table 6: Grouping of Individual dietary diversity of the study population in Isiolo County

Variable	Percentage/frequency N= 190	p-value
Low	5.8% (11)	
Moderate	47.9% (91)	0.000
High	46.3% (88)	
Total	100.0% (190)	

Starchy staple foods were the modal food group 100% of the respondents consumed. Vitamin A-rich fruits, vegetables, and tubers were consumed by (60.0%) and (62.6%) respectively. Most (80%)

respondents consumed dark green leafy vegetables, while (55.2%) reported eating fleshy meat. Consumption of eggs, legumes, nuts, and seeds accounted for 41.0% and 74.6%. **Table 7**

Table 7: Individual dietary diversity of the study population in Isiolo County

Individual dietary plan	Percentage/frequency N= 190	p-value
Starchy staple food		
Yes	100.0% (190)	
No	0% (0)	0.000
Total	100.0 % (190)	
Vitamin A-rich vegetables and tubers are available.		
Yes	62.6% (119)	
No	37.4% (71)	0.000
Total	190(100.0 %)	
Dark green leafy vegetables		
Yes	80% (152)	
No	20% (38)	0.000
Total	100.0 % (190)	
Vitamin A-rich fruit		
Yes	60% (114)	
No	40.0% (76)	0.000
Total	100.0 % (190)	
Fleshy meat		
Yes	55.2% (105)	
No	44.8% (85)	0.000
Total	100% (190)	
Legumes, nuts and seeds		
Yes	74.6% (142)	
No	25.4% (48)	0.000
Total	100.0% (190)	

G. Headteachers of the study participants' view of the school-feeding program at Isiolo County

All (100.0%) of the head teachers strongly agreed that their schools were beneficiaries of the school feeding program, and (76.5%) strongly agreed that their schools relied on the government and

donors to fund the school feeding program. Providing a meal was significant ($p=0.000$); The nutrition level of the food was substantial ($p=0.467$), with more than half (58.8%) of the head teachers agreeing while (41.2%) strongly agreeing that the meals provided by their schools were dietary nutritious. **Table 8**

Table 8: Headteachers of the study participants' view of the school feeding program at Isiolo County

Headteachers of the study participants' view of the school feeding program at Isiolo County.	Percentage/frequency N=17	p-value
The school is a beneficiary of the school feeding program		
Strongly agree	100% (17)	
The school provides a meal to all pupils daily		
Strongly disagree	11.8% (2)	
Agree	41.2% (7)	
Strongly agree	47.0% (8)	0.000
Total	100.0 % (17)	
The meals provided are dietary and nutritious.		
Strongly disagree	41.2% (7)	0.467
Agree	58.8% (10)	
Total	100.0 % (17)	
We witness increased attendance when meals are offered.		
Strongly agree	17% (3)	0.000
Total	100.0 % (17)	
Pupils do not eat hot meals issue at school; they pack them at home.		
Agree.	35.3% (6)	
Strongly agree	64.7% (11)	0.000
Total	100.0 % (17)	
The school solely relies on the government and donors for food donations.		
Agree	23.5% (4)	
Strongly agree	76.5% (13)	0.027
Total	100% (17)	
Sometimes, we send pupils to collect firewood and fetch water.		
Strongly disagree	58.9 (9)	
Disagree	47.1% (8)	0.808
Total	100.0% (17)	
Sometimes, students remain in school even after the school has closed if there is food.		
Disagree	5.9% (1)	
Agree	23.5% (4)	
Strongly agree	70.6% (12)	0.003
Total	100.0% (17)	

2. Association between nutritional status at baseline and after the intervention after six months of study participants at Isiolo County

There was a significant difference between the baseline body mass index (mean 21.3 ± 5.5) and the body mass index (mean 22.5 ± 3.9) after six months ($p=0.005$). Similarly, a comparison between

baseline mid-upper arm circumference (mean 17.5 ± 2.2) and after six months (22.5 ± 3.3) was significant ($p=0.000$). There was no association between baseline mid-upper circumference, body mass index, and mid-upper circumference, body mass index after six months. **Table 9**

Table 9: Association between nutritional status at baseline and after the intervention with the school feeding program.

There is no association between baseline MUAC, BMI, and MUAC, BMI after six months.	Test	Sig	Decision
The median of differences between the child's baseline mid-upper arm circumferences after six months is 0.	Related samples Wilcoxon Signed Rank test	0.000	There is no significant difference in baseline MUAC, BMI, and MUAC BMI after six months.
The median of differences between a child's baseline BMI and body mass index after six months equals 0.		0.005	

3. Relationship between the nutritional status of the study participants and the socioeconomic status of their households

None of the sociodemographic factors, child's age ($p=0.469$), child's religious affiliation ($p=0.594$), child's household size ($p=0.640$), sex

of the household head ($p=0.895$), household's primary source of income ($p=0.860$) and having mosquito net ($p=0.315$) had any relationship with the body mass index. **Table 10**

Table 10: Relationship between the nutritional status of the study participants and the socio-economic status of their households.

Children demographic variables	BMI (p-value)	MUAC (p-value)
Child's age	0.469	0.799
Child's religious affiliation	0.594	0.111
Child's household size	0.640	0.466
Sex of household head	0.895	0.641
Household's primary source of income	0.860	0.073
Does the household have a mosquito net	0.315	0.439

4. Relationship between BMI, MUAC, and food availability

There was no relationship between starchy staple food ($p=0.977$), Vitamin A rich vegetables and tubers ($p=0.47$), Dark green leafy vegetables ($p=0.361$), Vitamin A rich fruits ($p=0.333$), fleshy meats

($p=0.326$), legumes nuts and seeds ($p=0.575$), milk and milk products ($p=0.832$). There was a relationship between the availability of eggs ($p=0.03$) and mid-upper circumference. **Table 11.**

Table 11: Relationship between BMI, MUAC, and food availability

Food availability	M.U.A.C	BMI
Starchy staple	0.977	0.949
Vitamin A-rich vegetables and tubers	0.47	0.292
Dark green leafy vegetables	0.361	0.342
Vitamin A-rich fruits	0.333	0.456
fleshy meats	0.326	0.339
Milk and milk products	0.832	0.355
eggs	0.03	0.987
Legumes, nuts and seeds	0.575	0.013

5. The relationship between BMI, MUAC, and accessibility of food

There was no relationship between starchy staple food ($p=1.000$), Vitamin A rich vegetables and tubers ($p=0.706$), Vitamin A rich fruits ($p=0.257$), fleshy meats ($p=0.215$), eggs ($p=0.355$), legumes nuts

and seeds ($p=0.745$) milk and milk products ($p=0.262$) and accessibility of food. There was a relationship between the accessibility of dark green leafy vegetables ($p=0.037$) and mid-upper circumference. **Table 12**

Table 12: The relationship between BMI, MUAC, and accessibility of food

Food accessibility	M.U.A.C	BMI
Starchy staple	1.000	0.977
Vitamin A-rich vegetables and tubers	0.706	0.47
Dark green leafy vegetables	0.037	0.361
Vitamin A-rich fruits	0.257	0.333
fleshy meats	0.215	0.326
milk and milk products	0.262	0.832
eggs	0.355	0.987
Legumes, nuts and seeds	0.575	0.013

Discussion

1. Child's biodata, socio-economic and household

Most of the children who participated in the study were male, and their religious affiliation was Muslim. Most families were headed by men and had more than six members. The primary source of income was earned through casual labor. More than half of the children came from households with seven and above dwellers. Jacqueline Wairimu (2018) validated these results in her study; boys constituted the majority (58%) of the sample population, and most (90.2%) of the families were headed by men. Casual labor was the second most common (36.8%) source of income, with the most popular being small-scale trading (44.6%), and the average number of children in the household was way lower (3.53 ± 1.39) compared to (5.03 ± 2.27) which has been amplified through a study by Etana & Tolossa, 2017.

2. Anthropometric measurements and their interrelationships

Combined changes in BMI and MUAC can be used to determine malnutrition in both adults and children (Mwanthi et al., 2023). The baseline anthropometric measurements for the respondents showed that most were underweight as per their BMI but were of normal

nutrition as per their MUAC. However, there were significant changes in BMI and MUAC after six months of the school feeding program. This resulted in a decline in underweight respondents by BMI and an increase in respondents with normal MUAC. The baseline BMI, MUAC post-BMI, and MUAC after six months showed a relationship using Wilcoxon's rank test. This signifies a change in BMI and MUAC after the administration of the school feeding program. These results were similar to those of Kipkemoi (2017), who found the baseline prevalence of wasting among children in an experimental group to be 5.8% and 6.1% for corn soy blend and sorghum, maize, and soybean blend porridge, respectively. However, after feeding for six months, these values decreased to 3.9% and 4.8 respectively. In this study, his control group had a baseline prevalence of 6.1% that decreased to 4.8% in six months and later increased to 5.8% after nine months when they were weaned off from the feeding trial. The changes in underweight, growth in the number of healthy weight, decrease in the percentage of moderate malnutrition, and increase in the rate of respondents with normal MUAC could be attributed to sudden changes in the nutritional intake of children, therefore growing the nutritional adequacy of the children by the fortified composite porridge flour (Wright, 2019).

3. Availability and accessibility of foods

Starchy foods were the most available and accessible food groups by respondents. Availability and accessibility of dark green leafy vegetables were relatively low. In addition, the availability and accessibility of vitamin A-rich vegetables and tubers for the majority was still low for half of the respondents. Similarly, only half of the respondents reported high availability and accessibility of vitamin A-rich fruits. As documented by (Kipkemoi, 2017) through a study done in western Kenya. The KDHS also had similar findings as it explained that maize is the most consumed staple in rural households and a national staple food for Kenyans (Demographic and Health Survey Kenya Summary Report, 2022).

4. Individual dietary diversity

Starchy staple foods were the modal food group consumed by all respondents. Vitamin A-rich fruits, vitamin A-rich vegetables, and tubers were consumed as seen by Jacqueline (Jacqueline Wairimu, 2018) got similar findings: 78.9% of the respondents in her study had moderate dietary diversity, while only 20.1 had high nutritional diversity.

5. Headteachers and teachers view of the school feeding program

In this study, most of the teachers interviewed agreed and agreed that their respective schools provided daily meals to all pupils. However, most teachers strongly agreed that schools solely rely on the government and donors for food donations. This was also the case for head teachers, who all strongly agreed that their schools were beneficiaries of the school feeding program and relied on government donations and parents' contributions. This study's results are based on qualitative research. The participants unanimously agreed that parents and the school, through the school cafeteria, played an essential role in determining students' nutrition (Olarte, 2021). Similarly, Mwanthi et al. (2023) attributed the school feeding program to high attendance and retention of learners.

6. Relationship between bmi, muac, and socio-economic status of the respondents.

None of the socio-demographic factors were related to the BMI and mid-upper arm circumference. On the contrary, an individual's socio-economic status influences BMI and MUAC. Higher wealth index, higher education levels among household heads and parents, and higher number of household members in a family are some of the factors that influence obesity and normal MUAC (Das et al., 2020; Etana & Tolossa, 2017; Maralani & McKee, 2017; Wright, 2019).

7. Effects of the feeding program in the nutritional status of the pupils.

The study results showed that most pupils were malnourished, with most underweight. Consumption of fortified composite porridge for six months led to significant changes in BMI and MUAC: a decrease in the percentage of underweight respondents, an increase in the rate of pupils who had a healthy weight as well as a more than 30% increase in the percentage of pupils that had normal MUAC. No association was found between the nutritional health status (BMI and MUAC) and socio-demographic characteristics of the respondents, as well as the availability and accessibility of foods.

Conclusion and Recommendations

I. From this study, the following conclusions were made

- a. The baseline anthropometric measurements revealed a high prevalence of underweight based on BMI, although MUAC indicated normal nutrition.

- b. After six months of the feeding program, significant improvements were observed in BMI and MUAC, suggesting nutritional enhancement.
- c. Starchy foods were the most available and accessible food group, while dark green leafy vegetables, Vitamin A vegetables, fruits, eggs, legumes, nuts, and seeds were less accessible. Similar findings were reported in other studies, highlighting the prevalence of cereals and starchy roots in diets.
- d. Most respondents demonstrated moderate to high dietary diversity, with the most consumed starchy staple foods. However, vitamin A-rich vegetables, fruits, legumes, nuts, and seeds were limited.
- e. Stakeholders generally agreed that school meals were provided daily and were nutritionally adequate. However, reliance on government and donor support was high, and reduced attendance was observed when meals were not offered.

II. Recommendations

- a. Enhanced Nutrition Education: Implement nutrition education programs targeting households and schools to promote the consumption of diverse and nutritious foods, especially those rich in essential nutrients like vitamins A and C, iron, and protein.
- b. Diversification of food sources: Encourage the cultivation and consumption of a variety of foods, including dark green leafy vegetables, vitamin A-rich fruits and vegetables, eggs, legumes, nuts, and seeds to improve dietary diversification and nutritional adequacy.
- c. Support for school feeding programs: Strengthen support for school feeding programs, ensuring consistent provision of nutritious meals and reducing reliance on external donations through sustainable funding mechanisms.
- d. Continued monitoring and Evaluation: Regularly monitor and evaluate the nutritional status of children, the effectiveness of interventions such as fortified composite porridge, and the impact of socioeconomic factors and availability of dietary outcomes to inform evidence-based interventions.
- e. Community Engagement: Engage communities in decision-making processes related to nutrition and food security, empowering them to address local challenges and implement sustainable solutions tailored to their needs.

Declarations

Ethical Approvals

This research proposal was subjected to an ethical review board and obtained clearance from the Kenyatta National Hospital University of Nairobi Ethical Research Committee (KNH - UoN ERC) P606|07|2023, The National Council for Education in Kenya (NACONEK) and approval from the County government through the Deputy Sub County Officer of Education to grant consent for conducting the research in the County. The consent form was signed by the primary caregivers of the children who were included in the study and teachers who participated did sign.

List of Abbreviations

KNH: Kenyatta National Hospital
UoN: University of Nairobi

BMI: Body Mass Index
 MUAC: Mid-upper Arm Circumference

Data Availability

The data can be availed upon formal request.

Conflict of Interest

There are no conflicts of interest in this article.

Funding Statement

The study had no external funding and was done through personal savings.

Authors' contributions

	OM	SN	AA
Research concept and design	√	√	√
Collection and assembly of data	√	--	--
Data analysis and interpretation	√	--	--
Writing the article	√	--	--
Critical revision of the article	√	√	√
Final approval of the article	√	√	√
Statistical analysis	√	--	--

Acknowledgment

We want to acknowledge the County Government of Isiolo and Isiolo Deputy Sub County Educational Officer

References

- [1] 2022 Demographic and Health Survey Kenya Summary Report. (n.d.). www.DHSprogram.com.
- [2] Abitew, D. B., Worku, A., Mulugeta, A., & Bazzano, A. N. (2020). Rural children remain more at risk of acute malnutrition following exit from community-based management of acute malnutrition program in South Gondar Zone, Amhara Region, Ethiopia: A comparative cross-sectional study. *PeerJ*, 2020(2). <https://doi.org/10.7717/peerj.8419>
- [3] Adelman, S., & Gilligan, D. (2008). How effective are food for education programs?: A critical assessment of the evidence from developing countries. <https://doi.org/10.2499/0896295095FPREV9>
- [4] Das, A., Saimala, G., Reddy, N., Mishra, P., Giri, R., Kumar, A., Raj, A., Kumar, G., Chaturvedi, S., Babu, S., Srikantiah, S., & Mahapatra, T. (2020). Mid-upper arm circumference as a substitute of the body mass index for assessment of nutritional status among adult and adolescent females: learning from an impoverished Indian state. *Public Health*, 179, 68–75. <https://doi.org/10.1016/j.puhe.2019.09.010>
- [5] Etana, D., & Tolossa, D. (2017). Unemployment and Food Insecurity in Urban Ethiopia. *African Development Review*, 29(1), 56–68. <https://doi.org/10.1111/1467-8268.12238>
- [6] Jacqueline Wairimu, M. (2018). FEEDING PRACTICES AND NUTRITION STATUS AMONG CHILDREN AGED 6-23 MONTHS FOLLOWING DISCHARGE FROM SUPPLEMENTARY FEEDING PROGRAM IN ISIOLO COUNTY, KENYA. [7] Kenya: Nutrition Profile. (n.d.). [8] Kiilu, R. M. (2019). Status of school feeding program policy initiatives in Machakos County, Kenya primary schools. *African Educational Research Journal*, 7(1), 33–39. <https://doi.org/10.30918/AERJ.71.18.107> [9] Kwena, A., & Baliddawa, J. (2012). Nutritional status of children aged 6 to 59 months in western Kenya's community-based education and service centers (COBES). *African Journal of Food, Agriculture, Nutrition and Development*, 12(51), 6229–6244. <https://doi.org/10.18697/ajfand.51.10665> [10] Maralani, V., & McKee, D. (2017). Obesity is in the eye of the beholder: BMI and socioeconomic outcomes across cohorts. *Sociological Science*, 4, 288–317. <https://doi.org/10.15195/v4.a13> [11] Mwanthi, M. M., Wafula, C. M., & Mbugua, J. M. (2023). Regular Provision of Meals during Schools Days and Learner Participation in Public Primary Schools in Makueni County, Kenya. *Higher Education Studies*, 13(3), 117. <https://doi.org/10.5539/hes.v13n3p117> [12] National Bureau of Statistics Nairobi, K. (2023). Kenya Demographic and Health Survey 2022 Key Indicators Report. www.DHSprogram.com. [13] Nwoke, C. E. (2022). Socio-Cultural Perception, Attitude and Behavior That Affects Malnutrition Incidence among Children in Maiduguri, Borno State, Nigeria. *Food and Nutrition Sciences*, 13(06), 577–599. <https://doi.org/10.4236/fns.2022.136044> [14] Olarte, D. A. (2021). Feeding the Minds of Children: Teachers' Role in School Lunch A Qualitative Study. [15] Paulitsch, R. G., & Dumith, S. C. (2021). Is food environment associated with body mass index, overweight, and obesity? A study with adults and elderly subjects from southern Brazil. *Preventive Medicine Reports*, 21. <https://doi.org/10.1016/j.pmedr.2021.101313> [16] School feeding Programmes in Kenya. (2011). [17] Shree, A., & Narayana Murthy, M. R. (2021). Impact of malnutrition on scholastic performance among school children in Mysuru. *Clinical Epidemiology and Global Health*, p. 11. <https://doi.org/10.1016/j.cegh.2021.100780> [18] WFP KENYA | Country Strategic Plan School Meals Programme in Kenya Quick Facts. (2018). [19] Wright, D. (2019). Nutrition and Hospital Mortality, Morbidity and Health Outcomes. In *Strategies to Reduce Hospital Mortality in Lower and Middle-Income Countries (LMICs) and Resource-Limited Settings*. IntechOpen. <https://doi.org/10.5772/intechopen.84282>



Published by AMMS Journal, this is an Open Access article distributed under the terms of the Creative Commons Attribution 4.0 International License. To view a copy of this license, visit <http://creativecommons.org/licenses/by/4.0/>.

© The Author(s) 2024