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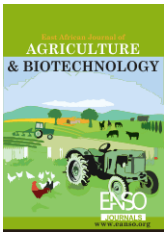

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Original Article

Teachers' Perception and Contribution of School Meals to Nutrient Intake of Kenyan Children in Relation to Recommended Dietary Requirements

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School Meals, Nutrient Intake, School Age Children, Teachers, Food Insecure.

ABSTRACT

Background: Information on the composition of school meals and their contribution to the nutritional needs of children is scarce. Although teachers are pivotal in the school meals provision process, their perceptions have been ignored. **Methods:** A cross-sectional study was conducted among 70 school teachers and 200 pupils from 11 public schools. Data collection tools included: a pretested study questionnaire, interview guide, food diary, analysis of school records and observation checklists. **Results**: Over 77% of school teachers perceived the portion of school meals served to children to be inadequate, 98.6% were of the view that meals lacked dietary diversity, while 95.7% reported meals were not well balanced. These findings highlight teachers' contextual awareness of poor meal quality; nevertheless, this could be leveraged in having them as advocates for enhanced school meals. About 84.3% of teachers indicated provision of school meals was irregular, implying that their full potential to alleviate short-term hunger, improve attention spans and learning capabilities was not being fully utilised. Meals consisted only two food groups 130 grams of maize (cereals) and 20 grams of beans (legumes), and were low in micronutrients providing only 8.8% of calcium, 22.2% of iron, 17.7% of zinc, while completely lacking in vitamin A and Vitamin C. Need to explore strategies to include more food groups in school meals to enhance dietary diversity and micronutrient adequacies. Current school meals provided 5.8 grams of protein, which was only 76.7% of the daily requirements and did not meet the recommended nutrient needs for energy and carbohydrates, implying children were at increased risk of nutritional deficiencies. Evidenced by findings that 24.0% of the children were stunted. **Conclusion:** This study highlights the need to improve the quality of school meals, particularly with regard to dietary diversity and nutrient adequacy for protein, carbohydrates, vitamin A, Vitamin C, calcium, iron and zinc. Establishing school gardens and supporting them technically and financially, especially in livestock rearing and the production of fruits and vegetables, could enhance food variety, thereby improving dietary diversity and micronutrient intake of school-going children in Kenya.

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INTRODUCTION

According to the Food and Agriculture Organisation **(**FAO) (2019), the school age period encompasses the age between 6-11 years. School-age years are characterised by dynamic growth and development, usually accompanied by mental, emotional, social and physical changes. The school age is, therefore, a profoundly important time to lay foundations for good health and optimal nutritional status, even for later years of life. Yet, malnutrition remains of public health concern with several school-age children across the world being stunted, underweight with multiple micronutrient deficiencies (United Nations System Standing Committee on Nutrition 2017). Globally, about 180 million school-age children are malnourished, with 66 million children attending school hungry (Locke et al. 2024; Agu et al. 2023). The majority of these school children reside in developing countries. According to Takeuchi et al. (2022), about 12.4%, 11.7% and 7.8% of school-age children in Kenya are stunted, thin and underweight, respectively. Additionally, 80.2% of school-age children in Kenya suffer zinc deficiency, 22.1% have iodine deficiency, while 16.5% are anaemic (Kenya, Ministry of Health, 2011). Yet, worldwide undernutrition is the leading risk factor for morbidity and premature mortality, accounting for more than half of all childhood-related deaths (Simwanza et al. 2023; Zahra 2023).

Undernutrition is primarily a consequence of poor diets. However, diets of school-age children in Kenya have been reported to be sub-optimal, lacking dietary diversity, and inadequate, with insufficient amounts of nutrients (Ndung'u and Chege, 2019; Wasike et al., 2018). Interventions to promote access and intake of healthy diets among children are urgently required for optimal growth, strengthening of the immune system and reducing incidences of disease and infections (Kishino et al. 2024; Takeuchi et al. 2022). Children spend a significant amount of time in schools; therefore, these environments are ideal settings for nutrition and health intervention programmes with the potential to attain the highest impact on children's wellbeing (Liguori et al. 2024; Shinde et al. 2023).

Schools offer platforms for food system transformations, for example, by the provision of healthy, nutritious school meals. School meal programs that provide lunch during school days are a common feature in many countries, including Kenya (Ministry of Education 2023). School meals are considered an important safety net for

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vulnerable children from food-insecure households and communities, particularly in Arid and Semi-arid Lands (ASAL) like Tharaka Nithi County. The provision of school meals is aimed at not only eradicating short-term hunger but also meeting the nutritional needs of children. For, majority of children in low-income settings, food provided in school represents the only meal eaten in a day (Wineman et al. 2022), implying school meal programs are critical in meeting the Sustainable Development Goal on hunger eradication. Yet studies examining the composition/content of school meals are lacking.

National guidelines stipulate that school meals should consist of cereals, pulses, vegetable oil and salt, while supplemented with fruits and vegetables (Kenya Ministry of Education, 2018). Yet, ingredients, portion sizes and nutritional recommendations are irregularly monitored. Moreso in ASAL regions, availability of food is a challenge due to poverty and harsh climatic conditions, not conducive for agricultural activities. Most studies have focused on school feeding programmes supported by the government without evaluation of those supported by parents. Also, aspects of the school feeding programmes that include opinions of teachers have been ignored. Teachers can be pivotal and serve as change agents in the process of providing school meals (Shinde et al. 2023). In view of their roles, it is important to ascertain their views on the effectiveness of the school feeding programme‘s implementation.

METHODOLOGY

Study Area and Study Design

The study was conducted in Tharaka Nithi County, one of the 47 Counties in Kenya. The estimated primary school-age population size in the county is 66,018 children, making up 18.6% of the total population (County Government of Tharaka Nithi 2023). Tharaka Nithi County is an ASAL region with high food poverty levels at 33.6% (Naeku and Irungu, 2024). A cross-sectional study design that involved public schools since hunger and poverty are more rampant in these environments.

Sample Size and Sampling

A sample size of 10% or more is considered adequate with the ability to provide reliable research results (Gay and Airasian, 2003). In this study, 10% of the target population was included, that is, 11 public primary schools, 70 teachers, and 200 pupils aged 7–9 years.

Tharaka Nithi County was purposively selected since it is an ASAL region. Simple random sampling was used to select the 11 schools, allowing eligible participants an equal and independent opportunity of being selected to participate in the study. Systematic random sampling was then used to select the teachers and pupils to participate in the study, which reduced the risk of bias and allowed for uniform coverage of the target population. Each school contributed a minimum of 6 teachers and 18 pupils. Only schools with operational school feeding programs were included in the study. Schools that declined to provide informed consent were excluded. Additionally, children whose parents provided informed consent were allowed to participate. The study focused exclusively on children aged 7–9 years.

Data Collection

This study adopted a mixed-methods approach. Data collection tools included: a pretested study questionnaire, interview guide, food diary, school records analysis and observation checklists. The questionnaire was administered to the teachers to gather information in reference to school meals. A food diary was used to document all the foods consumed in school for five consecutive days. The food diary was completed by the children with the help of an adult. Moreover, ingredients of food, amounts of food cooked, number of children served the prepared food, quantity of food served to each child and amounts of leftover food were collected, weighed and recorded by the researcher in grams. The seven (FAO, 2010) food groups: cereals, tubers

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and roots; milk and milk products; meat, poultry and fish; eggs; pulses, seeds and nuts; vitamin A rich vegetables and fruits; and other fruits and vegetables were used to determine dietary diversity. Dietary diversity scores were then constructed at a range of 0-7 and classified as: less than four food groups, low dietary diversity; 4-6 food groups, moderate dietary diversity; and more than six food groups, high dietary diversity. Information in regard to the food sources was collected. Age, anthropometric data (height and weight) were taken for each child using standardised procedures.

Ethical Considerations

The study was granted ethical approval by the Mount Kenya University Ethical Clearance Committee, and a research permit was obtained from NACOSTI. Further, authorisation was obtained from the relevant county offices of Tharaka Nithi County. Teachers and parents gave informed consent while children provided verbal or written assent before participation.

Data Analysis

Food items consumed in school were coded and input into the NutriSurvey software, in which the Kenya food composition databases of 2018 were embedded. Nutrient intake analysis was then performed using the Nutrisurvey software, and values were obtained and compared to the FAO dietary guidelines provisions. Anthropometric data were analysed using WHO Anthro-plus software to determine children's nutritional status. SPSS version 25.0 was used to analyse teachers' perception of school meals quality and for further analysis of the nutrient intake and anthropometric data. Descriptive statistics were used to summarise the data.

RESULTS

Characteristics of School Teachers and Children

The majority of the children were female at 52.0%, 24% had moderate malnutrition, while 29% were consuming the school lunch as the only meal of the day. School teachers were predominantly female (65.7%), aged 30-39 years (41.4%), with a certificate level of education (74.3%) (Table 1).

Table 1: Characteristics of School Teachers and Children

Parameter	n (%)
Gender of Teachers	
Female	46 (65.7)
Male	24 (34.3)
Age of Teachers	
20-29 years	11 (15.7)
30-39 years	29 (41.4)
40-49 years	23 (32.9)
50-59 years	7 (10.0)
Teachers' Level of Education	
Bachelor's Degree	5 (7.1)
Diploma	13 (18.6)
Certificate	52 (74.3)
Gender of Children	
Female	104 (52.0)
Male	96 (48.0)
Anthropometrics of Children	
Normal >-2 to <2 height-age-Z-scores	152 (76.0)
Moderate malnutrition <-2 to >-3 height-age- Z-scores	48 (24.0)
Children School Lunch Consumption Pattern	
Children Consuming School Lunch only on a day	58 (29.0)
Children consume both school lunch and dinner from home in a day	139 (71.0)

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Teachers' Perception of School Meals Quality

Table 2 shows that over 77% of school teachers perceive the portion of school meals served to children to be inadequate. Also, 98.6% were of the view that school meals lacked dietary diversity, 95.7% of meals were not well balanced, with 84.3% indicating provision of school meals to children was irregular. Although most teachers reported that school meals improved children's nutritional status and overall child health, they observed that school cooks/caterers lacked prior nutrition training. For all schools examined in this study, parents supported the school meal provisions, however, teachers observed that parents had difficulty in financing the programme.

Table 2: Teachers' Perception of School Meals Quality

	Strongly Agree	**Agree**	**Neutral**	**Strongly Disagree**	**Disagree**
Statement	n (%)	n (%)	n (%)	n (%)	n (%)
Portion of school meal served to children is adequate	10 (14.3)	6 (8.6)	0	37 (52.8)	17 (24.3)
School meals are made up of a variety of Foods	0	0	1 (1.4)	36 (51.4)	33 (47.2)
All the pupils in my school are served lunch from Monday to Friday	0	6 (8.6)	5 (7.1)	59 (84.3)	0
List of ingredients of school meals is available to parents and children	0	0	17 (24.3)	45 (64.3)	8 (11.4)
Food provided to school children is well-balanced	0	0	3 (4.3)	46 (65.7)	21 (30.0)
School meals reduce undernourishment	19 (27.1)	47 (67.2)	4 (5.7)	0	0
Provision of school lunch has led to a reduction in pupils' episodes of sickness	9 (12.9)	55 (78.5)	6 (8.6)	0	0
School meals improve overall health	16 (22.9)	50 (71.4)	4 (5.7)	0	0
School cook/caterer has prior nutrition training	0	0	0	54 (77.1)	16 (22.9)
Children's meal programs in my school are supported by parents	70 (100)	0	0	0	0
Parents have financial challenges in supporting school meal programmes	56 (80.0)	14 (20.0)	0	0	0

Ingredients of School Meals

Children were served with a mixture of boiled beans and maize with little salt added. School meals were of low dietary diversity, consisting of only 2 food groups. No school was serving milk and milk products, eggs, meat, fish, vitamin A-rich fruits and vegetables, dark green vegetables, other fruits and vegetables and organ meat (Table 3).

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Table 3: Ingredients of School Meals

Food Group	n (%)
Cereals, tubers and roots	70 (100)
Milk and milk products	0
Eggs	0
Legumes and nuts	16 (22.9)
Meat, poultry and fish	0
Vitamin A-rich fruits and vegetables	0
Other fruits and vegetables	0
Type of meal prepared	
Boiled Maize and Boiled Beans	70 (100)

Contribution of School Meals to Recommended Nutrient Intake

Children's meals consisted of 130 grams of maize, 20 grams of beans and 2 grams of iodised salt. Meals served in school were low in micronutrients and provided only 8.8% of the calcium, 22.2% of the iron, and 17.7% of the zinc daily recommended nutrient intake for school-age children (7-9 years). Additionally, school meals provided 5.8 grams of protein, which was only 76.7% for school-age children 7-9 years old. Also, the school meals were not meeting the RDA for energy and carbohydrates. Overall, the school meals lacked vitamin A and Vitamin C (Table 4).

Table 4: Contribution of School Meals to Recommended Nutrient Intake

Nutrient	Nutritional Requirements 30% FAO RNI	Boiled maize + boiled beans % contribution to 30% FAO RNI)	School meal % to which RNI was met
Energy (Kcal)	509.4	270.8	53.1
Carbohydrates (g)	52	49.3	94.8
Fat (g)	11	5.6	50.9
Protein (g)	7.56	5.8	76.7
Calcium (mg)	210	18.5	8.8
Iron (mg)	5.4	1.2	22.2
Zinc (mg)	3.39	0.6	17.7
Vitamin A ug/RE	150	0	0
Vitamin C	10.5	0	0

RDA values derived from FAO (Burgess & Glasauer, 2004)

DISCUSSION

Kenya State Department for Early Learning and Basic Education (2023) stipulates that school meals consist of 150 grams of cereals, 40 grams of pulses, 5 grams of vegetable oil, 2 grams of iodised salt, fruits and vegetables. However, school meals being served to children in Kenya are inadequate, consisting of only 130 grams of maize and 20 grams of beans. This implies children in Kenya still endure hunger in school, are prone to class skipping, with poor concentration spans limiting educational attainment and continuing to widen economic disparities. School meals are predominantly maize-based and are deficient in milk and dairy products, eggs, meat, fish, vitamin A, rich fruits and vegetables. Yet, 29.0% of children in this study receive only one meal a day, mostly from school, therefore unlikely that they will receive a variety of foods while at home, considering this is a food-insecure region with high poverty levels.

Habits of provision of school meals that lack animal foods, fruits and vegetables have been reported in Kenya (Hulett et al. 2014), Tanzania (Roothaert et al. 2021) and Sweden (Colombo et al., 2021). Diets

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that are low in animal source foods, fruits and vegetables cannot be ignored since such poor diets are contributory factors for undernutrition and multiple micronutrient deficiencies (Hulett et al., 2014; Ndung'u and Chege, 2019). Plant-based diets are high in antinutrients, including phytate, dietary fibre, and low in vitamin B12, impairing bioavailability of nutrients, including zinc and iron (Nair & Augustine, 2018; Samtiya et al., 2021). World Food Programme (WFP, 2020) emphasises its own food production through the adoption of school gardens. However, all schools examined in this study lacked functional gardens attributable to water scarcity for any meaningful agricultural activities. Also, poverty and harsh climatic conditions are major hindrances of school gardens establishments at Tharaka Nithi County. In this regard, climate-smart interventions, including borehole drilling, water harvesting, mulching, among others, are recommended.

School meals in Kenya lack dietary diversity, yet school meal guidelines outline the need for the inclusion of a variety of foods. Kenya State Department for Early Learning and Basic Education (2023) estimates that 93% of school meals are cereal-based. Implying that children are receiving low-quality diets. High dietary diversity is correlated to positive nutrition outcomes, including better nutrient intake, improved haemoglobin levels, anthropometric measures and lowered morbidity and mortality (Frempong & Annim, 2017; Oladejo & Ayodele, 2019). Well-planned school meals increase dietary diversity and could provide a third of the RDA for energy, protein, Vitamin A, iron and iodine. Challenges to offer nutritionally adequate school meals remain. According to the Kenya State Department for Early Learning and Basic Education (2023). The government is supposed to provide KES. 10 per child each day for school feeding in food-insecure regions. However, in this study, parents contributed money to enable the purchase of food, however, the funds were insufficient, with some unable to consistently make monthly payments. Indicative of the need for the government to recommit to financially supporting school feeding by disbursing funds to concerned schools.

School meals provided in Kenya do not meet the RDA guidelines for energy, fat, protein, and carbohydrates. Similar observations were made in studies in Ethiopia (Destaw et al. 2022) and Ghana (Ayogu et al. 2018). Carbohydrates are essential for the provision of energy to body cells, particularly the brain, which is glucose-dependent. Carbohydrates should provide 45-65% of energy to ensure that protein is sparingly used for growth, repair and maintenance. Also, fat should provide 25-40%, the fat intake values obtained in this study suggest the need for increased macronutrient intake. In this study, parents contributed money to enable schools to purchase food for meal preparation. However, teachers observed that not all parents were able to contribute, resulting in insufficient funds hindering the purchase of enough food, and this may be the main barrier to macronutrient adequacy. A combination of strategies that address nutritional, social, environmental, and economic factors is needed for quality school meals.

School meals were low in micronutrients, including calcium, iron, zinc, Vitamin A and Vitamin C, attributed to the lack of inclusion of milk and milk products, eggs, meat, fish, vitamin A-rich fruits and vegetables. Reaffirmed by the finding that 24.0% of children in this study were stunted, implying that children are predisposed to multiple nutritional deficiencies. Deficiency of whichever nutrients at any stage of the lifecycle is carried through to the next stage. Similar to current study findings, Mungai et al. (2024) reported that school meals provided in Kenya are low in nutrients, increasing children's risk of premature death, frequent infections, illnesses and poor cognitive development. Nutrient deficiencies are linked to lowered human productivity from 15% to 10% and a reduction of gross domestic product by 10% (Ayal et al. 2022). Mungai et al. (2024) observed the need for community empowerment to boost income

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generation and food production activities to meet the nutritional needs of children, even when at home.

This study has some limitations. The study involved participants in Tharaka Nithi County, study findings may therefore apply to ASAL regions only. Biochemical tests to determine the different biomarkers for nutrients were not conducted. In this regard, studies covering more regions in Kenya and those that involve biochemical analysis are recommended. Notwithstanding study provides useful information on teachers' perception of school feeding programs and contribution of school meals to nutrient requirements and the nutritional status of children. Study findings remain relevant to various stakeholders, including the government, parents, teachers and school managers for the improvement of school meal qualities for better education, nutrition and health outcomes.

CONCLUSION

This study revealed that school meals were inadequate, mainly based on cereal foods, and lacked dietary diversity. Children were also not consuming animal foods, fruits and vegetables. Consequently, daily nutrient needs for energy, protein, carbohydrate, fat and micronutrients were not being met. Moreover, about 24% of the children were stunted. Nutrition gaps, especially for vitamin A, iron, zinc and calcium, hinder optimal growth and development of children. Schools need to be financially and technically supported in livestock keeping, fruit and vegetable production to ensure food availability, improving dietary diversity and micronutrient intake of school-going children. Community empowerment programs geared towards better income generation and poverty reduction are also critical in enhancing the nutrient intake and nutritional status of children. Government policies on school feeding should be linked with local communities to strengthen food systems to ensure the production of diversified foods for better nutrition.

Author Contributions

Jane Mbijiwe and Pamela Muriungi conceptualised the study. Peter Kibet Koech, Mugendi Kanampiu M'Rithaa, Jane Mbijiwe and Pamela Muriungi developed the methodology and collected data. Data was analysed by Jane Mbijiwe. Interpretation and discussion of results were done by Peter Kibet Koech, Mugendi Kanampiu M'Rithaa, Jane Mbijiwe and Pamela Muriungi. All the authors read through the manuscript and approved it before submission.

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Authors Information

All the authors are employees of Machakos University, Kenya.

Disclosure Statement

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