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The Cost of a Nutritious School Meal in Kenya

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The Cost of a Nutritious School Meal in Kenya

Education Sector

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Table of Contents

List of Tables

List of Figures

Abbreviations and Acronyms

AU	African Union
AUDA-NEPAD	African Union Development Agency-New Partnership for African Development
ECD	Early Childhood Development
FAO	Food and Agriculture Organization
GoK	Government of Kenya
HGSF	Home Grown School Feeding
HGSMP	Home-Grown School Meals Programme Implementation Guidelines
Ksh	Kenya Shilling
MoE	Ministry of Education
MoAL	Ministry of Agriculture
MoH	Ministry of Health
RAE	Retinol Activity Equivalents
RDA	Recommended Daily Allowance
SDGs	Sustainable Development Goals
SFPs	School Feeding Programmes
SSFNI	Sustainable School Food and Nutrition Initiative
UNESCO	United Nations Educational, Scientific and Cultural Organization
UNICEF	United Nations Children's Fund
UNU	United Nations University
USD	United States Dollar
WHO	World Health Organization
WFP	World Food Programme

Abstract

School meals are integral for advancing education, nutrition, and social welfare goals, prompting nations such as Kenya to expand their school meal programmes. School meals should meet the micro- and macro-nutrient requirements for children. However, costing of these meals in Kenya does not consider the requirements for micro nutrients, and generally lack a systematic costing approach. Subsequently, there is dearth of information on costs in Kenya that affects planning and implementation of school feeding policies. This study used linear programming approach to obtain nutritious menus for school meals and their costs. The estimated average daily cost of a nutritious school meal ranged from Ksh 10.71 to Ksh 51.86, varying across age groups, with older children's meals costing more due to greater nutritional needs. For Early Childhood Development (4-5 years) children, the average cost was Ksh 26.76, with a range of Ksh 10.71 to Ksh 51.86. For primary school children, the average cost was Ksh 35.68, with a range of Ksh 17.4 to Ksh 51.77. For secondary school children, the average cost was Ksh 38.93, with a range of Ksh 20.3 to Ksh 51.72. The study also established the possibility of meeting the requirements at the prevailing expenditure ceiling per child, particularly for pre-primary children's meals. School feeding policies and guidelines should integrate milk, and green vegetables in school feeding menu guide in addition to maize, as they improve the nutritional quality of school meals at manageable costs. The supply of school meals should be integrated with locally available foods, putting into consideration seasonality and preservation methods. This includes encouraging cultivation of alternative and nutritious foods within the school environment, as it would further cut costs while improving the quality of meals. Under-utilized foods such as millet and sorghum have potential of replacing maize and should be considered for school feeding. Lastly, budget allocations for school meals should reflect distinct nutritional requirements for different age groups. This means having a multifaceted approach to enhance the effectiveness and efficiency of school meal programmes in Kenya, in promoting both education, health and nutrition outcomes.

Introduction

School meals provide an opportunity for promoting several human development agendas simultaneously, and this calls for inter-sector collaboration to achieve common goals. Globally, over 116 countries of diverse income levels provide school meals, making them the most widespread form of social safety net (Bundy et al., 2024; and Drake et al., 2020). School meals present an opportunity for convergence of health, education, nutrition, and social protection outcomes, thus an opportunity for improving human capital holistically (Drake et al., 2020). UNESCO, UNICEF, WFP (2023) describe school feeding programmes (SFPs) as a cost-effective investment with an estimated US$ 9 in returns for every US$ 1 invested. More countries and children could therefore be integrated into school feeding.

SFPs and home-grown school feeding programmes (HGSF), which source foods from local producers, present an important gateway for fostering uptake of crucial macro- and micronutrients to school-going children, who have been observed to suffer high rates of under-nutrition (Vastrand et al., 2023; Ali, Kassahun, Wubneh, Mekonen and Workneh, 2022; and Mwaniki and Makokha, 2013). These nutrients are key in facilitating cognitive development of children and are projected to contribute to the realization of the Sustainable Development Goals (SDGs) 1, 2, 3, 5, and 14 (Ahern et al., 2021).

HGSF directly contribute to the implementation of the Sustainable Development Goals (SDGs) such as zero hunger (SDG 2) and quality education (SDG 4) as demonstrated in recent evidence compiled by WFP (2017). The Africa Union (AU) recognizes the critical role school meals play in enhancing education objectives and adopted HGSF as a strategy for sustainable school feeding. School feeding is also one of the strategies adopted by the Union in the Continental Education Strategy for Africa 2016-2025. To implement the strategy, the AU further developed guidelines to help countries in the process of establishment and review of HGSF programmes (AUDA-NEPAD, 2022).

As part of the process of enhancing education and human capital outcomes, the Government of Kenya (GoK) with the support the from various stakeholders has been running various models of school feeding programmes since the 1980s. These programmes have evolved from being dependent on development partner funding to fully-fledged government-funded programmes. In Kenya, the HGSF programme is implemented in four (4) models: in-kind; cash transfer; community-based; and outsourced catering. The Government of Kenya has adopted the in-kind and cash transfer models, while the community-based is implemented by communities on a voluntary basis. The outsourced catering is implemented by both government and communities or partners.

The HGSF programme in Kenya is recognized as a social safety net for school children by the National Social Protection Policy of 2011. The programme been applied as a social safety net in the arid and semi-arid regions of Kenya that record limited net enrolment rates, school attendance and completion rates (Bhalla, 2023). It is also an important avenue for addressing micro-nutrient deficiency: pre-school and school-going children have previously been found to be deficient in micro-nutrients such as iron, zinc and iodine (Ministry of Health, 2011).

The intentions of the government's school meals programme are spelt out in the Kenya School Meals Policy that was in its final stages of drafting by the time of this study. The target is to provide at least one nutritious meal to all school-going children per school day at all levels (pre-primary, primary, secondary). The objectives of the Kenya School Meals Policy include, among other things, increasing the number of learners accessing safe, diverse and nutritious school meals, and establishing mechanisms for resource mobilization and sustainability of the school meals programme. This policy is to be implemented in phases, with a plan to double the number of children accessing school meals by the year 2024 and cover all children by the year 2027.

Expanding the currently limited coverage of the school meals programme requires extensive knowledge of the cost structure to be able to estimate the budgetary needs for meeting the programme objectives. The current estimated cost of one meal per day per child is Ksh 23, but this figure has not been determined using a systematic approach in Kenya. The efficiency of this cost is not clear due to the paucity of information on the cost of school meals in Kenya. Studies on school feeding programmes mostly focus on assessing the impact, with limited attention given to the costs of implementing the same (Geli et al., 2011). Studies that have attempted to estimate this cost belong to contexts that are fundamentally different from those in Kenya (Stern et al., 2023; Eustachio-Colombo et al., 2020; and Geli and Suwa, 2014), which greatly influences the suitability and transferability of the computed estimates of cost of foods. The paucity of information on costs leads to arbitrarily set costs that introduce uncertainties and sustainability issues in school feeding programmes.

This study seeks to estimate the cost of a nutritious school meal in Kenya, motivated by the need to systematically establish the cost of school meals in Kenya. Estimation of such costs is important in facilitating resource mobilization strategies towards implementation of the Kenya National School Meals Policy. The study targets implementation instruments such as the school meals menu guide that was being drafted by the time of this study. Specifically, the study seeks to estimate the cost of foods constituting a nutritious school meal and construct models of meals that are adaptable to realities of school feeding in Kenya.

The rest of the paper is organized as follows: section 2 presents a review of Kenya's policies and strategies of school meals and to assess their orientation towards nutrition. Section 3 comprises of literature review, while methodology is laid out in section 4. The results from analysis and discussion of the same is in section 5, with part 6 presenting conclusions and recommendations from the study.

Overview of Policies, Programmes and Strategies on Nutritious School Meals

The Constitution of Kenya, Acts of Parliament and policies support the agenda of school meals in Kenya. The Constitution guarantees every child a right to basic nutrition in Article 53 1(c). Among the laws supporting school meals in Kenya is the Basic Education Act of 2013. There has also been recent but unsuccessful attempts to legislate provision of milk as a component of nutritious meals in Kenya, through revision of the latter Act. The set of policies with pronouncements on school meals in Kenya include the Kenya School Meals Policy; Kenya School Health Policy; Sessional Paper No. 1 of 2005 on education, training and research; Home-Grown School Meals Programme Implementation Guidelines (HGSMP); and National Pre-primary Education Policy. Others include strategies to implement the policies such as the National School Meals and Nutrition Strategy (2017-2022). Table 2.1 summarizes the key issues and observations pertaining to school meals that emerged from a review of the same.

Table 2.1: A summary of review of legal and policy provisions for school meals in Kenya

Key area for school meals	Policy or legislation	Provision	Remarks
Legal basis for school meals	Constitution of Kenya (CoK) in Article 53 (1) (c)	CoK guarantees every child a right to basic nutrition. This acts as a basis for development of school feeding programmes, since children spend significant amounts of their time in school.	• CoK provision provides a basis for estimating and updating the cost of school feeding, to support resource mobilization strategies that can meet the needs of all school children. • There are no regulations in Kenya governing the conduct of school feeding. All existing instruments are mainly persuasive. • There has been past but unsuccessful attempts to introduce milk in school feeding through the Basic Education Amendment Bill No. 4 of 2021. The cost of such an intervention has, however, not been systematically estimated.
	The Basic Education Act, 2013 .	Guarantees every child free and compulsory education, thereby providing a basis for facilitating children to acquire the same; for example school meals given that children often report to school hungry or fail to report due to lack of food and other necessities.	
Scope or coverage of school feeding	Constitution of Kenya in Article 53 (1) (c)	Forms a basis for inclusion of all children into school meals.	• Apart from the government financing through the regular budget, there is no comprehensive study that quantifies the accompanying cost of the expansion. Instead, there is a call for more partnership between parents, communities and development partners to fund school meals.
	Kenya School Meals Policy of 2023 (draft)	Declares the need for expansion to increase the number and profile of learners benefiting from school meals.	
	Sessional Paper No. 1 of 2005 on education, training and research	Expanded the scope of Kenya's school-feeding programme to cover children in all needy areas.	

Standard, safety and quality	Kenya School Meals Policy of 2023 (draft) Kenya School Health Policy	• Ministry of Education commits to enhance the safety and quality standards of food for school meals. • Commits schools to provide diverse meals for purposes of achieving nutritional requirements.	• Does not provide a framework to guide the standards and quality (nutrition value; recipes or fortification). For instance, it is not clear what happens when schools are found offering meals that do not meet nutrition thresholds.
	Home-Grown School Meals Programme Implementation Guidelines (Ministry of Education, 2017)	• Illustrates potential food quality issues and techniques of avoiding or dealing with such issues during procurement, storage and handling of food for school meals. • Provides a combination of a menu comprising of cereals, pulses and vegetable oils. Advises other interventions to provide additional nutrients that may not be met from the standard school meal.	• The provided combination does not meet the nutrition requirements for school children as established in this study: lack vegetables and fruits.
	National School Meals and Nutrition Strategy (2017–2022)	• Declares nutrition considerations as a necessity in school meals programme. The strategy also suggests legal anchorage of school meals funding to avoid ad hoc budget cuts that have been shown to affect planning and execution of the programme.	• Absence of guidance to address inherent trade-offs between nutrition considerations; food diversity and cost of school meals. • Resource mobilization strategy is also not clear. Instead, responsibilities relating to these aspects are disjointly allocated to stakeholders in the strategy.

Governance and management of school meals	National Pre-primary Education Policy of 2017	• Directs county governments to establish mechanisms for ensuring provision of nutritious meals for pre-primary children.	• No guidelines and strategies on the implementation of the nutrition pronouncements in the policy. This is despite pre-primary children having different nutrition requirements that may not fit those of primary school age children.
	Kenya School Meals Policy of 2023 (Draft) Kenya School Health Policy	• Provides for arrangements to facilitate parental involvement in design of school meals; research, monitoring and evaluation to improve knowledge and accountability in school meals. • The policy provides a coordination structure that lays out reporting lines for school feeding programme.	• Coordination structure is devoid of a national technical committee that would infuse technical inputs to improve the efficiency of school meals.
	National School Meals and Nutrition Strategy (2017–2022); Home-Grown School Meals Implementation Guidelines	Provides institutional framework that allocates roles to different players in the school feeding programme	
Planning and costing of school meals	Kenya School Meals Policy of 2023 (draft)	• School meal planning roles are distributed to various actors based on their respective mandates. • Ministry of Education is expected to jointly work with other sectors to provide safe, diverse, nutritious and locally available school meals to learners.	• To infuse technical efficiency using multidisciplinary inputs; it would serve better to have a national technical committee. This would check aspects of the programme such as adherence to nutrition standards and budget adjustments on a regular basis.
	Home-Grown School Meals Programme Implementation Guidelines (Ministry of Education, 2017)	• Guides the food procurement and accountability process, including stock management. • The guidelines provide for revision of the money allocation per child to accommodate changes in market prices. • The price quoted by suppliers under the HGSMP is inclusive of transport and taxes.	• There is need for the guidelines to be informed by systematic estimation of costs, which integrates the nutritional and other requirements of school children.

Financing of school meals	Kenya School Meals Policy of 2023 (draft)	• Recommends government (national; county) as main sources of funding for school meals. Others financiers include development partners and community (parents). • Recommends development of a school feeding resource mobilization framework to harness the above sources of financing.	• There is no provision for formal estimation or projection of financial requirements. • The cost of implementing the policy is also not available, especially that of availing school meals to all children.
	National School Meals and Nutrition Strategy (2017–2022)	• Recommends legal anchorage of funding of school meals to prevent ad hoc budget cuts that affects implementation of programme.	• Cost of implementing the strategy is not available. • The basis for anchoring the funding is not clear, in the absence of any threshold for school meals requirements.

The school feeding budget also portrays policy stance, as increments or reductions in the same could end up improving or worsening adherence to nutrition standards. Budget allocations for school feeding increased significantly between 2021/22 and 2022/23. This was in response to the growing number of school children and government's strategy of improving retention of children in schools. However, there is no clear pattern between the changes in the budget and the number of children benefiting from school feeding as shown in Table 2.2. This suggests a lack of systematic approach in developing the expenditure estimates for school feeding. The current study seeks to contribute towards such an approach by determining the cost of a nutritious school meal.

Table 2.2: Allocation to school feeding and number of children in the programme

Year	Government of Kenya (billion)	No. of children benefiting from school meals (millions)
2018 /19	1.8	1.6
2019/20	2.0	1.6
2020/21	1.9	1.6
2021/22	1.8	1.8
2022/23	4.4	1.9
2023/24	4.9	2.6

Source: Ministry of Education

Literature Review

Studies on school meals have largely dwelt on the benefits and impacts of school feeding programmes on learning outcomes (Mohammed et al., 2023; Destaw et al., 2022), health and micro-nutrient status (Adelman et al., 2019; Hochfeld et al., 2016; Jomaa, McDonnell and Probart, 2011). Literature on costs of school meals or even cost effectiveness is scanty, yet financial commitments from governments are important determinants of sustainability of school meal programmes. As observed by Goldsmith et al. (2019), most school feeding policies in developing countries have information gaps in that they do not give much details on the nutritional composition and attendant costs of school feeding programmes. Lack of information on costs and their basis can generate gaps between policies on school meals and what is actually implemented. This may degenerate in school feeding failing to achieve the intended objectives. For instance, there is recent evidence that school meals do not meet the Recommended Dietary Requirements (RDA) of nutrients (Desalegn, Gebremedhin and Stoecker, 2022; Goldsmith et al., 2019) or even learning outcomes (McEwan, 2013). Failure to establish real costs may lead to financial inadequacies that in turn lead to lower quantity and quality of school meals.

Nutritional content of school meals needs to be supported with equivalent financial commitments to prevent substitution with lower quality alternatives. Commonly consumed foods even by households have been shown to have little to no nutrition value (Madhala et al., 2022), implying the need to guide and monitor the nutrition value of school meals during design and implementation of school feeding programmes. There is also evidence suggesting that more nutritious and locally produced foods can be incorporated in school meals to meet the RDA intake of nutrients for school-going children without disruptive adjustments (Goldsmith et al., 2019) or with some major adjustments in the programme, such as the case of including fish in school food (Ahern et al., 2021). This calls for rigorous interrogation of options before settling on the food basket, as this can greatly alter the cost profile and resource utilization.

There are several approaches to assessing the costs of nutritious school meals. The first approach is to examine the nutrition component of existing school meals, while seeking possibilities of rectifying any deficiency within a given budget. Goldsmith et al. (2019) used this approach to test four propositions using actual meals consumed in schools in Ghana. These are: (1) that a school meal can be delivered by caterers at less than the 100 pesewas (US$ 0.21) ceiling set by the government; (2) that the prepared meal meets the Recommended Dietary Allowance (RDA) for protein; (3) that soy can cost-effectively replace rice as a better source of protein; (4) that significant differences exist in the macro- and micro-nutrient profile of the meals due to caterer choices, and that these differences do affect the marginal cost of adding proteins to the meals. The study established that school meals could be prepared at an average of 62 pesewas, leaving a margin of 38 per cent for caterers; this is well below the 100 pesewas ceiling that the government paid the caterers for each child fed. Further, the meal as prepared met the RDA for 4-8-year-olds but could only meet 18 per cent of the RDA for 9-13-year-olds. Replacing rice with soy increased the net average cost of the meal by 25 per cent (15 pesewas) from 62 (US$ 0.13) to 77 (US$ 0.17) and improved the RDA for protein by 24 points. This study provides a basis for setting higher RDA and costs for higher age sets, to avoid a situation of trading off cost efficiency with nutritional suitability of school meals.

The current study followed this argument, but did not have the privilege of examining meals being consumed in schools.

In another similar approach, Parish and Gelli (2015) analyzed existing school meals in Ghana in a bid to establish the nutritional content and seasonal variations of the same, using financial allocation per child by the Government of Ghana as the main constraint. The nutritional adequacy was set at 1/3 of daily requirements for each age group since children took only one meal in school under the programme. Most meals were found to have adequacy of both carbohydrates and proteins but deficient in iron and vitamin A. The government allocation per learner was, therefore, providing nutritionally inadequate meal for school children, suggesting the need for consideration of nutrition content at the stage of calculating the cost of school meals. The current study sought to establish nutritional shortcomings of the model menus for school meals, and establish superior alternatives alongside their costs.

Another similar attempt is found in Galloway et al. (2009), who estimated the school meal cost and impacts from World Food Programme (WFP) school feeding programmes in a bid to establish the cost-effectiveness of WFP school meal programmes in Kenya, Gambia, Lesotho and Malawi. The information on cost was obtained from both WFP records and complemented with interviews from education officials and stakeholders in the countries. The cost of feeding a child per day, assuming a 195-day education calendar was estimated at US$ 0.09 (2005 prices) and US$ 0.15 (2022 prices). Notably the cost was determined from aggregating the different programme expenditures as opposed to starting with the food requirements. Although this may capture both the food and administrative expenditure, there are major drawbacks that affect the nutrition profile of the said meal. First, the cost of meals was not based on a predetermined nutritional threshold but the WFP purchase and government administrative costs. The shortcoming of such approach is expressed by Winemann et al. (2022), who finds that over-reliance on foreign food aid donations is correlated with less diverse and therefore less nutritious foods in Africa. The nutritional value of the meals resulting from such costs cannot be ascertained. The other limitations emanate from bias in the stated costs, especially by the respondents depending on the motive (Galloway et al., 2009).

While the above literature on school meals and the attendant costs generally refer to scenarios in low or lower middle-income countries, there is another set of literature revolving around sustainability of school meals. This literature emanates from matured school feeding programmes in developed nations such as Italy (Rossi et al., 2021; and Sweden (Colombo et al., 2019). The studies find combinations of food for public meals that are nutritious; acceptable to beneficiaries; lead to lower greenhouse gas emission and achieved at minimum costs. The approach used by these studies informs the methodological basis for optimization, but the environmental trade-off was not within the scope for the current study. To improve on approaches used by Parish and Gelli (2015) and Goldsmith et al. (2019, the current study set the established RDA of school children as constraints in a modelling environment to sought the minimum costs for achieving combinations of foods (menus) that meet those RDAs.

4 Methodology

4.1 Empirical Framework

When planning meals for school children at all levels, there are minimum considerations for nutritional needs of the beneficiaries. Adequate provision of essential nutrients, including proteins, carbohydrates, fats, vitamin A, iron, folate, vitamin B12, iodine, zinc, and other vital elements is imperative for their physical growth, cognitive development, and overall well-being. The objective of the analysis was, therefore, to select meal plans comprising of food items available in the Kenyan market that meet 30 per cent of the recommended daily allowance of 4-5-year-olds (pre-primary), 6-13-year-olds (primary) and 14-17-year-olds (secondary), respectively, while achieving a minimum cost for the same.

To achieve this, the study used linear programming (LP) approach, which minimized a given (linear) objective function subject to a set of (linear) constraints that comprised of a set of decision variables. An LP set-up has three (3) main elements: (i) the objective function (a loss function or its negative of the goal variable); (ii) the decision variables (the variables to be changed by the model); and (iii) a set of model constraints (or conditions) to be met. If all the set constraints are met, then a solution to the problem will have been arrived at. The model set up is as follows:

Let:

MinCost be the minimum cost of a meal

x_i be the quantity of food item i (in grams or millilitres) to be included in the meal

$cost_i$ be the wholesale price per 100 grams or millilitres of the i^thfood item

n_min_j be the minimum allowable amounts of nutrient j

n_max_j be the maximum allowable amount of nutrient j

$amt_{[j,i]}$ be the amount of nutrient j per 100 grams or milliliters

Then the objective function is expressed as

MinCost= $Min\ Cost = \sum_{i=1}^{n} cost_i * x_i$

and the set of *n* constraints to ensure that the meal meets the nutritional requirements, namely calcium, carbohydrate, energy, fat, food folate, iron, protein, vitamin A-RAE, vitamin B12, and zinc so that:

$$n\_min_j \leq \sum_{i=1}^{n} amt_{[j,i]} * x_i \leq n\_max_j$$

The study used the lpSolve package in R to find the optimal values for the food items that minimize the total cost while satisfying the nutritional constraints (conditions).

The optimal solution to the minimization problem provided the quantities of food items to include in the meal, along with the corresponding total cost to achieve that meal plan. Additionally, it provided an overview of the nutrients available in the suggested meal. To meet these needs, the study selected food items available in the Kenyan market to form the meal plans that meet 30 per cent of the daily nutritional requirements for each age group.

The optimal menus were compiled into a database and then classified using criteria such as:

(i) Ease of availability of food items;

(ii) Ease of handling the food items (combining them and possible forms); and

(ii) Cost (whether below or above the current budget allocated per child).

4.2 Data Sources

The data collected for this study include nutritional content of various food items available in Kenya, and wholesale market prices for food items and the recommended average daily nutrient intake for each age group. This data was collected from three (3) main sources:

(i) Kenya Food Composition Table 2018: a primary source of information for the nutritional content of various food items. This was the most recent data jointly compiled by the Ministry of Agriculture, Ministry of Health, FAO and other partners.

(ii) Wholesale market prices from the Ministry of Agriculture: provided the average annual prices of food items in Kenya's market calculated from the daily prices. The Home-Grown School Meal Programme Implementation Guidelines make reference to wholesale prices: these are lower than retail prices due to economies of scale emanating from bulk purchases.

(iii) Tufts University and WHO (Human energy requirements: report of a joint FAO/WHO/UNU Expert Consultation (2004). This was the source of 30 per cent (1/3) of the recommended average daily macro and micro nutrient intake for children aged 4-5; 6-13 and 14-17 years. Schools provide only 1 out of 3 required meals per day, which should account for 100 per cent of the daily nutrient intake. The 1/3 cutoff, therefore, applies to the single meal taken in school.

This study took note of varying ranges of the proportion of energy intakes from carbohydrates, protein and fats recommended in the relevant literature. For instance, WHO (2023) recommends that 40-70 per cent of daily energy intake be derived from carbohydrates. Earlier references guide that 55-75 per cent of energy intake should be derived from carbohydrates, 15-30 per cent from fats and 10-15 per cent from proteins (WHO, 1989).

Table 4.1 presents a comparison between the nutrient composition in 1/3 of the recommended average daily nutrient intake from the prevailing school meal menu. The menu applied for primary and secondary school children consists of 237 grams portion comprising of maize, broad beans, corn oil, and iodized salt. The expenditure allowed per school child for this meal is Ksh 23 and covers food items, storage and logistics; the cost of these food items estimated by this study using 2021 prices was Ksh 9.3.

The nutrition composition of this meal is deficient in energy requirements for children aged 6 years and above, and grossly deficient in key nutrients such as calcium, vitamin A-RAE, and vitamin B12. It, however, meets the zinc, iron and folate requirements. The menu for pre-primary school children comprises of 127 grams portion comprising of maize, broad beans, corn oil, and iodized salt, with a cost of the menu estimated at Ksh 6.3. This menu meets the energy, iron and zinc requirements for children. However, it is grossly deficient in calcium, Vitamin A and B12. Similar patterns of school meals that are deficient in Vitamin A were found in Ghana by Parish and Geli (2015).

Noticeably, there is no mandatory requirement for school menus to include milk or vegetables, yet the two are cited by the Ministry of Health (2011) as the major sources of calcium and vitamin A in Kenya. The current study sought to establish alternative menus that meet learners' nutritional requirements as a means of contributing towards the debate on standards of school meals in Kenya.

Table 4.1: Nutritional requirements versus current intake for school-fed children

Age set	Nutritional requirements of children by age			Intake from current meal (4-5years	Intake from current meal (6-17years)
	4-5 (Pre-primary)	6-13 (Primary)	14-17 (Secondary)		
Energy (kcal)	433.50	720.93	951.92	451	684.5
Carbohydrate (g)	43-76	72-126	95-167	70.5	109.35
Protein (g)	11-16	18-27	36-95	13.09	22.19
Fat (g)	7-14	12-24	16-32	9.81	12.36
Calcium (mg)	200.00	433.33	433.33	19.89	75.04
Iron (mg)	1.40	5.25	5.53	3.69	5.98
Zinc (mg)	0.97	1.57	1.57	2.59	4.24
Food folate (mcg)	66.67	133.33	133.33	121	206.5
Vit A-RAE (mcg)	150.00	200.00	200.00	0.4	1.1
Vit B12 (mg)	0.40	0.80	0.80	0	0

Source: Adopted from FAO/WHO/UNU Expert Consultation report of 2004; Carbohydrates; protein and fat distribution based on WHO (2023) and WHO (1989)

5 Results and Discussion on Cost of School Meals

This section presents the results obtained from the optimization model. The optimization generated a total of 3,579 feasible menus that met all the nutritional requirements of school children at minimum cost for the involved ingredients. The whole set of menus are found in a separate *Nutritious School Meal Menus Handbook*, which should be read together with this paper. Each menu is uniquely identified by the number (e.g. 269) and the part (e.g. 5) of analysis where it was extracted from. The menus were categorized by the age of school children and are fit for: 4-5 years (pre-primary); 6-13 years (primary) or 14-17 (secondary).

An illustration of a menu for children aged 4-5 years as found in the manual is shown in Table 5.1. This sample menu (number 269 (5)) meets all the nutrition requirements of a child aged 4-5 years, at a cost of KSh 10.7.

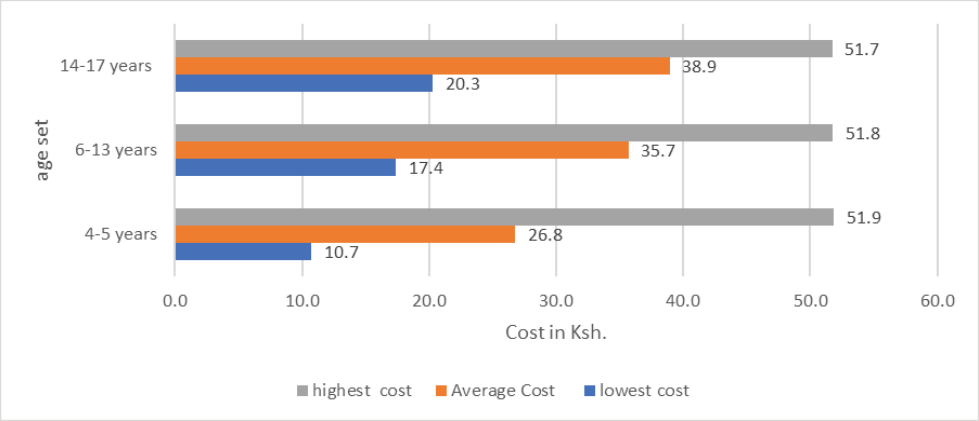
Table 5.1: A sample of a nutritious school meal for children aged 4-5 years

Analysis Part	Sample Menu	Market Item Name	Quantity to Buy	Edible Quantity	Price per 100 Grams	Optimum Cost (Ksh)
5	269	Maize, grain, dry	107.9	107.9	3.1	3.4
		Amaranthus (Terere)	107.6	63.5	3.5	2.2
		Milk (cow at collection point)	67.7	67.7	4.7	3.2
		Vegetable cooking fat	5	5	35	1.8
		Salt	2	2	3.9	0.1
		Total	290.4	246.3	50.3	10.7

Source: Authors' Computation

The average, lowest and highest cost of a nutritious school meal estimated for each age set of school children is illustrated in Figure 5.1.

Figure 5.1: Cost range of a nutritious school meal menus (in Ksh)



Source: Authors' Computation

The cost of nutritious school meal menus increases up the age sets due to higher nutrition requirements of older children, especially that of energy, carbohydrates and proteins. The average cost of food items for a nutritious school meal for children aged 4-5 years is Ksh 26.7, with lowest and highest cost for this age category being Ksh 10.7 and Ksh 51.8, respectively.

The average cost of a meal for primary school age children (6-13) is Ksh 35.6, with a minimum and maximum cost of Ksh 17.4 and Ksh 51.7, respectively. The cost of a menus for secondary school children is Ksh 38.93 with a minimum and maximum of Ksh 29.3 and Ksh 51.7, respectively (Figure 5.1).

Table 5.2 presents samples of among the cheapest but nutritious meal for children of different age groups. A menu consisting of dry maize grain, Amaranthus (terere), cow milk, salt, and vegetable cooking fat provides a balanced mix of macronutrients, micronutrients and dietary fiber for all age groups.

Table 5.2: Samples of nutritious and cost analysis for children of different age groups

Age group/ Quantity	Maize, grain, dry	Amaranthus (terere)	Cow milk	Salt	Vegetable cooking fat	Total
4-5 years (pre-primary)						
Quantity of food to buy (grams)	108.0	107.7	67.8	2.0	5.0	290.5
Edible quantity (grams)	108.0	63.5	67.8	2.0	5.0	246.3

Average of Price per 100 (grams)	3.2	3.5	4.8	3.9	35.0	10.1
Cost (in Ksh)	3.4	2.2	3.2	0.1	1.8	10.7
6-13 Years (Primary)						
Quantity to buy (grams)	172.9	236.5	135.6	2.0	5.0	551.9
Edible quantity (grams)	172.9	139.5	135.6	2.0	5.0	455.0
Average of Price per100 (grams)	3.2	3.5	4.8	3.9	35.0	10.1
Cost (in Ksh)	5.5	4.9	6.5	0.1	1.8	18.7
14-17 Years (Secondary)						
Quantity to buy (grams)	240.4	219.8	135.6	2.0	5.0	602.9
Edible quantity (grams)	240.4	129.7	135.6	2.0	5.0	512.7
Average of Price per 100 (grams)	3.2	3.5	4.8	3.9	35.0	10.1
Cost (in Ksh)	7.6	4.5	6.5	0.1	1.8	20.5

Source: Authors' Computation

The minimum cost of foods in such a nutritious meal varies significantly across the 3 age groups (Table 5.2), reflecting differences in the quantities of food items required and therefore cost. The lowest cost of this meal for children aged 4-5 years is Ksh 10.7, Ksh 18.7 for 6-13-year-olds, and that of children aged 14-17 years is Ksh 20.5. These figures represent the approximate food expenditure required to meet the specified nutritional needs of learners within each age bracket.

Given the number of feasible nutritious school meals, this study sought to put into perspective the possibility of delivering more nutritious school meals within the current expenditure ceiling set by the Ministry of Education. The current expenditure per student is set at Ksh 23 for a single meal for Early Childhood Development (ECD) and primary school children. It was apparent that the menu being offered using this amount was not meeting the nutritional requirements of children (see Table 5.2).

Out of the 3,579 menus obtained from the cost minimization process, 348 menus estimated cost below Ksh 23. These menus comprised about 10 per cent of all the menus, suggesting that it is possible to provide school meals that meet all the required daily intake of nutrients at a cost that is within the Ksh 23 allowance per child. Most (85%) of such menus would mostly cater for nutrition requirements of the pre-primary children, since they require smaller portions than primary or secondary school children. The next sub-section discusses the food composition of these meals, which can act as alternatives for school feeding.

Composition of nutritious school meals costing less than Ksh 23 for children aged 4-5 years

The cheapest school meal that met the nutrition requirements for children aged 4-5 years is menu 269(5). This meal comprises of 107.9 grams of dry maize(cereal); 63.5 grams of Amaranth leaves (vegetable); 67.7 grams cow milk; 5 grams of vegetable cooking fat and 2 grams of salt (Table 5.3). The cost of the uncooked ingredients was estimated to be Ksh 10.7, and fell within the expenditure applied for each child by the Ministry of Education. Other variations of this meal and the costs are shown in Table 5.3.

Table 5.3: Cheapest school meal menus (4-5 years)

Menu (part) Number	Menu (food type)	Estimated Cost (Ksh)	Menu (part) number	Menu (food type)	Estimated Cost (Ksh)
269(5)	Dry white maize; Amaranth leaves; cow milk; vegetable cooking fat; Iodized salt	10.7	226(1)	Maize whole flour; sukuma wiki; Cow milk; Vegetable cooking fat; Iodized salt	12.7
61(1)	Dry white maize; Amaranth leaves; camel milk; Vegetable cooking fat; Iodized salt	12.1	45(1)	Dry white maize; Amaranth leaves; goat milk; vegetable cooking fat; iodized salt	18.6
226(1)	Maize whole flour; sukuma wiki; cow milk; vegetable cooking fat; iodized salt	12.7	227(1)	Maize whole flour; sukuma wiki; goat milk; vegetable cooking fat; iodized salt	19.1

Source: Authors' computation

Menus with cow milk appear to have the least cost followed by those with camel milk, while menus with goat milk have even higher costs, holding all other ingredients constant. This suggests that cow milk could be more cost-effective solution for school feeding compared to camel or goat milk. More variations to the menu can be introduced by substituting Amaranthus in menu number 269(5) with other vegetables as shown in Table 5.4.

Table 5.4: Vegetable substitutes in nutritious school meals (4-5 years)

Food to substitute	Menu 269(5): Dry white maize; Amaranthus leaves; Cow milk; Vegetable cooking fat; Iodized salt		Cost of the menu (Ksh)
	Alternative vegetables	Menu (with such alternatives)	
Amaranth (vegetable)	Pumpkin flesh	120 (1)	15.8
	Ethiopian Kale (Kanzera)	92 (1)	15.5
	Lettuce	108 (1)	15.9
	Squash butternut flesh	138 (1)	14.9
	Jute mallow leaves	87 (1)	14.3
	Coriander leaves	44 (1)	13.7
	Vine African spinach	146 (1)	12.4

Source: Authors' computation

Another version of such low-cost menu can be obtained by substituting the maize in Table 5.5 with millet (see menus 450 (1); 452(1); 287(6) and 285(6) as shown in Appendix Table 1. Further substituting Amaranthus with the vegetables in Table 5.4 would lead to school menus that cost less than Ksh 20 (see menus 305(6); 474(1); 482(1); 485(1); 488(1); 512(1); 542(1) and 544(1) attached in Appendix Table 2.

The importance of foods such as groundnuts and chicken eggs should also be considered alongside milk for purposes of meeting the nutritional requirements of children aged 4-5 years. This is especially for meals that incorporate polished white rice and pasta as in menus 198(6); 236(6); 249(6) and 251(6) for rice and menus (58(6); 60(6); 125(6); 143(6); 963(5); 935(5) for pasta as shown in Appendix Table 3.

Dagaa fish or Omena as popularly known in Kenya can be a useful component of school feeding; menus comprising the fish had very low costs from the analysis. This is due to the fish's ability to meet some micro-nutrient requirements at very small quantities. Table 5.5 is a sample of low-cost menus incorporating Dagaa obtained from the analysis.

Table 5.5: Dagaa as an option for menus for pre-school children (4-5 years)

Menu number	Menu (food type	Estimated Cost (Ksh)	Menu number	Menu (food type	Estimated Cost (Ksh)
142(1)	Dry white maize; squash butternut flesh'; Dagaa fish (Omena); vegetable fat and salt	11.8	475(5)	Maize whole flour; squash butter nut; Dagaa fish (Omena); vegetable fat and salt	14.2
52(2)	White polished rice; African vine spinach; Dagaa fish (Omena); ground nuts; vegetable fat and salt	15.5	712(4)	Butter nut squash flesh; Dagaa fish (Omena); Pigeon peas; ground nuts; vegetable fat and salt	16.9
697(4)	Spinach leaves; Dagaaa fish (Omena); pigeon peas; ground nut; vegetable fata and salt	15.4			

Source: Authors' Computations

Composition of nutritious school meals costing Ksh 23 or less in Kenya for ages 6-13 years

This study produced a total of 46 menus for nutritious means for primary school-going children. The cheapest school meals that meet the nutritional requirements for this category of children are menus 49(1) and (69(1) each costing Ksh 17.4. The first is menu 69(1) that comprises of 174 grams of dry maize; 91 grams of African Vine Spinach; 135 grams of cow milk; 5 grams of vegetable fat and 2 grams of salt. Menu 49(1) comprises of 185 grams of dry white maize; 120 grams of Kales (sukuma wiki); 80 grams of camel milk; 5 grams of vegetable oil and 2 grams of salt (Table 5.6).

Table 5.6: Cheapest school meal menus (6-13 years)

Menu number	Menu (food type	Estimated Cost (Ksh)	Menu number	Menu (food type	Estimated Cost (Ksh)
69 (1)	Dry white maize; African vine spinach; cow milk; Vegetable cooking fat; Iodized salt	17.4	87(1)	Dry white maize; Amaranth; Camel milk; Vegetable cooking fat; Iodized salt	22.9
49 (1)	Dry white maize; African Kale (Sukuma Wiki); Camel milk; Vegetable cooking fat; Iodized salt	17.4	98(1)	Maize whole flour; African Kale (Sukuma Wiki); Cow milk; Vegetable cooking fat; Iodized salt	20
33(1)	Dry white maize; African Amaranth; Cow milk; Vegetable cooking fat; Iodized salt	18.7	118(1)	Maize whole flour; African vine spinach; Cow milk; Vegetable cooking fat; Iodized salt	21.6

Source: Authors' Computations

Just like the case for pre-school children, milk (cow, goat or camel) could play an important role in feeding of the pre-primary and primary school age children. Substituting maize grain with flour also retains the cost of menus marginally below the current budget of Ksh 23 per child. This suggests that this budget cannot comfortably produce a nutritious school meal as in the case of the pre-school children.

Other potential menus can be obtained by substituting maize with sorghum grains as shown in Table 5.7, such as in menus 600(1); 610(1); 614(1); 631(1); 651(1); 667(1);685(1); 690(4); 753(4) and 755(4); 775(4). Maize grain can also be substituted with wheat grain, such as in menu 718(1); 739(1); 822(4) (see Appendix Table 4)

Another observation from the results is that root tubers such as cassava or Irish potatoes can fulfil the nutritional requirements of school children. This is especially so when they are combined with other cheap but nutritious food items such as sukuma wiki or carrots, Dagaa and groundnuts. Examples of such combinations achieved at less than Ksh 23 are found in menu 23(2); 41(2) and 107(2), illustrated in Appendix Table 5. An interesting observation is the nutritional potential of menus that lack the traditionally established sources of carbohydrates such as white maize (Table 5.7).

Table 5.7: The role of beans and Omena (Dagaa fish) in creating nutritionally adequate school menus for 6-13 age group

Menu number	Menu-Food type	Estimated Cost (Ksh)
380(2)	Kale (sukuma wiki); Dagaa fish (Omena); kidney beans; ground nuts; vegetable fat and salt	22.6
736(2)	Vine African Spinach; Dagaa fish (Omena); pigeon peas; ground nuts; vegetable fat and salt	22.9
402(4)	Finger millet; Amaranth leaves; Dagaa fish; groundnuts; vegetable fat and salt	22.8
564(5)	Irish potato; sukuma wiki; Dagaa fish; ground nut; vegetable fat and salt	22.7
640(4)	White polished rice; Amaranth leaves; Dagaa fish; groundnuts; vegetable fat and salt	22.7

Source: Authors' Computations

Seemingly, traditional meals such as a mix of dry white maize grain, beans and vegetables that are viewed as cost-efficient or cheap may not be sufficient in meeting school children's nutrition requirements. Nutritional adequacy can only be achieved upon adding other foods such as milk as demonstrated by menus 864(3) and 175(4). This improvement can be achieved with the Ksh 23 ceiling, as the estimated cost of each of the two menus was Ksh 22.9 (see Appendix Table 6).

Composition of nutritious school meals costing Ksh 23 and less in Kenya for ages 14-17 years

The study produced very limited menus that can meet the nutritional requirements of children aged 14-17 years below the current expenditure ceiling of Ksh 23. This is due to the increase in nutritional requirements and quantity of food items needed to meet the same. Most nutritious menus for this category of learners largely exceeded the current set cost per child, indicating need for more resources to avail diverse and nutritious meals.

The cheapest menu costs Ksh 20.3, comprising of a mixture of dry maize (219 grams) and finger millet (27 grams) grains; Amaranth leaves (97 grams); cow milk (80 grams); vegetable fat (5 grams) and salt (2 grams). The number of menus costing less than Ksh 23 largely consist of dry maize with vegetables and milk, and lack as much diversity as found in menus for primary and ECD children. Dietary diversity reflects access to variety of foods and is normally used to proxy nutrition adequacy. This means that for secondary school age children, nutritional adequacy would only be achieved with more investments.

Table 5.8: Cheapest school meal menus (14-17 years)

Menu number	Menu (Food type)	Estimated Cost (Ksh)
960(2)	Dry white maize; finger millet; amaranth leaves; cow milk; vegetable fat and salt	20.3
46(1)	Dry white maize; sukuma wiki; camel milk; vegetable fat and salt	20.5
66(1)	Dry white maize; African vine spinach; goat milk; vegetable fat and salt	22.2
969(2)	Dry white maize; finger millet; carrot; cow milk; vegetable fat and salt	21.2

Source: Authors' Computation

Previous observations regarding more popular meals for school feeding, such as maize, beans and rice are sustained for this category of children. For instance, for a meal containing maize to be nutritious, it has to be accompanied by other food items such as green leafy vegetables or vitamin A-rich vegetables and tubers; fish, chicken egg or whole milk (see sample menus 574(1); 571(1); 552(1) among others). This diversity comes with an additional price, as even the most basic nutritious meal (maize flour; spinach leaves; whole cow milk; vegetable fat and salt) is estimated to cost Ksh 29.3. School feeding covering secondary school children should, therefore, be planned with a higher cost ceiling to meet nutrition standards.

Conclusion and Policy Recommendations

The conventional school menu procured by the Ministry of Education for pre-primary, primary and secondary school children meets a 1/3 of recommended daily intake of energy, iron and zinc. However, this menu is grossly deficient in micronutrients such as calcium, Vit A-RAE and Vitamin B12. The results of this study indicated that better menus could be achieved within the expenditure ceilings set per child.

To close the nutritional gap, school feeding guidelines should include a wider variety of foods to increase diversity and nutritional standards. Traditional school feeding foods such as maize could be supplemented with milk and green vegetables, which are the main sources of Calcium and Vitamins. Groundnuts and Dagaa (Omena) have also emerged as nutritious food items and should be considered in menu guides and meal plans, due to reasonable costs.

Further to this, fortified alternatives such as maize flour could be explored for school feeding to ensure that the children consume a nutritious school meal. Cultivation of under-utilized foods such as millet and sorghum should be promoted in Kenya, since they are climate-smart and can introduce diversity of cereals for school feeding.

The RDA for nutrients varies across age groups, with the higher age groups (primary and secondary level) requiring more nutrients compared to the lower age group (pre-primary). The implication of this observation is that lower levels of education have cheaper menu options compared to higher levels. This calls for variation of resource allocation, with the higher levels of education receiving higher allocation to enable them to meet the cost of a nutritious school meal.

Different regions could have different menu combinations depending on the season and geographical location. Some of these menus are way below the set cost of the current school meal. This implies that there is room to improve the nutritional quality of school meals without huge resource implications especially for pre-primary and primary going children. However, more resources will be required for secondary school age children.

The new menu designs bring to the fore front low-cost, locally available and climate-smart food alternatives such as millet and sorghum that are drought tolerant. This is important because it ensures the availability of food throughout the year despite Kenya being 87 per cent arid and semi-arid. Adoption of such crops could reduce imports that are associated with food miles and greenhouse gas emissions.

The menu also includes emerging food value chains such as goat and camel milk, nuts and edible oils, under-utilized fish and vegetables. The foods are readily available in some regions and have high and unique nutritional profile. Adoption of some of the menus will thus stimulate these value chains.

Consequently, engaging various stakeholders in the school meal design and selection, particularly local communities can be prioritized. Institutions such as governments, faith-based and non-governmental organizations that implement school feeding programmes could lobby for support and investment to facilitate provision of nutritious school meals. This is particularly with regard to efforts geared towards cultivation of some of the food items within school grounds, which may reduce the costs of school feeding.

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Appendix

Appendix Table 1: Alternative cereals in low-cost nutritious meals for children aged 4-5 years

Menu (part) number	Menu (Food type)	Estimated Cost (Ksh)	Menu (part) number	Menu (Food type)	Estimated Cost (Ksh)
Millet as an alternative to Maize					
450(1)	Dry millet, Amaranth leaves, camel milk, vegetable fat and iodized salt	16.3	452(1)	Dry millet, Amaranth leaves, cow milk, vegetable fat and iodized salt	14.8
Sorghum as an alternative to maize					
287(6)	Dry red sorghum, Amaranth leaves, cow milk, vegetable fat and iodized salt	12.9	285(6)	Dry red sorghum; Amaranth, leaves camel milk, vegetable fat and iodized salt	14.6

Appendix Table 2: Alternative vegetables in low-cost nutritious meals for children aged 4-5 years

Menu (part) number	Menu (Food type)	Estimated Cost (Ksh)	Menu (part) number	Menu (Food type)	Estimated Cost (Ksh)
Pumpkin flesh			**Ethiopian Kale**		
120(1)	Dry white maize, pumpkin flesh, cow milk, vegetable fat and iodized salt	15.8	92(1)	Dry white maize, Ethiopian kale (kanzera), cow milk, vegetable fat, and iodized salt	15.5
Lettuce			**Squash butternut flesh**		
108(1)	Dry white maize; lettuce, cow milk, vegetable fat and iodized salt	15.9	138(1)	Dry white maize, squash, butternut, cow milk, vegetable fat and iodized eating	14.9
Jute mallow leaves			**Coriander leaves**		
87(1)	Dry white maize; cow milk, Jute mallow leaves, vegetable fat and iodized salt	14.3	44(1)	Dry white maize; cow milk; commercial, vegetable fat coriander leaves, fresh, raw salt, iodized	13.7
Vine African Spinach					
146(1)	Dry maize; vine (African) spinach, camel milk; vegetable fat and iodized salt	12.4			

Appendix Table 3: Ground nuts and chicken eggs in low-cost nutritious meals for children aged 4-5 years

Menu (part) number	Menu (Food type)	Estimated Cost (Ksh)	Menu (part) number	Menu (Food type)	Estimated Cost (Ksh)
198(6)	White polished rice,Kale (sukuma wiki), ground nut with skin, camel milk, vegetable fat, and iodized salt	18.3	236(6)	White polished rice, spinach, ground nut with skin, camel milk, vegetable fat, and iodized salt	18.8
251(6)	White polished rice, vine (African) spinach, ground nut with skin, cow milk, vegetable fat, and iodized salt	16.9	60(6)	Pasta (Spaghetti), Amaranth leaves, ground nut with skin, cow milk, vegetable fat, and iodized salt	19.1
58(6)	Pasta (spaghetti), Amaranth leaves, ground nut with skin, camel milk, vegetable fat, and iodized salt	20.5	143(6)	Pasta (Spaghetti), Vine (African) spinach, chicken egg ground nut with skin, vegetable fat, and iodized salt	22.6
125(6)	Pasta (spaghetti), Spinach, ground nut with skin, cow milk, vegetable fat, and iodized salt	19.7	963(5)	Pasta (macoroni), jute mallow leaves, ground nut with skin, cow milk, vegetable fat, and iodized salt	19.7
935(5)	Pasta (spaghetti), coriander leaves, ground nut with skin, cow milk, vegetable fat, and iodized salt	18.2			

Appendix Table 4: Alternatives cereals to maize in school meals for 6-13 years

Menu (part) number	Menu (Food type)	Estimated Cost (Ksh)	Menu (part) number	Menu (Food type)	Estimated Cost (Ksh)
600)1)	Red sorghum, Amaranth leaves, cow milk; vegetable fat and iodized salt	22.5	610(1)	Red sorghum, kale (sukuma wiki); camel milk; vegetable fat and iodized salt	22
614(1)	Red sorghum, kale (Sukuma wiki); camel milk; vegetable fat and iodized salt	21.1	631(1)	Red sorghum, vine (African) spinach leaves, cow milk; vegetable fat and iodized salt	21.2
651(1)	White sorghum, Amaranth leaves, cow milk; vegetable fat and iodized salt	22.2	667(1)	White sorghum, kale (sukuma wiki), camel milk; vegetable fat and iodized salt	20.9
685(1)	White sorghum, vine (African) spinach leaves, cow milk; vegetable fat and iodized salt	20.9	690(4)	Red sorghum, kale (sukuma wiki); cow milk; vegetable fat and iodized salt	22.5
753(4)	Dry whole wheat, spinach leaves, cow milk; vegetable fat and iodized salt	24.5	755(4)	White sorghum, kale (sukuma wiki); cow milk; vegetable fat and iodized salt	19.5
775(4)	White sorghum, vine (African) spinach; cow milk; vegetable fat and iodized salt	20.9	718(1)	Whole wheat, Amaranth leaves; cow milk; vegetable fat and iodized salt	22.1
739(1)	Whole wheat, kale (sukuma wiki) leaves; cow milk; vegetable fat and iodized salt	20.2	822(4)	Whole wheat, kale (sukuma wiki) leaves; camel milk; vegetable fat and iodized salt	22.6

Appendix Table 5: Tubers in school meals for 6-13 years

Menu (part) number	Menu (Food type)	Estimated Cost (Ksh)	Menu (part) number	Menu (Food type)	Estimated Cost (Ksh)
23(2)	White cassava, carrot, dry dagaa fish ground nut with skin, vegetable fat and iodized salt	21.9	41(2)	White cassava, kale (sukuma wiki), dagaa fish, ground nut, with skin and vegetable fat iodized salt	21.8
107(2)	Irish potatoes, kale (sukuma wiki) leaves; ground nuts with skin; vegetable fat and iodized salt	22.7			

Appendix Table 6: The role of milk in improving the current version of school meals (6-13 years)

Menu (part) number	Menu (Food type)	Estimated Cost (Ksh)	Menu (part) number	Menu (Food type)	Estimated Cost (Ksh)
175(4)	Whole maize flour Amaranth, leaves, cow milk, vegetable fat and iodized salt	22.9	864(3)	Whole maize flour Amaranth, leaves, pigeon peas, cow milk, vegetable fat and iodized salt	22.9