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AFRICAN JOURNAL OF FOOD, AGRICULTURE, NUTRITION AND DEVELOPMENT
SCHOLARLY, PEER REVIEWED
Volume 24 No. 7
July 2024
PUBLISHED BY AFRICAN SCHOLARLY SCIENCE COMMUNICATIONS TRUST
ISSN 1684 5374

Afr. J. Food Agric. Nutr. Dev. 2024; 24(7): 26819-26836 https://doi.org/10.18697/ajfand.132.23895

Date	Submitted	Accepted	Published
	23rd July 2023	23rd June 2024	27th July 2024

CONTRIBUTION OF SCHOOL LUNCH PROGRAMME TO INTAKE OF MICRONUTRIENTS AMONG PRESCHOOL CHILDREN IN SEMI ARID AREAS OF KILIFI COUNTY, KENYA

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ABSTRACT

Undernutrition adversely affects the cognitive and physical development of preschool children especially in arid and semi-arid areas, with far reaching effects up to adulthood. School feeding programmes are perceived as safety measures to improve children's health. The study assessed the contribution of school lunch feeding programmes in improving the micronutrients intake of preschool children in Kilifi County, Kenya. This quasi experimental study involved 288 children from ten Early Childhood Education Development (ECED) centers and their parents/ guardians. Five of the centers had a government sponsored school lunch programme (Lunch programme group) and the other five centers had no lunch programme (Non programme group). Data collected included types of food, frequency and quantity consumed by the children using 24 hours' recall method and Individual Dietary Diversity Score (IDDS). The micronutrients intake was assessed through Recommended Dietary Adequacy (RDA) using NutriSurvey 2007 Program and 2009 WHO guidelines. The SPSS version 24 and SAS version 9.4 statistical software were used in data management and analysis. Inferential statistics including Chi-square, correlation and regression were used to evaluate the contribution of the feeding programme to the micronutrient intake. The threshold for statistical significance for all analysis was set at $p<0.05$. The results indicated a low intake of micronutrients with only 12% meeting RDA for zinc in the feeding programme and 2% for those not in the programme. For iron, 30% of those in the programme met the RDA and 16% for those not in the programme. All the children met the RDA for iodine, vitamin A and C but none met the RDA for calcium. The study suggests diversification and supply consistency of school feeding foods to boost the micronutrient intake. The community needs to be empowered in areas of nutrition education, income generation and food production to be able to cater for the children's nutritional needs and prevent micronutrient deficiency.

Key words: Dietary diversity, Micronutrient deficiency, preschoolers, recommended dietary adequacy

https://doi.org/10.18697/ajfand.132.23895

INTRODUCTION

Acute malnutrition has persisted for a long time in Kenya's Arid and Semi-Arid (ASAL) regions, mainly among children below five years of age. According to the 2022 Kenya Demographic Health survey report, the level of acute malnutrition in ASAL regions ranged from 15- 39% [1]. Effects of under nutrition among young children adversely affect their growth and cognitive development leading to low work capacity in adulthood and propagating the vicious cycle of intergenerational malnutrition [2]. Low intake of vitamins and minerals which is referred to as hidden hunger leads to brain damage, delayed physical growth, motor skills and intellectual development [3]. Food is recognized as an active force in stimulating a child's growth when provided in the right quantities [4]. Preschool children have higher dietary requirements being in the stage of developing the teeth, muscles, bones and blood which call for provision of an adequate balanced diet. Good nutrition is essential at this stage of development and should include provision of foods which are diversified and affordable [5]. According to UNICEF 2021 report [6] on child nutrition, global and national food systems should deliver nutritious, safe, and sustainable diets for children. This will contribute to preventing malnutrition which is critical for children's growth and development, growth of national economies and development of Nations [4].

To address child malnutrition in Kenya, school lunch programmes have been implemented in Arid and Semi-arid areas mostly targeting children in Early Childhood Education Development (ECED) centers and lower primary school level [5]. The kinds of foods given to preschoolers depends on the availability of food sources and locality whether urban or rural areas. Factors such as poverty, food insecurity due to drought and natural calamities as well as political instability of an area also influence the provision of school feeding [7]. The government in 2009 launched Home Grown School Meals Programme (HGSMP) through which funds for the programme were to be disbursed directly to the schools [5]. Lack of cooking facilities, shortage of water, food insecurity and inaccessibility are some of the challenges facing the programme up to date [7]. The school feeding programmes policy should encourage sourcing of school feeding foods within the locality when available to provide additional benefits to smallholder farmers in the communities, and support rural economy [8]. The Government should also setup monitoring mechanisms to ensure equity and accountability in food sourcing and distribution to schools. This would promote food production leading to consistency and sustainability of the feeding programmes and food security in the households [9].

The World Food Programme (WFP) 2022 report [8] recommended that a feeding programme contributes 30 to 45% of the required daily intake for the children. This was to ensure that the children especially in ASAL areas who go to school on an

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ISSN 1684 5374

empty stomach meet their basic nutritional needs [10]. According to Bandoh & Kenu [11], most school menus consist of a legume, cereal, minimal oil quantities and salt which provide only up to 20% or less of the recommended dietary intake. The food also lacks diversity leading to inadequate micronutrients consumption. School feeding foods lack of diversity especially in semi-arid areas of Kenya may be attributed to inability to produce enough food stuffs. Most areas produced starch rich foods like sweet potatoes, cassava, cereals and legumes [7]. The region also experiences inadequate rainfall contributing to low production of vegetables, fruits and animal-based foods leading to low micronutrients intake [7]. The high level of poverty and lack of adequate information on nutrition by the majority of caregivers at household level are other factors that lead to low food diversity among the children [12, 13, 14]. This aggravates micronutrient deficiency and causes children to start life at mentally sub optimal levels which is a future development threat and a health risk [5].

The study evaluated the lunch feeding programme contribution to the intake of micronutrients of health concern among preschool children which include vitamin A and C, iodine, iron, zinc and calcium. The dietary intake of the children in the programme was compared to a similar group from the same locality but not in the programme. It was based on the assumption that the two groups share the same demographic and socio-economic characteristics and have similar feeding habits. The assessment was carried out by comparing the frequency of food intake, dietary diversity and recommended daily allowance as per WHO/ FAO guidelines [15, 16, 17].

MATERIALS AND METHODS

Study area and population

Kilifi County was purposely selected as one of the ASAL regions due to the high level of malnutrition in terms of stunting at 37% compared to the national average level of 18% [1]. The study was carried out in Ganze constituency of Kilifi County. The Constituency is considered as one of the areas with the lowest level of resources in the County and a high level of undernutrition among the children. It is Semi-Arid and experiences constant drought where the rainfall is erratic leading to a cycle of food insecurity. The study population was pre-school children aged between three and five years attending Early Child Education Development (ECED) centers in public schools and their parents/guardians.

Ethical approval

Ethical approval was obtained from National Commission for Science, Technology & Innovation (NACOSTI) through Pwani University research ethical review

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committee; reference number ERC/PhD/008/2014. Informed written and verbal consent was obtained from the school administrators and parents/ guardians.

Study Design

The study adopted a Quasi-experimental (Longitudinal) design. It incorporated four time-points assessment where data was collected and evaluated at baseline (at the commencement of the lunch programme), at month 3 (after three months lunch programme), at month 6 (after six months lunch programme), and at month 9 (after nine months lunch programme). The three months period was calculated from the beginning of every school term and ended at the closing day of the term. The study was carried out for nine months to cater for seasonal variation in dietary intake.

Sampling criteria

Ganze constituency had 196 ECDE centers with an average of fifty (50) children per center. The Constituency was divided into five zones. In each zone, two schools were purposely selected; one with a school lunch feeding programme and the other without. The schools with a lunch feeding programme were selected based on their good management record of the programme given by the Constituency programme coordinator. Selection of the non-feeding programme schools was based on their close proximity to those with a feeding programme. This was done to allow for recruitment of a homogeneous group in relation to households' demographic and socio-economic characteristics.

Using stratified selection, 30 children aged 3-5 years were targeted from each school with a lunch programme, and those with no programme. The children were divided into two categories based on age (3-4 and 4-5years) and gender (male and female). Children selected from schools with lunch feeding programmes were 146 and those from schools with no programme were 142. A total of 288 children who met the set criteria were selected. The number included 87 boys and 59 girls in the lunch programme group. The non-feeding group had 89 boys and 53 girls. The children included in the study were those registering in Early Child Education Development (ECED) centers for the first time and their guardians had given consent for their participation. The response rate of those selected was 100%.

Data collection methods and tools

Twenty-Four Hour Dietary Recall

The interviewers visited the homes and schools of the selected participants and collected data on their dietary intake. The pre-school children's guardians/school care givers were asked to recall and describe all intakes of foods and drinks and portions consumed within the period of twenty (24) hours preceding the time of interview [16, 17]. Details of all the foods and beverages consumed, ingredients, cooking methods were collected and recorded chronologically in relation to the

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ISSN 1684 5374

time of taking the meal [17]. In households where the actual food was available, weighing of food portions and measuring of beverages was done using the household utensils including cups, plates and spoons. The weights were later confirmed by use of a kitchen balance and the volumes using a calibrated measuring cylinder to ascertain the quantities consumed by each index child [16, 17]. For the children in the lunch programme their intake was assessed both at the ECED centers and at home.

Daily food intake of each child was assessed at intervals of three non-consecutive days per week for a period of three months. The average daily intake was calculated based on the weekly assessments. This assessment was carried out for a period of nine months to cater for seasonal variations in dietary intake. The average consumption frequency and quantities for each of the three months period was noted and recorded. The data was entered into the NutriSurvey 2007 program to generate the average intake of the selected micronutrients [19, 20].

Individual Dietary Diversity Score (IDDS) assessment
The 24 hours' dietary recall method was used to assess the food groups' consumptions and frequency which was based on nine (9) food groups; cereals and tubers, pro-vitamin A rich local vegetable, other vegetables and fruits, fish/ seafood/ meat, eggs, pulses/ legumes and nuts, milk and milk products, fats and oils, sugars and confectioneries [15, 16]. For the children in this study, eight (8) food groups were used for evaluation due to the absence of some food groups in their diet. To determine the dietary diversity, the interviewer used a reference card with a list of the food groups. The respondent was requested to identify the food items consumed by the index child as listed in the card. The interviewer categorized the food items according to the food groups for each child assessed. The dietary diversity score for each child was obtained by summing the scores of the different food groups consumed.

The Individual Dietary Diversity was scored out of eight food groups based on the number of food groups consumed in the locality and FAO categorization [17, 18]. Each of the food groups from which at least one of the food items was consumed was given a score of "1" and those not consumed a score of "0" [16]. The Index child IDDS was calculated based on the number of food groups consumed within the 24 hours' period. The assessment was repeated every three non-consecutive days in a week for three months. The average daily IDDS for each child was determined by dividing the total scores with the number of days the assessment was carried out within the three months. Children whose daily dietary consumption was more than four food groups (IDDS>4) were classified as having a high Individual Dietary Diversity Score and consequently good dietary diversity. Those

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Volume 24 No. 7
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ISSN 1684 5374

who consumed four or less food groups in a day (IDDS≤ 4) were categorized as low IDDS hence poor dietary diversity [16, 17, 18].

The data on average Individual Dietary Diversity Score for every three months assessment was analyzed and compared between the children in the lunch programme with those not in the programme to determine the contribution of the programme to the children's IDDS.

Micronutrients intake assessment
The average daily food intake for each child was compiled from 24-hour dietary recall assessment. The intake per day for each child was calculated at the commencement of the study (baseline), first assessment after three months, second assessment after six months and third assessment after nine months. The average daily quantities of food intake of each child for the four assessments were used to determine nutrient intake using NutriSurvey computer software Erhardt 2007 program. International Mini food list and the revised Kenyan food database were incorporated in the program to allow for inclusion of local foods [19]. The NutriSurvey Program generated the nutrient intake data for vitamin A and C, iodine, iron, zinc and calcium for each child based on the average portions of food consumed as per the 24 hours' assessment. Bioavailability adjustment was calculated at 5 % for the cereals and legumes only to cater for inhibitory effects of anti-nutrients and losses during cooking [20]. Each child's dietary intake profile data obtained from the NutriSurvey Program was recorded and analyzed based on WHO/ RDA threshold standards [15].

Data analysis
Descriptive statistics including mean and proportions for quantative data were analyzed using Statistical Package for Social Sciences (SPSS Version 24). Inferential statistics including Chi-square, correlation and regression were evaluated through SAS version 9.4 statistical software to determine the contribution of the feeding programme to the micronutrient intake

RESULTS AND DISCUSSION

Frequency of food groups consumption among the children in the lunch programme and those not in the programme
Figure 1 summarizes the frequency of food groups consumption among the children in lunch programme and those not in the programme.

Consumption of high starch foods including cereals and root tubers was consistently high among the two groups at an average of 98% throughout the study. There was no significant difference in consumption between the children in the lunch programme and those not in the programme. The high consumption among

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ISSN 1684 5374

preschool children is attributed to the low cost and accessibility of plant foods compared to animal source foods. According to Ronoh *et al.* report [22] on preschool consumption patterns in Western Kenya, most children are fed on plant foods because animal source foods are priced out of reach for the low-income households. High consumption of plant foods, especially cereals and legumes, and lack of animal source foods among children was also reported in a study on feeding habits among the nomadic community because nomadism makes animal source foods inaccessible [23]. The high intake of plant based foods by preschoolers has also been reported in related studies in Ghana, Malawi, Ethiopia and other regions in developing countries [10]. The studies show that plant based foods are accessible to most low-income households because they are cheaper than animal foods. Unfortunately, they limit micronutrient intake by the children [18].

High consumption of pro-vitamin A rich local vegetables at above 95% throughout the study among the children in the lunch programme and those not in the programme was noted. There was no difference in consumption from the beginning to the end of the study for the two groups. This was contributed by the feeding habit in all households in Ganze where the main meal comprised of local vegetables and cooked maize meal ('sima').

Consumption of legumes was low at the beginning of the study but increased by about 30% during the three consecutive assessments for the children in the lunch programme showing a significant contribution by the lunch programme. However, there was minimal change for those not in the programme. Legumes were a food component in the lunch programme leading to high consumption by the children in the lunch programme, but consumption was low in the households contributing to low consumption by those not in the programme.

The lunch meal provided in the ECED centers was composed of boiled maize grains and beans, “Githeri” fried with oil or boiled rice served with beans or green gram stew. The children’s diet at home was mainly cooked maize meal, “sima” served with traditional vegetables or pulses, and minimal intake of animal products. In this study, there was very low consumption of animal foods including meat/ fish/ eggs at 10% and milk/ milk products at 5% for both groups. Subsequent follow up at month 3, 6 and 9 did not record any significant change in consumption.

Consumption of oil/fats at the beginning of the study was similar at 25% among the two groups but consecutive assessments in months 3, 6 and 9 indicated a significant increase of over 50% consumption for the children in the lunch programme. The lunch programme contributed significantly to the increase in oil/ fat consumption. The lunch programme had a component of oil/fat which contributed to the higher intake, but for those not in the programme the

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consumption did not change. Most households in Ganze boiled their foods limiting the amount of oil/fats intake by the children [24]. Low intakes of fats/oil in the diet subsequently lead to low intake of fat-soluble vitamins.

The recommended ratio for the feeding programmes in Kenya of 150 grams of cereal, 40 grams of pulses, 5 grams of oil, 3 grams of salt and one glass of milk per child per day is not met by most school lunch programmes. This occurs due to poor funding of school feeding programmes and also poor management of the fund which denies the children their daily requirements [8, 24]. The low intake of fruits, and animal products lead to insufficient intake of micronutrients needed to support early age of children's growth. The FAO report [25], on the state of food security in the world indicates that poor dietary intake in the households due to poverty has limited dietary adequacy for most children in the developing countries. This has led to micronutrient deficiency and put the children at risk of poor brain development, weak learning, low immunity, increased infection and potentially death [26]. According to UNICEF [6], children who are exposed to poor nutrition carry the scars of poor diet and feeding practices for life.

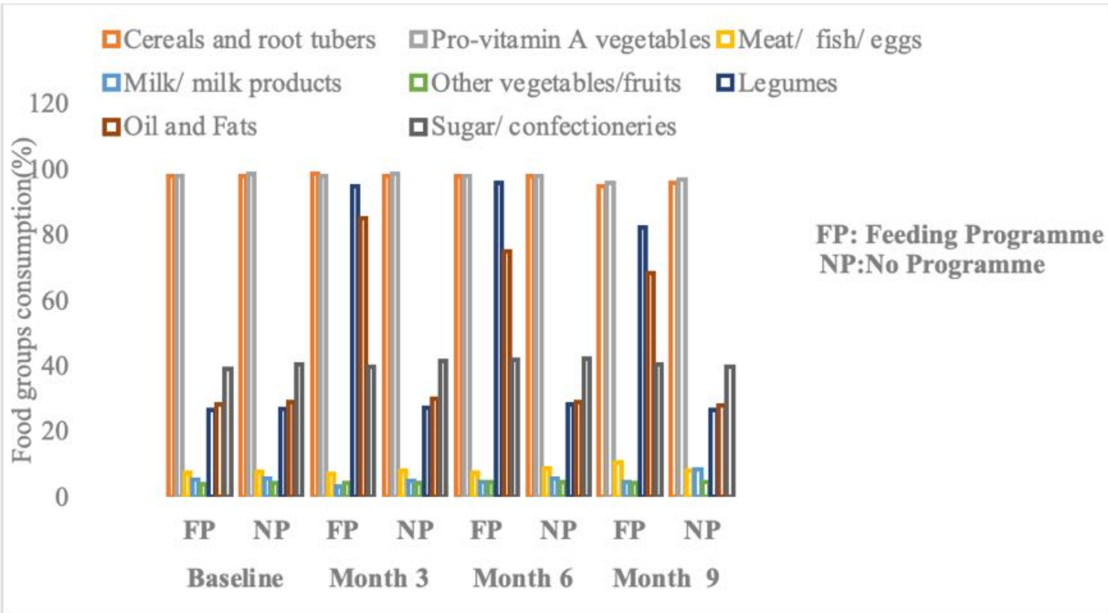

Figure 1: Frequency of food groups consumption among the children

Individual Dietary Diversity Score of children in the lunch feeding program and those not in the programme

Table 1 highlights the Individual Dietary Diversity Score among the children. The Individual Dietary Diversity Score is used to predict the frequency of the foods taken, types of nutrients, their adequacy, diversity and the level of food security in the households [15, 17, 18].

The Individual Dietary Diversity Score for children uses nine (9) food groups based on FAO (2014) categorization [17], but this study IDDS was based on eight (8) food groups because some of the foods in the FAO category were not in the children's diet both in the lunch programme and the households. At the commencement of the study, both groups' dietary diversity was not different and the IDDS for most of the children was less than 4. However, at month 3, month 6 and month 9 the children in the lunch programme had a significantly higher IDDS compared to those not in the programme p <0.001. This was contributed by the foods in the lunch programme which were not consumed regularly in the households. There was not much change in IDDS within the groups which indicated low diversity of the foods consumed in the lunch programme and also at home.

Children in the lunch programme had a significantly higher Individual Dietary Diversity Score compared to those not in the programme. However, the increase in dietary diversity score did not translate to a higher Recommended Dietary Adequacy (RDA) due to low intake of foods rich in micronutrients. These findings are supported by a related study in Ghana [10] which recorded a high intake of carbohydrates by preschoolers compared to other nutrients. In the Ghana study, there was low consumption of pro- vitamin A rich foods and proteins. Low dietary diversity is a sign of food insecurity which causes a decreased intake of micronutrients among children, leading to deficiency with a far-reaching effect and interferes with productivity up to adulthood [2, 3].

Micronutrients intake among the children in the lunch programme and those not in the programme

Mean intake of Vitamin A and C among the children

Table 2 highlights the micronutrients intake among the children. Consumption of pro-vitamin A rich local vegetables was high in both groups because it was part of the main food consumed in every household. The pro-vitamin A mean intake was not different between the children in the lunch programme, and those not in the programme throughout the study, p=0.11. There was also no significant difference in vitamin C intake between the children in the lunch programme and those not in the programme p=0.58. Majority of the children in both groups met the WHO /RDA threshold for vitamin C and pro-vitamin A [20]. This contradicts reports from other studies where preschooler's diet is associated with vitamin A deficiency. A study in Ethiopia recorded a low intake of both vit A and C [26], while a similar study in Ghana reported only 11% of the children studied met the RDA for vitamin A [10].

The amount of pro-vitamin A and vitamin C consumed by the children in Ganze study was calculated based on the intake of the local vegetables, whose consumption was very high in the households. This could have resulted in over estimation of the vitamins intake. The lunch programme foods lacked vegetables and fruits, and may not have contributed to pro- vitamin A and C adequacy. A related study carried out in the area also recorded a similar outcome where most households' meals consisted of high quantities of local vegetables contributing to high intake of pro-vitamin A and C [23]. Intake of vitamin A and C are important in young children for boosting their immunity and promoting healthy development. Vitamin A deficiency leads to xerophthalmia, which is a disease that causes eye dryness leading to damage of the cornea and if not treated blindness may occur.

Mean intake of Iodine, Iron, Zinc and Calcium among the children

The intake of minerals; iodine, iron, zinc and calcium are considered essential for children's growth, development and maintenance of good health. In this study, the RDA for iodine was achieved by most of the children both in the lunch programme, and those not in the programme. The high uptake of iodine is attributed to the fact that most local foods are rich in iodine and also, commercial salts in Kenya are fortified with iodine to supplement its uptake from consumed foods. These findings are supported by the Kenya Demographic and Health Survey report (2022), which noted that 95% of households in Kenya use iodized salt [1]. Feeding programmes in Kenya have a component of salt so the iodine adequacy could have been contributed by the general diet both at school and home. Adequate intake of iodine among children was also reported in the MOH report on the National Micronutrient Survey [27].

Iron intake among the children was low and most children did not meet WHO (2009) recommended daily allowance [15]. The lunch programme contribution to iron adequacy was minimal because the plant foods which were the main source of diet are low in iron content and limited in body absorption. However, the children in the lunch programme had higher intake at an average of 30% meeting RDA for iron, compared to16% of those not in the programme. Iron deficiency among children in ASAL areas is of great concern because of high malaria incidence. Deficiency in iron increases the cases of anemia among the children subjecting them to poor cognitive, motor, social and neurophysical development [12].

Zinc intake was very low with only 12% of the children in the school lunch programme and 2% of those not in the programme meeting the WHO (2009) recommended daily allowance [15]. The lunch programme had a significant contribution $P < 0.001$ to the improved intake of zinc among the children in the programme, though the quantities were low. Zinc is mostly found in animal foods whose consumption was low among the children in both groups. It is important in the body due to its role in enzymatic reactions, immune functions, protein synthesis, DNA synthesis, wound healing which are very essential for optimum

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ISSN 1684 5374

growth and development in children [28]. Zinc is not synthesized by the body and has to be provided through intake of a balanced diet.

There was very low intake of calcium among the children both in the lunch programme and those not in the programme. None of the children met the RDA for calcium, which was attributed to inadequate provision of animal products in the children's diet, especially milk and milk products. Deficiency and poor absorption of calcium in young children lead to a condition known as rickets which causes softening of bones and bowlegs, stunted growth and weak muscles [28, 29]. In Arid and Semi-Arid areas, intake of animal products which are good sources of calcium and other minerals are limited due to low food production and poor accessibility associated with geographical location and poverty [30, 31].

Government nutrition intervention including salt iodization, nutrition awareness campaign, provision of vitamin A tablets, deworming, treatment of malaria and improved health services has contributed to reduction of micronutrient deficiency. However, more needs to be done when the national prevalence of deficiency among children is at 50% for zinc, 25% for iodine and 22% for iron [27].

CONCLUSION AND RECOMMENDATIONS FOR DEVELOPMENT

The study showed the existence of low dietary diversity and inadequate intake of micronutrients among the children in the lunch programme and also those not in the programme. There was also low consumption of fruits and animal products among the children leading to low micronutrient intake. The school lunch programme foods should be diversified to include fruits/ vegetables and animal products which are important in addressing the observed deficiencies in iron, zinc, and calcium and for promoting better child health and development. There is a gap in nutrition knowledge among the caregivers and a nutrition campaign is required to promote intake of balanced and diversified diets. The community should be supported in production of fruits and vegetables to improve dietary diversity. Keeping of domestic livestock including goats, rabbits and chicken should be promoted to provide animal products like eggs, milk and meat which are a good source of micronutrients.

Conflict of Interest

The Authors declare no conflict of interest.

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Table 1: Individual Dietary Diversity Scores (IDDS) of the children by study group

Time point/IDDS	Lunch programme (N= 146)		No programme (N= 142)		*p-value
	n	%	n	%	
Baseline					
IDDS ≤ 4	109	75	106	74	0.234
IDDS > 4	37	25	36	26	
Month 3					
IDDS≤4	70	48	102	72	<0.001
IDDS> 4	76	52	40	28	
Month 6					
IDDS≤4	72	49	104	73	<0.001
IDDS > 4	74	51	38	27	
Month 9					
IDDS≤4	74	51	101	71	<0.001
IDDS > 4	72	49	41	29	
Overall effect (lunch programme)	Odds ratio (95% CI)				
Not on lunch programme	Reference				**# p- value**
On lunch programme	[OR=0.13;95%CI=0.07-.0.24; p<0.001]				<0.001

n: number of children participants; *p-values from chi-square comparing the proportion of children with IDDS ≤4 or IDD >4; #p-value from the binary logistic regression measuring the overall effect of the feeding programme

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Table 2: Micronutrients intake among the children in the lunch programme and those not in the programme

		Lunch programme (N=146)			No programme (N=142)			p value*
Micronutrients/ Time point	**RDA/WHO Threshold**	**Mean intake**	**n meeting RDA/WHO Threshold**	**% meeting RDA/WHO Threshold**	**Mean intake**	**n meeting RDA/WHO Threshold**	**% meeting RDA/WHO Threshold**	
Vitamin A (mcg RAE)	300							
Baseline		339.7	139	95	359.9	134	94	0.75
Month 3		325.1	146	100	325.4	142	100	-
Month 6		333.7	142	97	329.7	136	96	0.49
Month 9		323.5	138	95	333.7	142	100	0.008
Overall effect (**feeding programme**)				Odds ratio (95% CI)				**p value#**
Not on feeding programme				Reference				
On feeding programme				[OR=-13.4; 95%CI -29.5 to 2.79, P=0.11]				0.11
Vitamin C (mg)	20							
Baseline		22.0	118	81	22.0	113	80	0.79
Month 3		37.1	141	97	38.9	124	87	0.40
Month 6		34.2	144	99	34.5	141	99	-
Month 9		33.6	143	99	32.0	141	99	-
Overall effect (**feeding programme**)				Odds ratio (95% CI)				**p value#**
Not on feeding programme				Reference				
On feeding programme				[OR=1.97;95% CI 0.18–22.0, p=0.58]				0.58
Iodine (mg)	90							
Baseline		129.3	146	100	127.3	142	100	-
Month 3		132.0	146	100	142.8	139	98	0.0.08
Month 6		124.2	145	99	134.5	138	97	0.224
Month 9		124.2	145	99	134.6	138	97	0.224

Overall effect (lunch programme)				Odds ratio (95% CI)				**p value#**
Not on lunch programme				Reference				
On lunch programme				[OR=0.24;95% CI=0.03–2.16; p=0.20]				0.20
Iron (mg)	10.0							
Baseline		7.38	26	17	8.38	22	15	0.14
Month 3		9.5	45	30.8	8.29	24	16	<0.001
Month 6		9.6	47	32.1	7.96	21	15	<0.001
Month 9		9.1	41	28.1	8.30	25	18	<0.001
Overall effect (lunch programme)				Odds ratio (95% CI)				**p value#**
Not on lunch programme				Reference				
On lunch programme				[OR=0.04 ;95% (0.02–0.08; p<0.001]				<0.001
Zinc (mg)	7.0							
Baseline		4.02	1	0.7	4.66	1	0.7	-
Month 3		6.60	16	11	4.56	3	2.1	<0.001
Month 6		5.73	17	12	4.48	1	0.7	<0.001
Month 9		5.70	17	12	4.64	6	4.2	0.01
Overall effect (lunch programme)				Odds ratio (95% CI)				p value#
Not on lunch programme				Reference				
On lunch programme				[OR=0.33 ;95% CI= (0.13–0.87; p=0.03]				0.03

n: number of children participants; *p-values from chi-square comparing proportions of children meeting the RDA (FAO/WHO 2009 threshold), #p-value from the binary logistic regression measuring the overall effect of lunch programme

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