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PROMOTION OF NUTRITION EDUCATION INTERVENTIONS IN RURAL AND URBAN PRIMARY SCHOOLS IN MACHAKOS DISTRICT, KENYA

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Abstract

Objective: Nutrition knowledge among primary school children in Kenya requires improvement because the coverage of nutrition in syllabi has been on a downward trend since independence. A nine-month nutrition education intervention was conducted to address the gap in knowledge among school children in Machakos District.

Methodology and results: A baseline survey was conducted among 350 pupils in classes 5 and 6 in 15 out of 23 schools in the zone. Two experimental and two control schools were selected from a rural and urban set-up to participate in the 9-month intervention. Structured questionnaires, focus group discussions, pre-tests and post-tests were used to collect data. SPSS and Nutri-Survey computer packages were used to analyze data in descriptive and inferential statistics. Nutrition knowledge among pupils improved significantly in experimental rural and urban schools compared to the control schools. Although not statistically significant, underweight, stunting and wasting levels before the intervention reduced from 14.5, 28.9 and 3.9% respectively, to 11.8, 21 and 2.6%, respectively after the intervention.

Conclusion and potential application of findings: There was significant improvement in nutrition knowledge and practices in both rural and urban experimental schools. Transfer of nutrition information and skills learnt at school to the community was also noted. Although food shortage may be a leading cause of malnutrition, lack of nutrition education is an equally important factor that should be addressed in tackling malnutrition. Nutrition education could be efficiently provided in the enabling environment provided by schools using affordable and easily available resources such as school gardens. More effort should be made to strengthen nutrition education among school children in developing countries.

Key words: Nutrition education and knowledge, rural and urban schools, interventions, nutritional status

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INTRODUCTION

Food shortage is a leading cause of malnutrition and poor health in many parts of Africa. However, a deeper analysis of the situation has revealed that other factors including ignorance and illiteracy, traditional attitudes and superstitions play important roles in the occurrence of malnutrition (Margaret & Mamdouh, 1994; Kimiywe, 1999). Nutrition education is the process through which people gain the knowledge, attitude and skills that are necessary for developing good dietary habits (WHO, 1990; Lungile, 1996). Nutrition education has had much more positive and far reaching results than the physical provision of food aid. Among the Chinese, for example, it is believed that teaching a community how to fish is better than providing fish. While giving people fish would feed them for a day, teaching them how to fish would feed them for life (Lungile, 1996). Outcomes of numerous studies have shown that if you feed the mind with knowledge you fight hunger more effectively, and that it is more useful and sustainable to empower people to produce their own food, instead of providing food aid (AMREF, 1994; Margaret & Mamdouh, 1994). However, nutrition education interventions require time to measure their effects (Margaret & Mamdouh, 1994), partly because people take long to change attitudes and adopt new practices, and also because eating habits have less tangible and immediate payoffs. As such, nutrition education interventions are more appropriately evaluated through measurement of knowledge acquisition in the short term.

Young minds are more receptive to new information and therefore knowledge and skills learnt in childhood are more likely to be retained and practiced in future (GoK, 1999; ACC/SCN, 2000). Children are effective change agents and what they learn in school is likely to be transferred to the community. Provision of nutrition education, especially to schoolchildren, is one of the effective development investments that governments and donors should support to address the nutritional problems of populations in the short and long term (WFP/UNESCO/WHO, 1999).

Nutrition education can be effectively targeted to pupils because schools offer enabling environments for teaching and reinforcing healthy eating and living behaviour (Piek, 1996; Kimiywe, 2003). This is because children spend most time at school (9 months in a year) and they are at an age when the mind is highly receptive to new knowledge (Kimiywe, 1999). Health and eating habits developed during childhood are also more likely to be practiced at home and during adult life (Piek, 1996).

Furthermore, to support learning portions of land in schools can be converted into gardens that can be used to strengthen nutrition education. During the time spent at school, teachers who are well trained role models, would instil appropriate nutrition habits until the child goes back home (Piek, 1996). The school also provides a protected environment, which instils confidence and builds self-esteem in children, which could further enable them to influence decision-making about food and health at home (Kimiywe, 1999 & 2003). In any community setting, children represent more than 80% of households, and thus provide an effective interface for school-community interaction (Kimiywe, 1999).

Despite its importance, nutrition education has not been given its due emphasis in Kenya. The teaching of nutrition in formal setting has been on a downward trend over the last four decades, with each syllabus revision omitting essential nutrition topics or reducing the content (KIE, 1986 & 1992; KIEa, b 2002). Although community participation in school nutrition related activities is important, studies in Kenya have shown that such participation is minimal (GoK, 2000; FAOa, 2005). Deficits in syllabi on nutrition education, among other factors, imply that nutrition

knowledge and good dietary practices are lacking and need improvement among school children in Kenya.

In Machakos District, the high levels of food insecurity and malnutrition could possibly be due to many pupils who drop out of school early, or have only primary school level of education, and therefore lack adequate information on nutrition (Mbithe, 2002; GoK, 2003). This study was designed to assess and address the gap in nutrition knowledge, using school gardens and other resources to promote nutrition to primary school children through a community based participatory approach.

METHODOLOGY

An experimental study design preceded by a baseline survey (cross sectional study design (Mugenda & Mugenda, 1999) was carried out in primary schools in Machakos District. The district was purposely chosen because of high levels of malnutrition and food insecurity. Purposive sampling was used to select four intervention schools (Fisher *et al.*, 1991; KDHS, 2003). Two schools, one from a rural set-up and another from an urban set-up, were selected as experimental schools while two other schools, each from a rural and urban set-up, were selected as controls. The selected schools were those with an average class size of 40 pupils as recommended by the Kenyan Ministry of Education, had almost equal acreage for school gardening and water holding facilities such as tanks, adequate latrines/toilets and with at least a distance of 7km between schools. The selected schools were day (children return to their parents daily after class) and mixed (boys and girls).

Stratified sampling was used to select pupils from classes 5 and 6. Pupils in these classes could respond to research questions and intervention components without difficulties since they are not as busy with schoolwork as those in upper classes (7 and 8), and are also at an age when they are likely to transfer nutrition information gained at school to the community.

At the start of the intervention the experimental rural and urban schools had a class 5 and 6 population of 87 and 83 pupils, respectively, while the control rural and urban schools had a combined class population of 82 and 80, respectively. Two pupils, both from the rural experimental and control schools, dropped out of school thus bringing the number to 86 and 81 at the end of the intervention. The intervention period spread over two school terms from May to December 2005. Nutrition education was provided in a classroom set-up and demonstrations within the curriculum and allocated time in the teaching timetable. A pre-test and post-test was administered (before and after the intervention) to test the effect of the intervention on knowledge about the nutritive value of food, deficiency diseases, hygiene, food safety, cooking methods, and selection of food for selected human groups. Other topics included food production, storage and preservation, selection of balanced meals from locally available foods and recipe development. Lesson plans showing the lesson organisation and presentation were also made with guidelines from the Kenya Institute of Education (KIE) of the Ministry of Education, and FAO (2003) – Feeding Mind, Fighting Hunger guidelines. Charts and other posters were prepared and pre-tested as needed.

A researcher with one research assistant administered the questionnaires and taught nutrition education. Teaching notes were generated by the researcher and more obtained from other sources. The researchers, with the help of the teachers and research assistant, grouped the pupils into working groups of mixed abilities and sex.

Data were analysed using Nutri Survey for Windows (Erhardt, 2005) and SPSS for Windows (Version 11.5, SPSS Inc. 2002). Questions on nutrition education given to the pupils in the pre-post test were evaluated on the Likert scale of performance (Duda *et al.*, 1995). Answers were rated as 1=very good/knew well, 2=good/knew, 3=average/had idea, 4=poor/not sure and 5=very poor/no idea (Duda *et al.*, 1995). Anthropometric measurements to assess nutritional status included height and weight controlled for age and sex and were collected and analysed as described by WHO (1986). Data were analysed using descriptive and

inferential statistics. Independent t-Tests were used to test the differences in means between pre-test and post-tests and between Z scores variables among the intervention and control school. Pearson's Chi-square tests (X^2) were used to determine the relationship between acquisition of nutrition education knowledge, nutritional status and practice. Significance was determined at 95% confidence interval with a P-value of <0.05 considered significant.

The relevant research permits were obtained from Kenyatta University and the Ministry of Education (Kenya). Pupils and parents informed consent was sought before the intervention.

RESULTS

Demographic and socio-economic characteristics of pupils' households: The average household size in the study area (based on pupils' households) was 7.1. There were no significant differences between the proportion of males (51%) and females 49%) in the total population of 2506 household members drawn from 350 households as represented by the study pupils. Majority of the population had not completed primary school level of education (Figure 1).

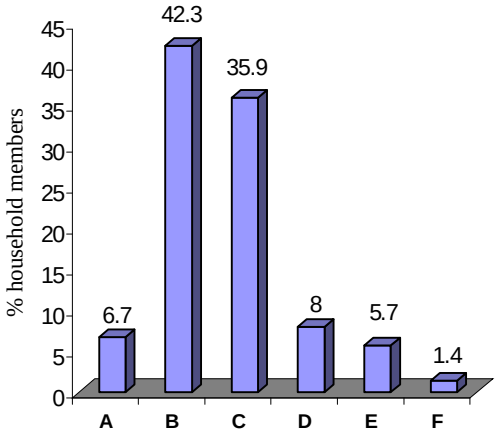

Figure 1: Distribution of household members by highest education levels achieved. Education Levels were: A-Preschool, B-Not completed Primary, C-Primary, D-Secondary, E-Post secondary, F-Not gone to school

Regarding occupation slightly more than half (56.1%) of the household members who were not students at the time of data collection were involved in unskilled work such as casual labour. About 17.4% provided unpaid family labor while 2.6% were engaged as unskilled public workers. Only 9.6% and 4.3% were involved in skilled private work and skilled public work, respectively. Ten percent of the respondents were involved in business.

Pupils' dietary intake, sanitation and disease pattern in the study area: While 61.2% of the pupils reported that their mothers made decisions on food choice, 8.8% were responsible for choosing what to be cooked. Further, 22.9% of the pupils were responsible for food preparation at home (Table 1).

There was a significant difference ($p<0.05\%$) between the number of pupils washing dishes after meals (64.3%) as compared to other household members (35.7%). Although not significantly different ($P>0.05$) more girls (13.45%) than boys (9.5%) were responsible for food preparation and cleaning up at home. More than a quarter (33.4%) of the pupils reported that raw food (maize, legumes, potatoes and pumpkin) at home is stored in sacks, 6.9% reported storage in granaries and 23.4% indicated raw food is stored in designated stores.

Food consumption patterns indicated that most pupils consumed maize at a very high frequency. However, ugali (stiff porridge) and chapati (flat fat cake) were made of sifted maize and wheat and therefore less nutritious than whole grain cereals. Consumption of muthokoi (dehusked maize) was also high, possibly because it was considered a delicacy among the study community. More than three-quarters of the pupils (89.6%) took milk (in tea) more than three times a week. The low consumption of fruits was also explained by the fact that most fruits are seasonal and that fruit are expensive. Oranges and avocadoes were the fruits in season at the time of data collection.

Table 1: Distribution of pupils by responsibility on food choice, food preparation and washing dishes at home.

Household members (Pupils N=350)	Makes decision on what is to be cooked	Prepares food at home	Washes dishes at home
Self (pupil)	31 (8.8%)	73 (22.9%)	225 (64.3%)
Mother	214 (61.2%)	139 (39.1%)	22 (6.8%)
Father	93 (26.6%)	18 (5.1%)	0
Sister/Other	12 (3.4%)	115 (32.9%)	100 (28.9%)
N =pupils = 350	350 (100%)	350 (100%)	350 (100%)

More than three-quarters (80%) of the pupils' households obtained water from rivers or streams while 19.1% had tap water, with 5.1% having taps in the house, while 14% obtained water from a communal tap. Nearly all the pupils (92%) drank water from untreated sources, while the rest consumed water that had been treated at source. All the pupils had a toilet at home, with more than a quarter (39.1%) using traditional pit latrines (earthen floor, no roof and walls made of banana fibres or grass), while 60.9% used PIV pit latrines (latrines built with stone or burnt brick, cemented floor, cement-plastered walls and corrugated iron sheet roof). A majority of 85.7% of the pupils had composite pits at home while 13.4% and 0.9% disposed their household refuse in cow sheds and gardens, respectively. The most common diseases among school children were malaria, headaches, noose bleeding, fainting, stomach aches and Upper Respiratory Infections (URI). Others were skin infections, worm infestations, pneumonia, and wounds that took long to heal.

School attendance: Slightly more than half of the pupils (61%) had missed school at least once in the term prior to the study mainly due to illness. A substantial 1.5 to 2% of pupils in upper classes (class 4 to 8) dropped out of school every year to look for employment and other means to supplement the family source of income and food. The effects of broken families and HIV/AIDS among household members were some of the factors that contributed to the relatively high school drop out rates.

Perceptions by teachers, pupils and parents of nutrition in schools: All head teachers (15) and class teachers of class 5 and 6 (30) identified reported that there was the need for nutrition education especially to girls who are likely to drop out of school due to pregnancies, early marriages or to search for employment. It was apparent that the current syllabus did not adequately address nutrition and was perceived as an easy subject. On the contrary, a focus group discussion with parents showed that parents viewed the current generation of teachers as ignorant and insensitive because they were not teaching nutrition well as it was done in the former years. Nearly all the pupils (95.7%) also identified the need to increase effort on nutrition education.

BASELINE DATA (INTERVENTION SCHOOLS)

Nutrition knowledge: Comparing all four intervention schools (experimental and control, rural and urban) there was no significant difference ($P<0.05$) in nutrition knowledge. Most pupils (35%) scored "Very Poor" in the pre-tests, indicating that the pupils were not knowledgeable in nutrition education (Figure 2). Overall, 4.6% of pupils in both the experimental and control schools in rural and urban set-ups scored " Average/some idea" while 37.6% scored "Poor/no idea". The majority (57.8%) scored very poor/no idea at all on the pre-tests.

Taboos and cultural beliefs: When pupils in the intervention schools were asked to state the food taboos they knew, significantly more rural pupils (65.1%; $P<0.05$), than urban pupils (34.9%) reported taboos and/or beliefs that negatively affected food consumption patterns. The pupils learnt of the taboos from parents, grandparents, older siblings and other community members. Comparatively, results from focus group discussions with parents concurred with those of the pupils, indicating the role of the community in influencing dietary patterns.

Food consumption patterns and nutritional status of pupils: There were no significant differences ($P>0.05$) in food consumption patterns and pupils' nutritional status between the experimental and control schools. However, pupils

in urban schools consumed chapati (flat fat cake), rice, meat, fish, margarines and pineapple more frequently (about three times in a month) than their rural counterparts. Assessment of the nutritional status showed that 14.5, 28.9 and 3.9% of the study pupils were underweight, stunted and wasted, respectively. In each of these forms of malnutrition, there were no significant differences (P>0.05) between boys and girls in both the experimental and control schools. However, urban schools generally presented better nutritional status than rural schools before the intervention.

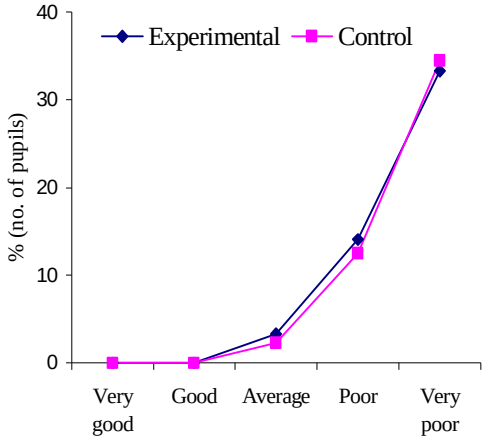

Figure 2: Pre-test (before intervention) performance in nutrition education comparing the experimental and control schools in Machakos district, Kenya.

EFFECTS OF THE INTERVENTION

The primary outcome was *nutrition knowledge* while *nutritional status and practice* were considered as secondary outcomes resulting from the positive effect of the intervention.

Nutrition knowledge: Post-tests showed a significant difference with the experimental schools performing significantly better than the control schools. The performance of the control schools also improved in some nutrition knowledge aspects such as nutritive value of food, food safety and hygiene. The pre-test post-test improvement in the control schools was however not significant (p>0.05) as compared to the performance of the experimental schools (Figure 3).

Significant differences in performance were observed between class 5 of both experimental schools except in the aspect of nutritive value of food and food sources (P>0.05), with class 5 urban experimental class scoring significantly better than the rural school (P<0.05) (Table 2). No significant differences were observed between class 6 in both experimental schools - Isooni Primary (rural experimental) and Kiteng'ei primary (urban experimental). When means for post-tests for both rural schools (experimental and control) and both urban schools (experimental and control) were compared, the experimental rural and urban performed significantly better (P<0.05) than the control schools.

Gardening activities: Rural experimental school did significantly better (P<0.05) than urban school, harvesting almost twice as much yields as the urban school on land of almost equal acreage and having applied the same kind of inputs.

Food selection: Urban experimental schools performed significantly better (P<0.05) in selection of balanced meals from a given list than rural schools while rural experimental schools developed significantly better menus and recipes from local foods than their urban counterparts. The reception of the new foods and recipes introduced by the researcher was slow in the beginning but picked momentum as the intervention continued. The new foods included vegetables such as mrenda (Jute or bush okra), which the pupils and the community later called "mulenda", saget (Spider plant) which the community called "Sake" and sweet potato leaves (Ukwasi).

Poster competition: Experimental schools did better in poster competitions than control schools, with all winning posters (12) emerging from the experimental schools. Class six pupils in both experimental and control schools from rural and urban set-ups did significantly better (p<0.05) than class five pupils, with 7 of the 12 winning posters being from class six experimental schools. The urban experimental school (Kiteng'ei primary school) had the best performance overall with 8 of the winning posters. In all schools, boys did better than girls.

Table 2: Post-test (after intervention) performance in nutrition education comparing the experimental and control schools from rural and urban set-ups in Machakos district, Kenya.

Nutrition knowledge aspect	Experimental school group			Control school group		
	Rural (Isooni)[a]	Urban Kiteng'ei [b]	T-Tests P<0.05	Rural Kituli [c]	Urban Kaviani [d]	T-Tests P<0.05
Grand Overall	2.15	1.75	0.012	4.37	3.94	0.044
Class 5	2.49	1.64	0.033	4.48	3.92	0.041
Class 6	1.79	1.87	0.097	4.26	3.96	0.039
Nutritive value of food *	1.31	1.31	0.993	4.34	4.24	0.087
Class 5	1.29	1.27	0.862	4.85	4.89	0.099
Class 6	1.33	1.36	0.089	3.83	3.59	0.111
Selection of meals *	1.35	1.48	0.055	4.22	4.56	0.019
Class 5	1.63	1.42	0.156	4.06	4.29	0.038[2]
Class 6	1.07	1.54	0.088	4.39	4.83	0.026 [2]
Food Selection for groups	2.49	2.21	0.064	4.43	4.46	0.409
Class 5	2.80	2.13	0.038	4.42	4.58	0.311
Class 6	2.17	2.31	0.097	4.44	4.34	0.259
Food storage/ preservation	2.55	2.13	0.049	4.08	4.11	0.408
Class 5	2.89	2.31	0.022	4.67	4.74	0.411
Class 6	2.21	1.95	0.089	3.49	3.48	0.399
Deficiency diseases	2.61	2.23	0.024	4.00	4.24	0.020
Class 5	2.98	2.13	0.031	4.29	4.24	0.301
Class 6	2.21	2.33	0.127	3.71	4.24	0.028 [2]
Hygiene and infections	2.37	1.89	0.010	3.95	4.13	0.018
Class 5	2.73	1.82	0.019	4.06	4.18	0.119
Class 6	2.01	1.96	0.112	3.84	4.08	0.026[2]

*No significant differences in overall performance by class and gender. Sig. [2] –Control rural schools significantly (P<0.05) improved as compared to control urban school. [a] n=86; [b] n=83; [c] n=81; [d] n=80.

Pupils' food consumption patterns and nutritional status: While food consumption patterns were not significantly different (P>0.05) between the experimental and control schools at baseline, notable differences occurred in the experimental schools after intervention. Levels of underweight (Weight/Age) were 14.5% and 11.8% before and after the intervention, respectively; stunting levels (Height/Age) were 28.9% and 21.0% before and after the intervention, respectively and wasting levels (Weight/Height) were 3.9% and 2.6% before and after the intervention, respectively. However, these changes were not significant (P>0.05).

Practice (results from observation and home follow-ups): Personal hygiene and school attendance improved during and after the intervention. During home follow-ups pupils in experimental schools were observed to have improved practices as compared to pupils from the control schools. About half (48%) of the parents from rural set-up, however, could not explain the changes in some of their childrens' practices such as washing vegetables before cutting. This indicated that measuring practice still required more time. Some parents, especially those from urban experimental school, reported that their children were keen on food selection, preparation, consumption and preservation. About half of the pupils from rural experimental schools transferred the knowledge gained on food production and preservation from the school gardens to the community. These were evident by the introduction of new crops such as Mulenda (Jute, bush okra) and *Sake* (*sage, Spider plant*), which were initially introduced in the school gardens.

DISCUSSION

Results from the baseline data of this study, as well as the pre- and post intervention tests showed that pupils lacked nutrition knowledge and identified the need to increase effort on nutrition education in Machakos district. School gardens and other resources, e.g. water tanks and latrines/ toilets that could have been used as teaching aids for nutrition education were not actively used in the study area. Consistent with the findings, nutrition practices in the area before the intervention were poor since the learners could not practice what they did not know. Disease prevalence before intervention was high yet it is well documented that nutrition knowledge, good dietary habits and hygiene can reduce disease prevalence. Further, the low ownership of granaries is a likely indicator of food insecurity in the study area as there is possibly never extra food to be stored in granaries. It could also point to significant post harvest spoilage due to poor food storage facilities. This further indicates the need for nutrition education among the school children. The pre-intervention test results also show that without adequate training girls would have no advantage over boys in nutrition knowledge.

Significant improvements in nutrition knowledge and practice were observed in both rural and urban experimental schools while control schools improved but not significantly. These findings agree with those of Glasauer *et al*. (2003) in China, where control schools also improved at the end of intervention in a study on the impact of nutrition education as an entry point for health-promoting schools. In China the improvement of the control schools was attributed to the fact that nutrition education intervention was not the only source of change in a population that was in the process of rapid change. In this study in Machakos district, the control schools could have improved because some questions in the tests were general knowledge and also because pupils in all schools were exposed to the same science syllabus, which has sections covering health education.

Changes in practice after intervention demonstrate the effectiveness of nutrition intervention programmes in improving nutrition, both among school pupils and household members. Pupils from rural experimental schools adopted new food production techniques, probably because they farm at home after school or during holidays. Comparatively, pupils from urban experimental schools exhibited improvements in selection of nutritious foods and better packaged foods, possibly because they are more exposed to buying ready made or packaged foods. Pupils from urban set-up also had a wider option to choose from while improvising packing containers while the rural schools only had empty cooking fat containers. A previous nutrition information study in Mozambique (Gasperini, 2003) looking at options for using food as a source of income had similar findings.

Nutrition education leads to general improvement in dietary patterns and practices (Zeina et al., 2003). For example, in this study, consumption of fruits before the nutrition intervention was poor, although almost every family owned a mango tree. After the intervention, however, consumption of mangoes increased, as has been reported elsewhere (Callens & Phiri, 2003).

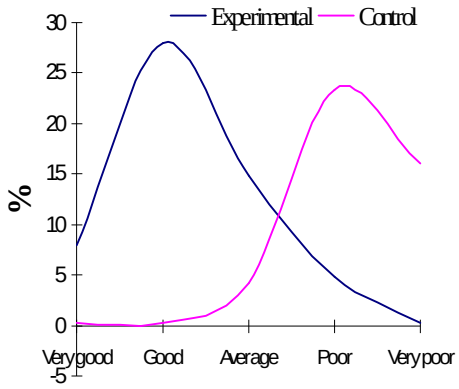

Figure 3: Post-test (after intervention) performance in nutrition education comparing experimental and control schools in Machakos district, Kenya.

School attendance also improved in experimental schools possibly because pupils were motivated to attend school since they consumed the products of cooking practical lessons, which they did not want to miss.

Nutrition education is a more effective way of fighting malnutrition, hunger and ill health than the physical provision of food aid. The findings of this study demonstrate that it is much more beneficial to transfer nutrition education, as it is more sustainable than the physical provision of

food. To validate our findings, other types of interventions could be carried out in schools in similar situations and results compared to those of this study. Further, it is recommended that the Kenyan primary school curriculum be strengthened by widening the scope of nutrition education coverage. Nutrition clubs should also be initiated in primary schools through which nutrition education could be taught at least once per week. Establishment and use of school gardens is also recommended as a simple and cost-effective means to improve nutrition education

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