

The impact of a nutrition education programme on feeding practices of caregivers with children aged 3 to 5 years in rural Limpopo Province, South Africa

LF Mushaphi^{ab*}, A Dannhauser^b, CM Walsh^b, XG Mbhenyane^c and FC van Rooyen^d

^aDepartment of Nutrition, School of Health Sciences, University of Venda, Thohoyandou, South Africa

^bDepartment of Nutrition and Dietetics, School of Allied Health Professions, University of the Free State, Bloemfontein, South Africa

^cDivision of Human Nutrition, Faculty of Medicine, Stellenbosch University, Cape Town, South Africa

^dDepartment of Biostatistics, School of Health Sciences, University of the Free State, Bloemfontein, South Africa

*Corresponding author, emails: lindelani.mushaphi@univen.ac.za, mushaphil@gmail.com



Objective: To determine the impact of nutrition education on feeding practices of caregivers with children aged 3 to 5 years at baseline and post intervention.

Methodology: A pre-test–post-test control group design was chosen using eight villages (four villages in the experimental group (E) and four villages in the control group (C)). The nutrition education intervention programme (NEIP) comprised ten topics emphasising healthy eating, hygiene and sanitation.

Results: Majority of children in both the experimental and control groups were given three meals or more per day, including starchy and protein rich foods at baseline and post intervention. The median carbohydrates and protein intake in both groups was adequate when compared to the Estimated Average Requirements/Recommended Dietary Allowance (EAR/RDA), though median energy intake was inadequate. Even before intervention, the majority of children ate indigenous foods. Despite this, the intake of some indigenous foods did improve significantly in the experimental group, but not in the control group (termites; mopani worms; indigenous vegetables including black jack, spider flower and wild jute; and, indigenous fruits including baobab fruit and pawpaw). On the other hand, the intake of mixed traditional dishes as well as the intake of the indigenous foods, stinging nettle, meldar, wild peach, pineapple, dovhi, *tshigume* and *thophi*, increased significantly in both the experimental and control groups.

Conclusion: Due to the fact that most children in both groups consumed most food items, including indigenous foods, before the intervention, improvements were only seen in a few feeding practices in the experimental group after the NEIP.

Keywords: children, indigenous foods, nutritional practices

Introduction

Appropriate feeding practices are fundamental to child survival, growth and development. According to Black *et al.*¹ 35% of child deaths and 11% of total global disease burden are due to poor feeding practices. The World Health Organisation² (WHO) reports that undernutrition in children under five years of age is often associated with inappropriate feeding practices. In developing countries, most children are given a diet that consists of predominantly starchy foods, often resulting in malnutrition.^{3–5}

The diets of most people in rural areas consist of plant-based staple foods, while common fruits and vegetables and indigenous fruits and vegetables, and animal products are rarely consumed.^{3,4} According to Faber and Wenhold,⁶ a decline in the use of indigenous foods may result in nutritional deficiencies, especially among children in rural areas. Therefore, the indigenous and traditional food systems of poor and rural communities need to be promoted in the search for solutions to the global problems of hunger and malnutrition,⁶ which often occur due to the lack of a regular income and purchasing power.

The consumption of indigenous vegetables, fruits and legumes is a sustainable way of reducing and controlling micronutrient deficiencies in resource-poor communities.⁷ In a study done in Malawi, it was found that most indigenous vegetables are rich in micronutrients, such as vitamin A, vitamin C and calcium.⁸ Steyn

et al. indicated that most commonly consumed indigenous vegetables and fruits in Limpopo are a good source of micronutrients, such as calcium, magnesium, iron, potassium, zinc, vitamin C and B-carotene. In addition, indigenous vegetables, besides being rich in micronutrients, have the added advantage of possessing other desirable traits, such as tasting acceptable to local communities, growing easily, and being resistant to pests and diseases⁷. Therefore, encouraging the consumption of indigenous vegetables and fruits could be a direct, low-cost solution to improving the micronutrient status of children in many rural areas and further improving their quality of life. This paper will focus on feeding practices of caregivers of children before and after being exposed to a nutrition education programme that encouraged the use of indigenous foods.

Research methodology

Study design

A pre-test–post-test control group design was chosen. Information related to feeding practices of caregivers and dietary intake of children aged 3 to 5 years was collected at baseline in both a control group that did not receive the intervention, and an experimental group that received nutrition education. The intervention programme was implemented for a period of 12 months, followed by a post-intervention assessment of the same variables.

Study population

The study population included caregivers and children aged 3 to 5 years living in rural areas of Limpopo province. For the purpose of the study, the caregiver refers to the legal guardian of the child or the mother of the child.

Sample size

Simple random sampling was used to select eight villages (experimental = 4 villages and control = 4 villages) from Mutale municipality in the Vhembe district, Limpopo province, South Africa. All households with children who met inclusion criteria and agreed to participate were included in the study. A total of 129 children aged 3 to 5 years (E = 66; C = 63) and 125 caregivers (E = 65; C = 60) were included in the study at baseline. At post intervention only 89 children (E = 40; C = 49) and 86 caregivers (E = 39; C = 47) remained. All these children were attending day care centers or primary school at post-intervention.

Data collection

Four trained field workers interviewed caregivers in the local language (Tshivenda) on nutritional practices and 24-hour recall at baseline and post intervention. The nutritional practices questionnaire was developed in accordance with information about infant feeding practices commonly referred to in the literature. In addition, questions on the use of indigenous foods were developed based on the known local and indigenous foods in the area. Multiple 24-hour recalls were applied on a week day and a weekend day, one week apart to determine the nutrient intake of children. Data was collected over a period of three years (2007 to 2009). Baseline and post-intervention data collection was done during summer (January to April and September to December).

Nutrition Education Intervention Programme (NEIP)

The NEIP was developed based on the South African Food Based Dietary Guidelines⁹ (SAFBDG) and the South African Paediatric Food Based Dietary Guidelines (SAPFBDG).¹⁰ MyPyramid for children¹¹ and dietary guidelines for children were also consulted to determine the types and frequency of foods that should be eaten by children.¹²

Implementation of NEIP

The NEIP consisted of ten topics namely: giving variety of foods; guidelines for feeding children 3 years and older; hygiene and sanitation; making starchy foods the basis of most meals; eating plenty of vegetables and fruits everyday; eating dry beans, split peas, lentils and soya; recommending that chicken, fish, meat, milk and eggs be eaten daily; using salt sparingly; eating fats sparingly; and, using food and drinks containing sugar sparingly and not between meals. Each topic was taught twice on different days and three months apart. Small groups of caregivers (ranging from six to twenty) were visited twice per week during the implementation period for a duration of 20 to 30 min. A presentation was done and discussion encouraged during each visit. The small group discussion approach was chosen because it promotes interaction between group members and allows caregivers to participate actively in the programme. The researcher facilitated all nutrition education sessions.

Data analysis

Data was analysed by the Department of Biostatistics (UFS). The data was expressed using median, minimum and maximum values to describe continuous data. Frequencies and percentages were used to describe categorical data, and 95% confidence intervals (CIs) for median and percentage differences to determine the impact of the intervention programme. The

24-hour recall data was analysed using the Food Finder III computer programme version 1.1.3. (South African Medical Research Council).

Ethical consideration

Ethical approval was obtained from the Health Research Ethics Committee of the Faculty of Health Sciences Research, UFS (ETOVS NR 24/06). Permission to conduct the study in the villages was obtained from local leaders and written informed consent was obtained from caregivers.

Results

Socio-demographic data

The socio-demographic data was comparable at baseline and post-intervention in both groups. More than 60% of caregivers had secondary education in both groups (E = 64.6%; C = 63.3%), while 18.3% (C) and 24.6% (E) of caregivers had never attended school. The majority of households in both groups depended on social grants (child grant: E = 75.4%, C = 78.3%; pension grant: E = 24.6%, C = 16.7%). More than 65% of households in both groups (E = 66.2%; C = 68.0%) had an income of less than or equal to R 1 000.00 per month. Firewood was the main source of cooking fuel (E = 98.5%; C = 95.0%), while electricity was also available to some of the households (E = 21.5%; C = 21.7%). The main source of water was from communal taps (E = 76.9%; C = 83.3%), while water from rivers (E = 32.3%; C = 31.7%) and wells (E = 35.5%; C = 8.3%) was also used. The majority of caregivers grew maize (E = 80.0%; C = 58.3%), but only about one third had a vegetable garden (E = 27.7%; C = 30.0%) and orchard (E = 32.3%; C = 21.7%). More than 40% of households had chickens (E = 44.6%; C = 43.3%), while some households had goats (E = 16.9%; C = 35.0%) and cattle (E = 13.9%; C = 10.0%).

Feeding practices of children

Even before intervention, the composition of meals (including a starchy food, vegetable, protein-rich food and fat source) was relatively good (>90% in both the E and C groups) and left little room for improvement as a result of the NEIP. Nearly two thirds (63.8%) of children in the control group and 87.2% of the children in the experimental group were given three meals per day. The percentage of children in the experimental group who ate three meals per day decreased significantly (95% CI for the percentage difference [- 44.6%; - 2.3%]); while, the number of children who were given four meals or more increased in the experimental group. In the control group, the median number of meals eaten per day remained unchanged.

At post-intervention, the percentage of caregivers who gave children peanuts (E = 95% CI for the percentage difference [9.1%; 37.5%]) and yoghurt (E = 95% CI for the percentage difference [7.1%; 34.8%]) as snacks increased significantly in the experimental group. The use of peanuts as a snack, however, also improved in the control group (95% CI for the percentage difference [4.2%; 27.2%]).

Frequency of consumption of certain foods at baseline and post-intervention

At baseline, less than 20% of caregivers reported giving children vegetables daily (E = 15.4%; C = 10.6%), while 31.9% (C) and 48.7% (E) gave vegetables three to five times per week. A large percentage of caregivers (E = 59.0%; C = 46.8%) gave children fruit less than three times per week at baseline; while at post intervention, the percentage of caregivers who gave fruit three

to five times per week (E = 28.2%; C = 34.0%) increased in both groups. The percentage of caregivers who gave vegetables daily improved slightly in the experimental group (E = 23.1%) and decreased slightly in the control group (C = 6.4%).

In the experimental group, the percentage of children who were given milk increased significantly (95% CI for the percentage difference [15.5%; 54.8%]); while in the control group, the percentage did not change.

Indigenous food consumption

At baseline, the majority of children were given indigenous foods, such as vegetables, fruit, mixed dishes and edible insects. Table 1 indicates that the intake of the indigenous vegetables, such as black jack, spider flower and wild jute, improved significantly in the experimental group. Furthermore, the intake of baobab fruit, pawpaw, termites and mopani worms improved significantly in the experimental group while it remained unchanged in the control group.

Nutrient intake of children at baseline and post-intervention

The median energy intake (E = 4 064 KJ; C = 3 954.3 KJ) in both groups was lower than the estimated energy requirement (male = 7 316 KJ; female = 6 896 KJ) for children in this age group. The median total protein (E = 27.7 g; C = 31.9 g) and carbohydrate intake (E = 162.2 g; C = 158.3 g) were adequate when compared to EAR and RDA for the age groups of one to three years and four to eight years (Table 2). At post-intervention, the median energy and plant protein intake in the experimental group had not changed, while in the control group the energy intake (95% CI for the median difference [34.7; 921.7]) and plant protein intake (95% CI for the median difference [2.81; 7.2]) had increased significantly.

At baseline, the intake of iron and zinc was adequate in both groups when compared to the EAR for the age group one to three years. In both groups, the median iron (E = 95% CI for the median difference [0.04; 1.89]; C = 95% CI for the median difference [0.5; 2.5]) and folate (E = 95% CI for the median difference [1.41; 70.1]; C = 95% CI for the median difference [55.7; 117.0]) intake increased significantly. The median zinc intake increased significantly (95% CI for the median difference [0.32; 1.15]) in the control group, while in the experimental group it increased only slightly. The median intake of vitamin C was adequate in both groups when compared to the EAR and RDA.

Discussion

At baseline more than 60% of caregivers indicated that children were receiving three or more meals per day in both groups. A similar observation was reported in the study done by Walsh *et al.*¹³ where most respondents indicated that children in the Free State were given three or more meals per day at baseline. However after intervention, the percentage of children who received more than three meals per day increased in the experimental group. This improvement could probably be attributed to the NEIP. A similar observation was made in the study done in rural Karnataka by Kilaru *et al.*,¹⁴ who reported that after the implementation of community-based nutrition education, children were offered at least four meals a day. After six months of implementation of intensive nutrition education, with or without a supplementary feeding programme, amongst moderately malnourished children in Bangladesh, the number of children who were offered more than three meals a day improved significantly.¹⁵ The results of the present study and of previous

studies show that, if caregivers are given information on how frequently to feed the child, they are more likely to improve their practices.

In the present study, all caregivers in both groups usually included starchy foods, such as maize porridge, bread or samp, on their children's plate daily. According to the 24-hour recall, maize-meal porridge and bread were the main starchy foods given to all children in both groups. This practice forms part of cultural eating habits and the nutrition education intervention programme had no impact on it. A similar trend was observed in the National Food Consumption Survey,¹⁶ where maize and brown bread were found to be amongst the most commonly consumed food items in children aged one to nine years. The diets of children in an informal settlement in the Free State³ and rural KwaZulu-Natal⁴ were also predominantly maize-meal porridge. Manu and Khetarpaul⁵ indicated that most rural Indian preschool children also consumed a starchy food (wheat) daily. Maize-meal porridge is a staple food in South Africa; hence, the majority of children were given starchy foods with each meal.

At baseline, most of the caregivers in both the control and experimental groups usually included protein-rich foods, such as meat, beans, eggs, fish or mopani worms, on the child's plate. The nutrition education intervention in the present study was unable to affect protein intake since more than 98% of the children were given protein-rich foods on their plate daily at baseline, even though the amount that was usually given was not known in this study. According to the 24-hour recall in the present study, protein-rich foods that were commonly given included chicken feet, chicken heart, chicken giblets or chicken liver. Contrary to the present study, most children under the age of five years in developing countries such as South Africa,¹⁶ Tanzania,¹⁷ Pakistan¹⁸ and rural Vietnam¹⁹ consumed diets with very low amounts of meat and meat products. Recently, Smuts *et al.*²⁰ observed that more than half of children aged zero to 71 months in rural districts of KwaZulu-Natal and the Eastern Cape seldom or never consumed meat products.

According to the SAPFBDG, children should be given at least 250 ml of milk to drink every day. This recommendation formed part of the intervention programme in the present study. After intervention, the number of children who received milk and yoghurt increased significantly in the experimental group, but not in the control group, possibly due to the intervention. A similar observation was made by Walsh *et al.*¹³ in their study in the Free State, where the percentage of respondents who gave milk increased significantly after a nutrition education intervention. Gibson *et al.*²¹ made a different observation, finding that the intake of dairy products did not change after a community-based dietary diversification intervention was implemented in rural southern Malawi. Even though the number of children who were given milk had increased in the experimental group at post-intervention, the frequency of giving milk and the overall number of children who received milk was still inadequate.

In the present study, the number of caregivers who usually included vegetables on the child's plate daily did not change after the intervention, since more than 90% of the children were already eating vegetables in both groups at baseline. In a study undertaken by Yunus *et al.*,²² the number of rural young children in Bangladesh who were given vegetables rich in beta-carotene increased from 28% to 96% 12 months after implementing a nutrition education programme. Vijayaraghavan *et al.*²³ indicated

Table 1: Types of Indigenous foods given to children at baseline and post-intervention

Types of indigenous foods		Experimental group (n = 39)			Control group (n = 47)		
Tshivenda	English & Scientific name	Baseline	Post	95% CI for % difference	Baseline	Post	95% CI for % difference
<i>Indigenous vegetables</i>							
Mushinzhi	Black Jack/ <i>Bidens pilosa</i>	28 (71.8%)	39 (100%)	[8.2%; 37.6%]	36 (76.6%)	42 (89.4%)	
Murudi	Spider flower or spider plant/ <i>Cleome gynandra</i>	27 (69.2%)	38 (97.4%)	[6.5%; 34.3%]	40 (85.1%)	41 (87.2%)	
Delele	Wild-jute plant/ <i>Corchorus olitorius</i>	29 (74.4%)	39 (100%)	[9.1%; 37.5%]	43 (91.5%)	47 (100%)	
Muxe	Night shave leaves/ <i>Solanum retroflexum</i> Dun.	38 (97.4%)	39 (100%)		42 (89.4%)	47 (100%)	
Dzaluma	Stinging nettle/ <i>Laportea peduncularis</i>	31 (79.5%)	38 (97.4%)	[0.5; 26.4%]	11 (23.4%)	23 (48.9%)	[8.1%; 37.6%]
Vowa/Thebe	Small pig weed/ <i>Amaranthus thunbergii</i>	38 (94.4%)	39 (100%)		37 (78.7%)	45 (95.7%)	
Phuri	Pumpkin leaves/ <i>Cucurbita moschata</i>	38 (97.4%)	39 (100%)		44 (93.3%)	47 (100%)	
Munawa	Cow pea's leaves/ <i>Vigna unguiculata</i>	32 (82.0%)	39 (100%)		42 (89.4%)	44 (93.6%)	
Tshipinatshi	Spinach	10 (25.6%)	8 (20.1%)		11 (23.4%)	12 (25.5%)	
Khavhishi	Cabbage	13 (33.3%)	12 (30.8%)		9 (19.1%)	10 (21.3%)	
Mutshaina	China spinach	12 (30.8%)	8 (20.1%)		8 (17.0%)	12 (25.5%)	
<i>Indigenous fruits</i>							
Mazwilu	Medlar/ <i>Vangueria infestata</i> Burch	23 (58.9%)	34 (87.2%)	[10.6%; 42.9%]	18 (38.3%)	31 (63.8%)	[10.4%; 37.7%]
Maramba	Wild peach/ <i>Strychnos spinosa</i> Lam	16 (41.0%)	30 (76.9%)	[14.0%; 51.9%]	14 (29.8%)	27 (57.4%)	[7.3%; 44.1%]
Nombelo	<i>Bequa magalies</i>	36 (92.3%)	39 (100%)		30 (63.8%)	34 (72.3%)	
Mbuyu	Baobab fruit/ <i>Adansonia digitata</i>	13 (33.3%)	31 (82.1%)	[25.5%; 59.6%]	45 (95.7%)	45 (95.7%)	
Mango	Mango/ <i>Mangifera indica</i>	39 (100%)	39 (100%)		47 (100%)	47 (100%)	
Papawe	Paw-paw/ <i>Carica papaya</i>	25 (64.1%)	37 (94.9%)	[12.4%; 42.6%]	46 (97.8%)	47 (100%)	
Magwavha	Guavas/ <i>Psidium guajava</i>	35 (89.7%)	39 (100%)		43 (87.8%)	47 (100%)	
Tshienge	Pineapple/ <i>Ananas comosus</i>	18 (46.2%)	33 (87.2%)	[15.3%; 51.2%]	22 (46.8%)	34 (72.3%)	[6.1%; 41.5%]
Muomva	Banana/ <i>Musa acuminata</i>	18 (46.2%)	6 (17.9%)		18 (38.3%)	6 (12.8%)	
<i>Indigenous mixed dishes</i>							
Tshidzimba	Samp, beans or jugo beans, groundnuts	33 (84.6%)	36 (92.3%)		37 (78.7%)	45 (95.7%)	
Dovhi	Ground nuts & dried vegetable or biltong	18 (46.2%)	30 (76.9%)	[9.8%; 47.0%]	32 (68.1%)	43 (91.5%)	[5.0%; 35.9%]
Thophi	Pumpkin & maize-meal	30 (76.9%)	37 (94.9%)	[0.3%; 30.1%]	31 (66.0%)	43 (91.5%)	[12.1%; 41.4%]
Tshimbundwa	Traditional bread made from maize	5 (12.8%)	10 (25.6%)		2 (4.2%)	21 (44.7%)	[26.2%; 55.5%]
Tshigume	Traditional peanut butter	9 (23.1%)	24 (61.4%)	[17.5%; 3.4%]	7 (15.0%)	27 (57.4%)	[21.8%; 57.3%]
Nawa	Beans	36 (92.3%)	39 (100%)		46 (97.9%)	45 (95.7%)	
<i>Edible insect</i>							
Nthwa	Adult insect	30 (76.9%)	33 (84.6%)		18 (38.3%)	26 (57.4%)	
Mashonzha	Mopani worms	28 (71.8%)	36 (92.3%)	[4.6%; 31.6%]	42 (89.4%)	42 (89.4%)	
Nzie	Locust	37 (94.9%)	38 (97.4%)		42 (89.4%)	41 (87.2%)	
Manzhulu	Termites	28 (71.8%)	35 (89.7%)	[2.7%; 27.8%]	17 (36.2%)	23 (48.9%)	

Table 2: Median nutrient intake at baseline and post-intervention

Nutrient intake	EER/ EAR	RDA	AI	Experimental group (n = 40)						Control group (n = 49)							
				Baseline			Post-intervention			Baseline			Post-intervention				
				Med	Min	Max	Med	Min	Max	Med	Min	Max	Med	Min	Max	95% CI for median difference	95% CI for median difference
Energy (kJ)	EER3-8 yrs (male 7316 kJ; female 6896 kJ)			4025	2107.5	7356.9	4087.2	2874.6	5936.1	3921.5	2308	7728	4359	3443	6480	CI [34.7; 921.7]	
Total protein (g)		1-3 yrs (13.0 g) 4-8 yrs (19 g)		25.6	13.2	56.4	27.6	17	52.9	30.9	15.2	55.6	31.7	22	56	CI [-3.2; 8.1]	
Plant protein (g)				18.2	13.2	28.2	20	11.9	28.5	18.1	9.5	32	22.8	14.8	32.8	CI [2.81; 7.2]	
Animal protein (g)				9.1	0	36.4	8.2	0.06	30.3	11.5	0.29	32.5	9.7	0.13	26.5	CI [-4.9; 2.3]	
Total fat (g)	ND	ND	ND	16.2	3.1	47.5	17.0	7.1	33.9	16.1	6.4	57.8	14.4	8.2	42.8	CI [-5.1; 2.9]	
Carbohydrates (g)	1-3 yrs (100 g); 4-8 yrs (100 g)	1-3 yrs (130 g); 4-8 yrs (130 g)		160.8	96.1	304.8	160.6	115.3	222.7	157.7	76.6	267.1	176.6	138	234.4	CI [7.8; 29.01]	
Calcium (mg)	-	-	1-3 yrs (500 mg); 4-8 yrs (800 mg)	107	40.5	640.2	125.5	32.8	437.8	109.8	21	479.2	124.8	53.2	307.4	CI [-27.5; 34.5]	
Iron (mg)	1-3 yrs (3 mg); 4-8 yrs (4.1 mg)	1-3 yrs (7 mg); 4-8 yrs (10 mg)		4	2.5	8.6	5.0	2.2	9.7	3.9	2.1	7.1	5.3	2.8	9.4	CI [0.5; 2.5]	
Haeme iron (mg)				0.07	0	0.31	0.04	0	2.2	0.07	0	0.67	0.09	0	1.1	CI [-0.04; 0.04]	
Non-haeme iron (mg)				1.1	0.43	2.8	1.1	0.02	3.9	0.9	0	3.2	0.82	0	4.3	CI [-0.2; 0.1]	
Zinc (mg)	1-3 yrs (3.0 mg); 4-8 yrs (4.0 mg)	1-3 yrs (3 mg); 4-8 yrs (5 mg)		3.1	1.6	6.2	3.6	2.1	6.1	3.1	1.9	6.23	3.9	2.4	7.0	CI [0.32; 1.15]	
Vitamin A (mcg)	1-3 yrs (210 mcg); 4-8 yrs (275 mcg)	1-3 yrs (300 mcg); 4-8 yrs (400 mcg)		94.3	25.2	427.4	101.6	4.6	3006.8	85.5	16.2	799.3	83.2	11.2	4353	CI [-21.7; 43.2]	
Total-carotene (mcg)				363	23.5	1233.5	430.2	0.26	3294.7	119.5	0	1222.8	156.6	0	3206	CI [-61.8; 193.2]	
B-carotene (mcg)				344	17	1173.2	425.9	0	2809.4	117.2	0	1167.5	146.5	0	3205	CI [-58.2; 141.1]	
A-carotene (mcg)				4.6	0	121.5	7.1	0	955.7	3.5	0	162.0	5.6	0	112.5	CI [-2.6; 8]	
Folate (mcg)	1-3 yrs (120 mcg); 4-8 yrs (160 mcg)	1-3 yrs (150 mcg); 4-8 yrs (200 mcg)		79.2	34.9	222.8	111.5	34	535.8	70.5	28.7	210.1	160.8	46.1	368.9	CI [55.7; 117.0]	
Vitamin C (mg)	1-3 yrs (13 mg); 4-8 yrs (22 mg)	1-3 yrs (15 mg); 4-8 yrs (25 mg)		35.3	0.01	295.2	11	0.5	229	9.3	0.05	275.8	8.4	1.7	85.7	CI [-4.2; 1.8]	

Notes: EAR = Estimated average requirement; EER = Recommended dietary allowance; AI = Adequate intake.

that rural Indian preschool children from households that were participating in a home garden project combined with an extensive nutrition education programme for three years, increased the consumption of carotene-rich foods to at least more than once per week. At baseline in this study, nearly half of children in the experimental group consumed vegetables three to five times per week, while half of children in the control group consumed vegetables less than three times per week. After intervention, the percentage of children who were receiving vegetables three to five times per week increased in both groups. In previous studies, the high consumption of vegetables amongst children was attributed to seasonal availability.^{3,16,19} Seasonal availability may also have played a role in this study, since data was collected during the time when most vegetables were available.

Consumption of indigenous foods

Indigenous foods form an important part of the diet of the rural people in South Africa.^{24,25} In the present study, more than 90% of the children consumed indigenous vegetables, indigenous fruits, indigenous mixed dishes and indigenous edible insects at baseline and post intervention. The high consumption of indigenous foods observed in the present study may also be attributed to the seasonal availability of foods such as indigenous vegetables and indigenous fruit at both baseline and post-intervention (from January to April and September to December), and may have contributed to the increased frequency of vegetable consumption observed in this study compared to other studies. Furthermore, the study was conducted in rural areas where the majority of people still rely on indigenous foods.

After intervention, the percentage of children who consumed indigenous vegetables such as black jack (*Bidens pilosa*; 95% CI for the percentage difference [8.2%; 37.6%]), spider flower (*Cleome gynandra*; 95% CI for the percentage difference [6.5%; 34.3%]) and wild-jute plant (*Corchorus hirsutus* or *Corchorus olitorius*; 95% CI for the percentage difference [9.1%; 37.5%]) had increased significantly in the experimental group. In the study done by Vijayaraghavan *et al.*,²³ the number of preschool children who were consuming vegetables such as amaranth and palak increased from 50% to 75% after the implementation of a home gardening and nutrition education programme in rural India.

Paw-paw was consumed by only two thirds of the children in the experimental group at baseline and this increased significantly (95% CI for the percentage difference [12.4%; 42.6%]) at post-intervention. On the other hand, a study done in rural India revealed that the number of preschool children who were consuming papaya increased from 8% to 12% after the implementation of home gardening programmes combined with extensive nutrition education.²³ Furthermore, the percentage of children who consumed indigenous fruit such as baobab fruit (*Adansonia digitata*) increased significantly (95% CI for the percentage difference [25.5%; 59.6%]) in the experimental group. The improvement observed in these studies shows that targeted nutrition education of caregivers can improve the feeding practices of children.

The consumption of indigenous mixed dishes such as *dovhi* (ground nuts and dried vegetables or ground nuts and biltong; E = 95% CI for the percentage difference [9.8%; 47.0%]; C = 95% CI for the percentage difference [5%; 35.9%]), *thophi* (pumpkin and maize-meal; E = 95% CI for the percentage difference [0.3%; 30.1%]; C = 95% CI for the percentage difference [12.1%; 41.4%]) and *tshigume* (traditional peanut butter; E = 95% CI for the

percentage difference [17.5%; 53.4%]; C = 95% CI for the percentage difference [21.8%; 57.3%]) had increased significantly in both groups after intervention. In addition, the intake of *tshimbundwa* (traditional bread made from maize) also increased significantly (95% CI for the percentage difference [26.2%; 55.5%]) in the control group, while in the experimental group it only increased slightly. Even though the data collection season at baseline and post-intervention was not different, the increase in consumption of indigenous mixed dishes observed in both groups could be due to the fact that these indigenous mixed dishes were usually prepared and consumed during and post-harvest, when most of the ingredients were easily accessible and available. Furthermore, at post-intervention, all children were attending a day-care centre, preschool or primary school. Furthermore, some of the indigenous mixed dishes may have been served as part of the National School Nutrition Programme (NSNP).

Nutrient intake

Several studies conducted in various countries, such as South Africa, India and Pakistan, have revealed that the diets of the majority of preschool children were predominantly cereal based, hence the high intake of carbohydrates.^{4,5,19,26} A similar observation was made in the present study, where the majority of children were found to be consuming cereal-based diets, resulting in high median carbohydrate intakes that were above the EAR recommended for age. At post-intervention, the median intake of carbohydrates increased significantly (95% CI for the median difference [7.8; 29.0]) in the control group, but not in the experimental group (95% CI for the median difference [-26.38; 13.95]). At baseline, the median protein intake was adequate in both groups and this did not change significantly (E = 95% CI for the median difference [-6.28; 8.57]; C = 95% CI for the median difference [-3.2; 8.1]) after intervention. The adequate median protein intakes were supported by the fact that more than 95% of the children in both groups were consuming protein-rich foods at baseline, as well as after intervention (including the indigenous protein food mopani worms).

In the experimental group, the median haem iron intake did not increase significantly (95% CI for the median difference [-0.07; 0.035]) at post-intervention. In contrast, a study undertaken amongst preschool children in rural Malawi showed that median haem iron was higher in the intervention group after one year of implementing a community-based nutrition education programme.²¹ These findings were supported by the observation that more than 95% of caregivers included protein foods on the child's plate daily in the present study and the fact that the children were given animal-based food (chicken feet, chicken hearts or chicken giblets), which may have improved the median haem iron intake. Since the improvement was observed in the experimental group, it can possibly be attributed to the NEIP.

After intervention, iron (E = 95% CI for the median difference [0.04; 1.89]; C = 95% CI for the median difference [0.5; 2.5]) and folate intake increased significantly (E = 95% CI for the median difference [1.41; 70.1]; C = 95% CI for the median difference [55.7; 117.0]) in both groups. In contrast, Gibson *et al.*²¹ indicated that total iron and folate intake did not change in children in their experimental group after implementing a community-based dietary intervention in rural Malawi. In addition, the iron intake at baseline was adequate, while folate intake was inadequate in both groups in the present study. Mamabolo *et al.*²⁷ indicated that most children aged one to three years in the central region of Limpopo province consumed inadequate amounts of most

micronutrients due to a diet that lacked variety. In the present study, the increase in the median intake of iron and folate in both groups may be attributed to the increase in the intake of vegetables and fruit by children in both groups. The school feeding programme may also have played a role in increasing the intake of iron and folate, since the majority of children were attending preschool or primary school and may have been given vegetables, such as spinach and fruit, at least twice per week as also reflected in a 24-hour recall. Furthermore, the intake of fortified maize-meal and bread may have contributed to the overall improvement in the intake of iron and folate, since these products are fortified with these nutrients.

The median zinc intake increased significantly (95% CI for the median difference [0.32; 1.2]) in the control group, while median zinc showed a tendency towards increase in the experimental group. In addition, the zinc intake was adequate among the children aged one to three years; while for children aged four to eight years, it was inadequate. In the study done by Gibson *et al.*,²¹ median zinc intake improved in the experimental group after implementation of a community-based nutrition education programme. The results of the study done by Mamabolo *et al.*²⁷ revealed that the zinc intake was inadequate in children aged one to three years. In the present study, the 24-hour recall showed that the majority of children were given chicken feet, chicken hearts, chicken giblets or chicken liver in one or two meals per week, and these are good sources of zinc. Since improvements were observed in both the control and experimental groups, they cannot be attributed to the NEIP.

Conclusion

The impact of nutrition education was only observed in some feeding practices, since the majority of caregivers were usually including most foods items, such as starchy foods, protein-rich foods and vegetables, on the child's plate daily at baseline, which left little room for improvement as a result of the NEIP. The results at baseline as well as post intervention revealed that the majority of children were eating some indigenous foods, which reflect the diet of rural people.

Recommendations

Indigenous vegetables and fruit are not formally cultivated and marketed. Therefore, we recommend that the Department of Agriculture make indigenous fruit and vegetable seed available and promote the cultivation of indigenous fruit and vegetables by small-scale farmers. Furthermore, indigenous foods (vegetables, fruit and edible insects) can be sold by food vendors, thus increasing the availability of these foods while simultaneously improving the income-generating potential of the vendors.

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