APPLICATION OF A FOOD-BASED DIETARY GUIDELINE AS NUTRITION STRATEGY IN CRÈCHES TO ENHANCE VITAMIN A CONSUMPTION*

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OPSOMMING

Kinders in ontwikkelende lande, oorleef op diëte wat min of geen verskeidenheid toon, gevolglik word die inname van nutriënte wat vereis word vir groei, ontwikkeling en gesondheid nie voldoende voorsien nie. Die afwesigheid of ongereelde inname van vars groente en vrugte, veral vitamien A ryke groente en vrugte, wek kommer, aangesien 'n gebrek aan vitamien A nie net kinders se immuniteit, maar veral hul groei en ontwikkeling belemmer. Daar word beraam dat 21% van die kinders jonger as ses jaar in Suid-Afrika, daagliks vir tussen nege en tien ure gedurende weeksdae in die sorg van crèches gelaat word. Die voedingswaarde van die maaltye wat daar aan hierdie kinders verskaf word, het dikwels ook 'n tekort aan mikronutriënte, waarvan vitamien A een is. Gebrekkige vitamien A inname word huidiglik as een van die vernaamste voedingprobleme in Suid-Afrika onder kinders gereken. Onvoldoende diëte as gevolg van 'n beperkte verskeidenheid en beskikbaarheid, tesame met onvoldoende kennis van optimale voedingpraktyke van versorgers by crèches is onderliggende faktore wat verder bydra tot die probleem.

'n Kwantitatiewe studie is gedurende April – September 2007 in die Thulamela munisipale gebied in Venda, Limpopo provinsie onderneem. Die doel van die studie was om voedingstrategiëe vir crèches te ontwikkel en implementeer, ten einde crèche kinders se inname van vitamien A ryke vrugte en groente te verbeter met behulp van die amptelik erkende Suid-Afrikaanse voedsel-gebaseerde dieetriglyne. Deur gebruik te maak van 'n gerieflikheidssteekproef, het 100 versorgers van 20 créches in die studie-area ingestem om aan die studie deel te neem.

Die navorsingsproses is in drie fases, volgens die trippel A siklusbenadering (assessering, analise en aksie), ooreenstemmend met aksienavorsing gestruktureer. Fase een het 'n situasie assessering en analise ingesluit , waar basislyn data oor die respondente, hul voedingkennis en die maaltye wat voorsien is, ingesamel is. Beperkinge wat tot die probleem bygedra het, is uitgewys en daar is bevind dat die kinders se inname van vitamien A ryke groente en vrugte beperk was. Die gebrek aan kennis en inligting oor vitamien A, gekoppel aan die onbeskikbaarheid en ontoegangklikheid van voedsel, wat verder toegeskryf kan word aan gebrekkige voedselproduksie en die bekostigbaarheid van voedsel, was van die vernaamste bevindinge. Voedselberieding, -berging en -preservering het verdere uitdagings aan diegene in beheer van crèches gestel.

Deur gebruik te maak van bewese gedokumenteerde studies en die bevindinge van fase een, is voedingstrategiëe ontwikkel en in fase twee geimplimenteer. Opleiding in die vestiging en instandhouding van groentetuine by crèches asook demonstrasies oor hoe om die beskikbaarheid en gebruik van verboude sowel as nie-verboude vitamien A ryke groente en vrugte te verbeter, is by elkeen van die 20 créches gegee. Opleiding in spyskaartbeplanning en voedselbereiding is ook aangebied en die konsep van die voedsel-gebaseerde dieetriglyn *"eet volop vrugte en groente elke dag"* is terselfdertyd aan die respondente bekend gestel, aangesien dit 'n integrale deel van die ontwikkelde voedingstrategiëe gevorm het.

Opvolgdata ingesamel in fase drie, het 'n betekenisvolle verbetering in die respondente se kennis en vaardighede getoon. Die beskikbaarheid, toegangklikheid en gebruik van vitamien A ryke groente en vrugte het noemenswaardig verbeter. Volhoubare groentetuine, voorafbeplande spyskaarte en korrek voorbereide maaltye was tasbare bewyse dat groente en vrugte meer dikwels aan die kinders bedien is. Die resultate bewys voorts dat deur die implimentering van relatief eenvoudige voedingstrategieë die inname van groente en vrugte verbeter kan word.

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INTRODUCTION

Vitamin A deficiency is a major public health concern around the world because it affects the human body's immune system and entire physiology. The World Health Organization (WHO) has estimated that globally over 250 million preschool children are vitamin A deficient. Vitamin A deficiency in children is a matter of great concern, as it not only causes severe visual impairment an ultimately blindness, and negatively affects growth, but it also considerably increases the risk of severe illness and even death from common childhood infections such as measles, diarrhoeal and respiratory disease (Chen *et al*., 2011; www.who.int/nutrition/topics/vad/en/ - accessed 13th Dec 2010; Sommer, 2008; Aguayo & Baker, 2005). According to Kapinga (2010) 43 million children in sub-Saharan Africa suffer from vitamin A deficiency. South African children continue to be equally affected by low intakes of this vital micronutrient as reported in the national surveys conducted in 1994/95 (Labadarios & Van Middelkoop, 1995), and the two National Food Consumption Surveys (NFCS) of 1999 and 2005 (Labadarios *et al.,* 2005; Labadarios *et al.,* 2008), as well as a number of smaller studies performed in different areas in South Africa (Laurie & Faber, 2008; Faber *et al.,* 2002a; Faber *et al. ,* 2002b).

Though progress has been made in ameliorating micronutrient deficiencies (Sommer, 2008; Aguayo & Baker, 2005) vitamin A deficiency remains a serious public health issue amongst preschool children (six months to six years old) in South Africa, and is primarily caused by inadequate diets (Faber & Wenhold, 2007; Nojilana *et al.,* 2007; Faber *et al*., 2006; Engelberger *et al*., 2003).

Young children are dependent on adults to provide them with an adequate micronutrient-rich diet. When children attend preschool, crèche or day care facilities that do not provide adequate meals and snacks during the time spent there, their nutritional status may be further jeopardised (Pietersen *et al*., 2002). The dietary intake of crèche children thus largely depends on the nutritional knowledge, menu-planning skills and meal preparation practices of crèche caregivers. It is therefore imperative that caregivers be aware of their responsibility in this regard, and that they be properly trained to provide in the basic nutritional needs of those in their care (Pietersen *et al*., 2002; Steyn & Marais, 2002).

However, to achieve the goal of improving the dietary intake of children in crèches requires that apart from improving the nutritional knowledge and food provisioning skills of the caregivers, that an adequate supply of nutritious food should be available and accessible. Food availability is based on its availability at national level as determined by local food production, exports and imports. Local food production, in turn, depends on geography, climate and seasonality (Bryant *et al.,* 2003:11). For food to be accessible it should be available (Faber *et al.,* 2006:17). Thus the development and implementation of strategies to improve the availability, access and utilisation of vitamin A-rich vegetables and fruit could lead to an increase in the consumption of vitamin A-rich foods (Jakubikova *et al.,* 2011; Laurie & Faber 2008; Faber & Van Jaarsveld, 2007; Department of Health, 2004:7). In this study utilisation of food included all the activities related to how food is obtained, preserved, stored, prepared, served and consumed (Kittler & Sucher, 2008:2).

The high rates of vitamin A deficiency, identified at 43% for the Limpopo province, as the highest in the country, requires that those responsible for the nutrition of children in this province take action.

To specifically address the challenge of combating vitamin A deficiency in preschool children, and to improve their vitamin A intake, Faber and Van Jaarsveld (2007) underline a variety of possibilities with the aim to increase the production, availability, access and consumption of vitamin A-rich foods. These include approaches such as; behaviour change to increase consumption, i.e. nutrition education; horticultural practices such as home-gardens; and improved methods of food preparation, preservation and cooking practices to preserve the vitamin A content of food. This study therefore aimed to develop and implement nutrition strategies that would improve the application of the food-based dietary guideline *"eat plenty of vegetables and fruits everyday"* that could be used by crèche caregivers in order to enhance the consumption of vitamin A-rich vegetables and fruit by crèche children in the Thulamela municipal area of the Vhembe district in the Limpopo province of South Africa.

RESEARCH METHODOLOGY

The research was empirical in nature and conducted within the quantitative paradigm following a positivistic orientation to address a real life problem (Strydom, 2005:409; Babbie & Mouton, 2001:22-28 & 47-53). It is applied action research as the researcher and the respondents took equal responsibility for the accomplishment of the specific aim and the envisaged outcome of the research endeavour as suggested by Strydom (2005:408-412) and Neuman (2003:24-25).

Following the triple A cycle of assessment, analysis and action the research was conducted in three phases (Tontisirin & Gillespie, 1999). Phase 1 was based on the assessment and analysis of the situation at the crèches to provide baseline information on the consumption, availability, accessibility and use of vitamin A-rich fruit and vegetables. The current knowledge and practices (i.e. food accessing, preparation, preservation, storage and planning menus) of the caregivers concerning the application of the food-based dietary guideline: *"eat plenty of fruits and vegetables everyday"* (with special emphasis on vitamin A-rich fruit and vegetables) was assessed during this phase. Phase 2 focused on the development and implementation of the nutrition strategies, which included food production and gathering, and nutrition education to enhance dietary diversity and optimise

food utilisation of vitamin A-rich fruit and vegetables. In Phase 3 the crèche situation was reassessed to determine if there was an improvement of the caregivers' nutrition knowledge and application of the relevant food-based dietary guideline through vegetable gardens and improved menus, vegetable preparation, preservation and storage.

Sampling and study population

Permission to collect data and to implement training programmes was obtained from the Department of Education, Limpopo Provincial Government. The Ethics Committee of the Faculty of Natural and Agricultural Sciences of the University of Pretoria approved the study before the research commenced.

The research was conducted in 20 crèches operating in the Thulamela municipal area in Venda. Convenience sampling was used and the study population was therefore the caregivers at the crèches and the sample consisted of 100 respondents who were 21 years of age and older and who gave their informed consent to participate in the study. They included managers and owners, teachers as well as the ladies who prepared the food. These people were all responsible for either providing food and/or taking care of children at these crèches. The number of respondents who participated in the research provided a sizable and representative sample of the targeted population.

Data collection techniques

Three data collection techniques were used namely, questionnaire, observation and a game. These techniques were effectively used in the two phases of data collection and were considered suitable for achieving the research objectives.

Questionnaires Self-administered questionnaires were developed to collect data before and after the development and implementation of the nutrition strategies. The questionnaire consisted of fifty-five questions which were divided into five parts. These included questions on demographics (for both caregivers and children), meal patterns, composition of meals and menus, nutrition knowledge about food choices regarding vitamin A (specifically vitamin A-rich fruit and vegetables) and the result of vitamin deficiency, dietary diversity, including data on the availability, accessibility, preparation, storage and preservation of vegetables and fruit.

Observation Data was collected using simple observation whereby the researcher was regarded as an outsider observer. Observation was advantageous in that it could be done at any time. Notes were taken on the observations as suggested by Babbie and Mouton (2001:294). Data was collected on food availability (i.e. gathering of indigenous vegetables, availability and accessibility to fruit trees and vegetable gardens), food utilisation (preparation, storage and preservation techniques as well as consumption), and menu planning. The collected data was recorded on observation checklists.

Game A game and score sheet was developed to collect data on the caregivers' knowledge of vitamin A nutrition, specifically vitamin A-rich vegetables and fruit and symptoms of a vitamin A deficiency.

Data collection

In Phase 1 the initial situation assessment and analysis was undertaken to gather baseline information in order to determine the constraints and note what had already existed before developing and implementing the nutrition strategies.

To assist inexperienced caregivers to fill in their responses correctly, the questionnaires were completed under the close supervision of the researcher as an interview. Some respondents preferred to write their responses themselves whilst others preferred to respond verbally. This approach is endorsed in the literature (Babbie & Mouton, 2001:249; Mouton, 1996:156-157). This was also done where there was a low level of literacy among the respondents. However, care was taken that respondents did not influence each other. Although this method was time-consuming the researcher had the opportunity to probe for answers when necessary. The questionnaires were coded and captured for analysis.

Phase 2 (the action part) commenced immediately after the baseline information had been collected and analysed. This phase focused on the development and implementation of the nutrition strategies that would improve the application of a food-based dietary guideline *"eat plenty of fruits and vegetables everyday"*. The main intention of this phase was to train the crèche caregivers. Various training methods such as lecturing, discussions, question and answer by means of a game, as well as demonstrations were used. The training focused mainly on educating caregivers on vitamin A nutrition (providing awareness on the importance of vitamin A to children as well as the consequences of its deficiency). Caregivers were made aware of the fact that fruit and vegetables are rich in vitamin A and were also taught how they could ensure year-round access and availability of vitamin A-rich fruit and vegetables.

The training materials used were a Vitamin A chart from the national Department of Health, two charts and a 2007 calendar from the Agriculture Research Council (ARC- Roodeplaat Vegetable and Ornamental Plant institute) illustrating vitamin A-rich vegetables, the South African Food-based Dietary Guidelines, the ten reasons for eating fruit and vegetables everyday and a pamphlet illustrating the complications that children with vitamin A deficiency experience. Each of the twenty crèches received these materials that they could keep. Caregivers were therefore trained on:

- How to start a vitamin A vegetable garden
- Vitamin A sources and vit A role in nutrition
- Menu planning
- Proper storage, preparation and cooking tech-

niques and preservation (drying and freezing) of vitamin A-rich fruit and vegetables.

During this phase vegetable gardens were established at crèches. The gardening demonstrations were facilitated by the gardening guidelines of Faber *et al.* (2006) that give instructions on how to plan and implement a home garden for planting pro-vitamin A-rich vegetables such as orange-fleshed sweet potatoes, spinach, carrots and pumpkins. Each crèche was supplied with these guidelines.

Those who already had gardens were encouraged to grow vitamin A-rich vegetables and plant fruit trees. The caregivers were also encouraged to grow vitamin A-rich indigenous vegetables as well as using locally available fruit and vegetables rich in vitamin A such as African nightshade, cowpeas, blackjack, okra, amaranth, mangoes, banana and paw-paws. The vegetables took between two to four months to grow before they were ready for harvesting.

Nutrition training and education focused on increasing caregivers' nutrition knowledge and awareness of vitamin A-rich fruit and vegetables. The cultivation and proper utilisation of fruit and vegetables were promoted in order to enhance their access and availability to the crèches and ultimately to improve their consumption by the children. Topics covered during the training sessions included basic education concerning vitamin A regarding its functions, the causes, warning signs and symptoms of vitamin A deficiency; the importance of fruit and vegetables to children including the identification of fruit and vegetables rich in vitamin A and strategies to improve the consumption thereof; the preparation of vegetables for maximum nutrient retention including preservation techniques and proper storage; dietary diversity and menu planning.

Criteria for menu planning that emphasised the application of a food-based dietary guideline that would improve consumption of vitamin A-rich fruit and vegetables were given to the caregivers. Caregivers were encouraged to include vitamin A-rich fruit and vegetables in their meals every day. In order to maintain the vitamin content of fruit and vegetables effective ways of cooking and preparing these foods were introduced to the caregivers and they were provided with vitamin A-rich recipes which included food products from their gardens. They were also trained on proper storage and preservation techniques such as freezing and drying to increase year-round availability of fruit and vegetables.

After training, the researcher visited the crèches from time to time to observe the gardens and caregivers to see how the strategies were put into practice and this information was recorded. Pictures of the vegetable gardens were taken at different stages, for instance, when gardens were being prepared; when vegetables were planted and harvested; and then when they were prepared, cooked and served as meals.
Phase 3 was based on reassessment using the same assessment criteria as in Phase 1. Phase 1 and three had the same number of respondents.

Data analysis

All data from questionnaires was entered and analysed in statistical analysis system, SAS (version 8.2) and the BMDP statistical software programmes. Descriptive and inferential statistical procedures were used to analyse data. The main aim of the inferential statistics (two way tables, Kruskal Wallis and McNemar's test) was to view and discuss all the underlying correlations, relationships, combination and interactions between different variables (Christensen *et al.,* 2011:391; Babbie & Mouton, 2001:487; Mouton, 1996:166).

RESULTS AND DISCUSSION

Phase 1 (pre-intervention) focused on the results obtained from the data collected during April 2007 that was used to provide baseline information for the *situational assessment and analysis.* Phase 1 results served as guideline as to how Phase 2 (intervention) as the *action* part should be carried out. Phase 3 (post-intervention) data was collected in September

TABLE 1: DEMOGRAPHIC PROFILE OF CAREGIVERS (N=100)

Age in years	
20-29	3
30-39	54
40-49	32
50-59	10
67	1
Education	
Tertiary education	30
Grade 12	30
Grade 8-11	29
Grade 1-7	11
Trained in childcare by:	
Crèche owner	31
Other caregivers	19
Other institutions	33
Department of Health	13
Diploma in pre-school teaching	39
Experience in years as caregiver	
1-5	23
6-10	52
11-15	20
16 and >	5

2007 and its results were used to evaluate the effectiveness of the nutrition intervention programme.

Demographic profile of caregivers and children

The demographic profile of the caregivers and children at the crèches included variables that gave a relevant indication of the participants' characteristics. Table 1 presents the demographic profile of the caregivers with reference to their age, educational background, training and experiences in childcare.

Demographic profile of caregivers The age distribution of the respondents ranged between 21 and 67 years. The results clearly indicate that the majority had lower than a Grade 12 level of education and yet some (30%) had above Grade 12 education (tertiary education). This was confirmed by the experience in which it was evident that some respondents had a low level of literacy as they were unable to complete the questionnaires on their own.

The respondents also had to indicate if they had had childcare training. As reflected in Table 1, 39% of the respondents had pre-school teaching diplomas, 33% had learnt about childcare from other caregivers, while 19% were trained by the owners of the crèche and 13% had been trained by the Department of Health. Another 13% indicated that they had been trained by various other institutions such as the Department of Education and some non-governmental organisations.

The caregivers' experience was of significance in this study. The assumption here was that the more experienced the caregivers were the better they would be able to take care of the children. The respondents' experience varied between one and twenty five years.

Demographic profile of children The crèche children's demographic information in terms of age and gender, and the time they spend at crèche each day were important aspects to depict the real situation of the crèches. See Table 2. Children from both gender groups were equally represented in the crèches. The ages of the children attending the selected crèches ranged from six months to six years and different ages for entry were indicated by the survey participants. The majority (55%) of the respondents indicated that they had children between the ages of six months and five years, and 28% had children between one and six years whereas 17% had children between the ages of two and five years. These results confirmed that children were attending crèches from a very young age.

TABLE 2: DEMOGRAPHIC PROFILE OF CHILDREN (%)

Age for entry to crèche of children	
2-5 years	17
1 year – 6 years	28
6 months- 5 years	56
Gender distribution	
Girls	49.6
Boys	50.4
Hours spent at crèche	
10 hours	5
9.5 hours	31
9 hours	48
8.5 hours	10
8 hours	6

The length of time children spent at the crèche during the day is of utmost importance. It might be assumed that the longer the children stay at the crèche, the more reliant they would be on the caregivers to provide them with adequate meals and snacks while they are there. The findings revealed that crèches operated between 6:30 and 17:30 for five work days each week. The time spent differed from crèche to crèche ranging between eight and ten hours a day. The majority of the respondents (48%) indicated that children spent nine hours at crèches, followed by 31% who showed that they spent nine and a half hours. It can be concluded that a striking majority of the children are at crèche for nine or more hours a day and all children are there at least eight hours a day. This means that, for the largest part of their day, every day of the week, these children are totally dependent on the caregivers to give them proper nutrient-rich food. This scenario could then raise a concern about the importance of nutritional knowledge and menu planning skills of caregivers employed at crèches.

The assessment was based on the meal pattern and composition of the meals served at crèches. For ease of comparison, the results obtained in Phases 1 and 3 are combined in one table, and discussed per topic.

Meal pattern

The children's meal pattern at the crèches generally consisted of two meals a day (breakfast and lunch) with one or no snack between them. All the caregivers indicated that lunch was served and the majority (95%) served breakfast. However, these meals lacked variety as the same types of foods were on offer every day. See Table 3. Caregivers indicated that unhealthy snack foods such as sweets, biscuits, popcorn and chips were consumed by some, as these were not necessarily served at crèches, but packed for children from home. Healthy snacks such as fruit were occasionally served to children at crèches and were handed out only when there were surpluses.

In comparison to Phase 1, Phase 3 results showed an increase in the number of caregivers who were now serving snacks. Such an increase would contribute to children being served a variety of food as well as an increase in intake of fruit and vegetables. To reflect on the changes, two-way frequency tables were used

TABLE 3: COMPARISON OF FOOD SERVED FOR BREAKFAST, LUNCH AND AS SNACKS (N=100)

Food served for meals	Frequencies	
	Phase 1	Phase 3
Breakfast		
Soft porridge and milk	31	30
Soft porridge , milk and fruit	5	45
Bread and tea	57	0
Bread, tea and fruit	0	25
Lunch		
Porridge with either meat, fish or soup	87	87
Porridge with cultivated vegetables	87	100
Porridge with indigenous vegetables	35	90
Snacks		
Fruit	63	100
Potato chips	11	0
Sweets	8	0
Biscuits	14	0
Other	30	0

TABLE 4: COMPARISON OF MORNING AND AFTERNOON SNACKS SERVED IN PHASE 1 AND 3 (N=100)

Phase 1	Phase 3		
	Morning snack served (NO)	Morning snack served (YES)	Total
Morning snack served (NO)	64	6	70
Morning snack served (YES)	0	30	30
Total	64	36	100
Phase 1	**Phase 3**		
	Afternoon snack served (NO)	Afternoon snack served (YES)	Total
Afternoon snack served (NO)	15	33	48
Afternoon snack served (YES)	1	51	52
Total	16	84	100

to summarise the number of respondents who reported that they served morning and afternoon snacks. In Table 4, the rows represent Phase 1 while the
columns represent Phase 3. The “yes” and “no” refers to whether they served the snack or not. To determine whether a significant change from Phase 1 to Phase 3 took place, McNemar’s tests were performed.

In Phase 1 only 30 respondents served morning snacks and 70 did not serve morning snacks. In Phase 3, 36 respondents served morning snacks and 64 did not serve morning snacks. The table further indicates that of the 70 respondents who were not serving a morning snack in Phase 1, 64 were still not serving this snack while six respondents had changed and were serving a morning snack in Phase 3. Furthermore, the results indicate that in Phase 3 there were no respondents (0) who changed from serving the morning snack. McNemar’s test indicated a statistically significant change or difference (p-value<0,05) between Phase 1 and Phase 3 as there was an increase in the number of caregivers who were serving a morning snack. With regard to the afternoon snack, Phase 3 results show a higher intake of afternoon snacks as compared to Phase 1 results. Phase 3 scores increased from 51 to 84 in the number of re-

TABLE 5: FREQUENCY AND TYPES OF VEGETABLES SERVED TO CHILDREN (N=100)

Frequency of vegetables served	Phase 1		Phase 3	
Once per week	66		0	
Twice per week	24		0	
Three times per week	0		15	
Four times per week	0		75	
Daily	10		10	
Type of vegetables served	**Raw**	**Cooked**	**Raw**	**Cooked**
Pumpkin	0	100	0	30
Carrots	5	10	49	89
Yellow sweet potatoes	0	0	0	11
Cabbage	0	71	18	91
Spinach	0	11	0	100
Butternut	0	9	0	14
Muroho (indigenous green leafy vegetables)	0	14	0	25
Chinese cabbage	0	25	0	0
Potatoes	0	10	0	0

spondents who were serving an afternoon snack. McNemar's test results indicate a significant change in the number of respondents who were serving afternoon snacks (p-value<0,05). It can be concluded that intervention was successful in changing from not serving to serving more afternoon snacks, the same also holds true for the morning snack. Taking into consideration the time children spend at the crèche each day, a late afternoon snack is recommended.

Composition of meals served

The results (Table 3) showed that the diet of the children at the crèches comprised a limited number of food items, and therefore lacked variety. Generally, the children were served a distinctly cereal-based diet, with maize-meal porridge being the staple food. There was a low consumption of vegetables and fruits, and the meals, in general, were deficient in vitamin A-rich food.

Although the same type of foods were served in both phases, a change could be seen in Phase 3 results where a larger number of the respondents were serving fruit to children at breakfast. According to the results it seems that bread and tea were served by the majority (57) in Phase 1 and replaced by other healthier options that include fruit in Phase 3. This was also the case for those who served only soft porridge and milk. It could thus be concluded that the increased intake of fruit at breakfast would more likely contribute to achieving the dietary guideline *"eat plenty of fruits and vegetables everyday"* and perhaps lead to an increased intake of pro-vitamin A foods among the children. It could thus be assumed that children who were served a breakfast that included a fruit were able to improve their vitamin A intake.

A change in the food that was served for lunch in Phase 3 was evident. Along-side meat, fish and soup, all the respondents (100 versus 87) indicated that they provided cultivated vegetables. This was also stated in their menus. There was a notable increase in the number who were serving indigenous vegetables to the children (90 as opposed to 35). The gardening project further resulted in an increased intake of dark green leafy vegetables as observation results showed that sweet potato leaves were mixed with other traditional green leaves and cooked together. This signifies an improvement in the caregiver's knowledge of the nutritional value of indigenous vegetables. As highlighted by other researchers (Maunder & Meaker, 2007) this in turn complemented the nutritional value of basic staple foods at crèches and at the same time increased the consumption of vitamin A-rich vegetables by children.

All the respondents indicated that they were only serving fruit to children as snacks. Seasonal variation in the availability of fruit was observed as an important factor that contributed to better access to fruit at crèches. Although mangoes were still not served in summer while in abundance, contrary to the situation in Phase 1, the consumption of avocadoes, was high during the winter season and this is important as they provide vitamin A. Observation results revealed that respondents who planted sweet potatoes sometimes served it as a snack. The caregivers cooked the sweet potatoes and then sliced them, giving the slices to the children.

Vegetables served During Phase 1 the majority of the respondents (66%) served vegetables only once a week followed by 24% who did so twice a week. See Table 5. Only 10% served vegetables on a daily basis. It was observed that the frequency of serving vegetables to children was influenced by having a vegetable garden at the crèche. The respondents who served vegetables on a daily basis were those who had vegetable gardens at their crèches. From the results it was concluded that children at crèches were not served enough vegetables. It was therefore important for the study to acknowledge that the dietary guideline *"eat plenty of fruits and vegetables everyday"* should form the core of nutrition information aimed to educate and motivate caregivers in order to improve the daily consumption of fruit and vegetables by children.

The majority (71%) of the respondents favoured cabbage which was attributed to its affordability, familiarity and year-round availability. Only a few respondents served vitamin A-rich vegetables such as spinach (11%), pumpkin (10%), carrots (10%), butternut (9%), *muroho* (14%). Meals thus generally lacked yellow and orange-coloured vegetables. Although serving yellow sweet potatoes could have been an option from this category, not one respondent chose to place it on the menu.

In Phase 3 an increase in the weekly vegetable consumption was evident as the majority of the respondents (75%) were serving vegetables at least four times a week. It is remarkable to find that in Phase 3 no respondents (as opposed to 66 previously) were serving vegetables only once a week. As reflected in Table 5, 89 respondents, instead of ten, served cooked carrots, 30 instead of ten, served pumpkin and eleven served yellow fleshed sweet potatoes which previously no one was serving. The consumption of spinach was highest in Phase 3 with all the respondents (100) serving it whereas before only eleven did.

The respondents also had to indicate whether the vegetables were served cooked or raw. With the exception of five percent who served raw carrots, results showed that the majority of the respondents served cooked instead of raw vegetables to the children. Change occurred in Phase 3 as the number of respondents serving raw carrots had increased from five to 49, and from zero to 18 in the case of raw cabbage.

The respondents were asked to report how frequently indigenous vegetables were on the menu. The majority (70%) said that indigenous vegetables would be served at the utmost once a week when in season as a supplement to cultivated vegetables. On the other hand, observation results revealed that indigenous vegetables were not a regular part of the children's diet at crèches as they were not even part of the menus. The reason for the low intake of the indigenous vegetables could be ascribed to the exclusive promotion of cultivated vegetables and fruit which resulted in indigenous vegetables being regarded as inferior, although many are nutritionally superior (Maunder & Meaker, 2007). Another explanation for the limited serving of indigenous vegetables was that the caregivers made it known that many parents did not want their children to eat indigenous vegetables as they regarded these vegetables as inferior and of low status. Some even saw them as animal fodder or weeds and they insisted that their children should not be given such vegetables. They even threatened that if their children were served these vegetables they would remove them from the crèche and register them at other crèches that do not serve indigenous vegetables. These results substantiate the claim made by Kepe (2008) and Faber *et al.* (2007) that promoting dark green leafy vegetables may be difficult because many people may regard traditional food crops as being inferior.

As was proposed by Faber *et al.* (2007), lack of popularity and unfamiliarity were also given as possible reasons for the low consumption of indigenous vegetables. This finding also confirms the viewpoints of other authors (Kepe, 2008; Faber & Wenhold, 2007; Maunder & Meaker, 2007), that there is an observed lower level of knowledge and esteem regarding traditional plants especially among the younger generation. However, barriers such as unavailability due to seasonal fluctuations were also seen as a cause of the low consumption of indigenous vegetables.

In Phase 3 there was an increase in the number (25 against 14) of the respondents serving *muroho* and more caregivers were serving Chinese cabbage, an increase from 25 to 50.

There was improvement in the serving of indigenous vegetables to the children in that this was done far more frequently. The majority of the respondents (62) indicated that they served indigenous vegetables three times per week when they were available, 23 served them four times per week, in contrast to only two who served them once a week in Phase 1. These results are notable in that the progress is principally due to the efforts of the caregivers who sought to increase the availability of less expensive locally produced or gathered vegetables, and promote their inclusion in the menus throughout the week for as long as they are in season. The respondents reported greater use being made of indigenous vegetables on the weekly menu despite the popular views that these vegetables have a low status. These results give the impression that caregivers were becoming aware of the importance of eating fruit and vegetables every day, consequently showing an understanding of the value of indigenous vegetables in children's diet.

A general increase in the consumption of dark green as well as yellow vegetables was observed in Phase 3 and two-way tables of analysis were used to demonstrate the difference between Phase 1 and Phase 3 results. Each vegetable served was analysed and compared separately to see if there was a significant improvement in the number of respondents who served a particular vegetable to the children in Phase 3. The tables indicated the extent of change by show-

TABLE 6: TYPES OF FRUIT SERVED TO CHILDREN (N=100)

Types of fruit	Phase 1	Phase 3
Apples	31	59
Bananas	26	85
Oranges	15	65
Avocado	3	51

ing the number of respondents who changed and those who remained not serving the vegetable. McNemar's test indicated a significant change (p-value<0,05) for carrots, butternut, *muroho,* and pumpkin. From these results it can be concluded that there was a significant improvement in the number of respondents who were serving vitamin A-rich vegetables in Phase 3 and this was seen to be so during site visits to the crèches. It was noted that the number of the respondents serving vitamin A-rich vegetables had increased as a result of the availability of these vegetables in crèche gardens.

Fruit served

To determine if children were served fruit, and whether it was rich in vitamin A, the respondents had to specify the kind of fruit that they gave the children. The fruit most commonly served by the majority of the respondents in Phase 1(31%) was apples, followed by bananas (26%), then oranges (15%) and the least served were avocadoes (3%). See Table 6. Apples and bananas were predominant because they were easily and cheaply acquired. It was, however, surprising to find that avocadoes, which were in season at the time of data collection, were not provided as often as one would expect. It is apparent from the results that some vitamin A-rich fruit such as mangoes and paw-paws were not served to the children at all. Although these fruit were not in season at the time of data collection, it was observed that even when they were in season, they were not included in the menu. When in season mangoes grow in home gardens and this was given as the reason why the respondents did not give them to children at the crèche even though they are found in abundance in the area.

The same kind of fruit (namely, banana, apples, oranges and avocadoes) were served to children in Phase 3 as in Phase 1. However, there was an increase in the number of respondents who served fruit to children in Phase 3. Contrary to the situation in Phase 1 where the majority served apples, in Phase 3 the majority (85) of the respondents served bananas. This could be that bananas were readily accessible and are available in the area all year round. Though there was an increase (to 65 from 15) in the number of respondents who served oranges in Phase 3, their availability was also affected by seasonality. The findings also revealed that the number of caregivers who served avocadoes increased from 3 to 51 and those who served apples also increased from 31 to 59.

The observation on fruit consumption showed that a variety of fruit was available; however, the kind of fruit consumed was dependent on the season. Fruit high in vitamin A such as mangoes, paw-paws and peaches can be grown easily by crèches and during a good season fruit is abundant and obtained easily from households or cheaply at the local market. However, results showed that these fruit were not served to the children in both phases.

Availability and accessibility of vegetables and fruit

Unavailability and lack of access to vitamin A-rich foods was a major concern observed during Phase 1. Accessibility and the type of vegetables and fruit obtainable were dependent on the existence of gardens, the particular season of the year as well as the purchasing capability of the crèche. For various reasons 13 out of 20 the crèches did not have vegetable gardens. Some experienced major obstacles to growing vegetables which included reasons such as the cost of fencing, no access to planting materials or seeds, limited land and an inadequate supply of water. For those with vegetable gardens, the vegetables grown were vitamin A-rich crops, except for cabbage, namely pumpkin, spinach, African-nightshade (*muxe)* and carrots, but the quantity produced was too low for including these on their menus. Although the yellow/ orange sweet potato was one of the options to choose from, no respondent mentioned planting these vegetables. Many crèches had no fruit trees in their yards, however fruit trees such as mango, paw-paw and avocado were available at some crèches.

Although the majority (70%) of the respondents indicated that they gathered and served indigenous vegetables such as jute mallow (*delele*), African-nightshade (*muxe*), black jack (*mushidzhi*) and pumpkin leaves (*phuri*) to the children, observation results showed that these vegetables were not served as such. However, some of these vegetables, such as *muxe* and *phuri,* were cultivated at some crèche gardens and also obtainable from the supermarket or open market. Only 14% of the caregivers indicated that they were gathering indigenous fruit such as wild figs (*mahuyu*), wild medlar (*mazwilu)* and *pfuka.* These fruits were available at some crèche yards and children were allowed to eat them as they like but they were not included in the menu.

From the results of Phase 3 it is clear that crèche gardens played a role in vegetable consumption. There was an increase (from 39 to 89) in respondents who had vegetable gardens in Phase 3. The presence of vegetable gardens at crèches is important because it would consequently contribute to increased accessibility of vegetables as well as the consumption thereof by crèche children. Only 11 respondents indicated that they did not have gardens and, as observed, these were the respondents who did not have water supply. Although not all the newly established gardens flourished, the results reflect that the respondents had gained knowledge and skills on how to cultivate vegetables. It was observed that

those who operated from a hired facility, such as the church, were also establishing vegetable gardens. Therefore the decline in the number of respondents who did not have a vegetable garden can be attributed to the training they received in Phase 2. The observation made was that, out of the 20 crèches in this study, only three crèches remained without vegetable gardens.

It could be concluded that an increase in the supply of vegetables, through vegetable garden production, resulted in increased weekly consumption of vitamin A-rich vegetables by children.These results concurred with other studies (Kristjansdottir *et al.,* 2006; Khetarpaul, 2006; Blanchette & Brug, 2005) who found availability as the most important determinant of children's vegetable and fruit intake because when there is high availability or accessibility of fruit and vegetables children eat more.

Utilisation

Utilisation refers to how available vegetables and fruit were used, which includes preparation, storage and preservation as well as menu planning. As highlighted by Faber and Van Jaarsveld (2007), the potential contribution of plant foods to vitamin A status depends on the retention of pro-vitamin A carotenoids after storage, preparation and processing. It was therefore anticipated that caregivers would display adequate knowledge of food utilisation during the assessment phase.

In Phase 1 results revealed that the respondents were preparing and handling vegetables in such a manner that valuable nutrients were lost through practices such as prolonged cooking, throwing away cooking water, the addition of bicarbonate of soda, boiling in too much water and the habit of soaking vegetables. A small number of caregivers added ingredients to enhance the nutritional value of certain vegetable dishes, such as pounded peanuts, oil and minestrone soup mix. Although oil was added to enhance the taste of vegetables, this is a good practice as it aids the absorption of vitamin A.

It was noticed that storage facilities were inadequate as the majority of the respondents had no refrigerators or deep freezers to store surpluses or leftovers. Though some respondents were buying just enough for use, others were throwing the leftovers away due to lack of storage space or facilities. Respondents were not preserving vegetables, not even those with vegetable gardens.

Caregivers displayed inadequate knowledge of the proper use of vegetables and fruit in menu planning. It was clear that the respondents had limited training in menu planning. Although written menus were available, they were not followed as set out. The food prepared was based on what was available and not on what was on the menu. The respondents did not understand the implementation of written menus. Menus remained the same the whole year round and often included vegetables or fruit which were out of season. Some menus included foods never served to the children, whereas some just indicated the type of meal and did not specify the food to be included in a meal. Recipes were not used to prepare the planned menu items.

In Phase 3 an improvement in vegetable preparation methods was noted and the children's increased enjoyment of eating vegetables was attributed to this. Properly prepared vegetables taste better and are more palatable.

Although various methods of food preservation were taught to the respondents in Phase 3 it was established that a disappointingly small number (32%) of caregivers were sun-drying cooked green leaves such as spinach and Chinese cabbage when these were plentiful. It was important for caregivers to have menu planning skills and to apply it in planning children's meals. It was evident from the written menus inspected in Phase 3 that it reflected dietary diversity and an increased use of vitamin A-rich vegetables. Moreover, what appeared on the menus was actually offered to the children, which was not the case in Phase 1.

Nutrition knowledge

The respondents' nutrition knowledge was regarded as inadequate from the data collected during Phase 1. Although the majority of the respondents knew that children should eat vegetables and fruit, they displayed little knowledge as to what would happen if children did not eat these. Regarding the importance of vegetables and fruit consumption during childhood, and the importance of vitamin A to children, they cited ordinary health reasons, based on common understanding and general knowledge that vegetables and fruit are good for health because they contain vitamins. Their knowledge about vitamin A-rich fruit and vegetables was assessed by letting them choose from a list of fruit and vegetables. They had to indicate which fruit and vegetables were rich in vitamin A, and were encouraged to mention some other fruit or vegetables which were not on the list. Some respondents knew that certain fruit and vegetables contain vitamin A. For example, 82% chose spinach, 74% yellow peach, 67% pumpkin, 66% *muroho* and 53% carrots which are rich in vitamin A. A small percentage (29%) of the respondents knew that yellow/ orange sweet potatoes and mangoes (30%) are rich in vitamin A. Only 30% of the respondents had added other fruit or vegetables that are rich in vitamin A and 45% had added others that are not rich in vitamin A.

In line with the findings by Maunder and Meaker (2007) and Faber and Wenhold (2007) there was a low level of knowledge and lack of esteem for indigenous vegetables. This underscored the urgent need to emphasise the nutritional value of indigenous vegetables, and the importance of nutrition education in this connection.

The respondents did not seem to know that the portion sizes of vegetables and fruit served to children

should be controlled. There was no portion control at all and the respondents did not really care about measurements. Through observation it was revealed that all the children were served the same amount of vegetables irrespective of their age and it seemed that the caregivers were giving children as much food as possible. It was also seen that, when children were served fruit at crèches, all the children from the age of two to six years old were given one whole fruit irrespective of their age. For example, if they were eating apples all the children would be given a whole apple yet the younger children were unable to finish the fruit they were served.

Another finding was that caregivers with lower educational levels had less nutrition knowledge than those with higher educational level. This was confirmed by a Kruskal Wallis test which was performed and the results showed a statistically significant relationship (p-value<0,05) in the scores of the respondents with different education level. The test revealed that the respondents with grade 11 and lower scored significantly lower than those with matriculation and tertiary education.

Phase 3 results indicated a marked positive change in the caregivers' level of nutrition knowledge. The respondents' knowledge of the symptoms of vitamin A deficiency had improved. More respondents knew that children who did not eat vegetables and fruit are at risk of contracting specific diseases. Contrary to the situation in Phase 1, the majority of the respondents related green and yellow/orange vegetables and fruit to vitamin A.

Although a small percentage of caregivers still had limited knowledge and understanding of vitamin A and the consumption of vegetables and fruit from a scientific point of view, it can be concluded that the study was successful in improving the caregivers' knowledge of what is important and better practices related to vitamin A intake.

CONCLUSIONS

Participation in this study gave the caregivers not only greater insight and knowledge on the importance of the consumption of vitamin A-rich vegetables and fruit but also developed their skills on how to:

1) increase the production, availability and access to vegetables and fruit;
2) increase the consumption of these foods by crèche children; and
3) enhance the availability of foods rich in precursors of vitamin A in the diet, through improved menus and proper storage and preservation techniques.

This study provides evidence that a food-based intervention can yield positive results within a relative short period of time regarding the availability, access and utilisation of fruit and vegetables rich in vitamin A. It further demonstrated that having a garden at the crèche significantly improved the children's dietary diversity and frequency of fruit and vegetables consumed. This together with the strategies to increase the caregivers' knowledge of vitamin A-rich vegetables and fruit to enhance the accessibility, availability and utilisation of cultivated vegetables, as well as those available growing in the natural environment, are important means to encourage those responsible for meals to crèche children to improve the intake of vitamin A-rich vegetables and fruit by those in their care. Substantial changes in caregivers' knowledge, and their access, availability and utilisation of vitamin A-rich vegetables and fruit were demonstrated in Phase 3 of this study after intervention.

This study highlights the need for more effort to target crèches that do not have vegetable gardens because they are more at risk of providing diets of poorer quality. The results should further help dispel the belief that this type of intervention takes a long time before it shows results.

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