

Original Article

Availability of, access to and consumption of fruits and vegetables in a peri-urban area in KwaZulu-Natal, South Africa

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Abstract

Availability and consumption of fruits and vegetables were assessed in peri-urban households in KwaZulu-Natal Province, South Africa. Caregivers of 400 randomly selected grade 6 and 7 learners were interviewed using a questionnaire that included unquantified food frequency questions. Using a repeated 24-h dietary recall, dietary intake was quantified for learners, caregivers and 2- to 5-year-old children in the household. Usual household fruit and vegetable consumption was expressed over three Living Standard Measure (LSM) categories. Average per capita intake of fruit and/or vegetables was 99 g for 2- to 5-year-old children and 124 g for caregivers. For consumers, fruits and/or vegetables contributed towards total dietary intake of fibre (16–21%), calcium (13–21%), vitamin A (27–31%) and vitamin C (47–62%). For households not consuming fruits ($n = 297$) and vegetables ($n = 178$) daily, cost was the major constraint ($\geq 75\%$). Of all households, 52% had fruit trees and 25% had a vegetable garden. Animals destroying vegetables was the major constraint to 59% of vegetable growers. Household consumption of fruits and vegetables increased over the LSM categories. Caregivers in the higher LSM group more likely used printed material for information on healthy eating, had fruit trees, were confident about vegetable gardening and sold some of their produce. To enable peri-urban populations of low socio-economic status to consume more frequently a bigger variety of fruits and vegetables, the cost of purchasing these food items needs to be addressed by government and business sector. Households should further receive support to overcome constraints which hamper the success of home gardens.

Keywords: children, community, dietary patterns, food consumption, socio-economic factors, micronutrients.

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Introduction

In South Africa the great majority of 1- to 9-year-old children consume a diet deficient in energy and of poor nutrient density, with a large proportion of children having a nutrient intake of approximately less than half the recommended requirement for a number of important nutrients (Labadarios *et al.* 2000). Although the latter study showed that KwaZulu-Natal was one of the provinces with the highest mean dietary intake for various nutrients

(Labadarios *et al.* 2000), a national survey done in 2005 showed that it is the most vulnerable province in terms of low vitamin A status (Labadarios 2007).

A meta-analysis of dietary surveys done in South Africa from 1983 to 2000 showed that less than 50% of 1- to 5-year-old rural and urban children consumed items from the vegetable group, while 12–18% rural and 27–44% urban South Africans consumed fruit (Nel & Steyn 2002). The National Food Consumption Survey that was done in 1999 showed that fruit was low on the list of commonly consumed food items for

1- to 9-year-old children (Labadarios *et al.* 2000). An estimated 11.1 million males and 12.5 million females over 15 years of age were affected by a low intake of fruits and vegetables in South Africa in 2000 (Schneider *et al.* 2007).

A high intake of fruits and vegetables can make a significant contribution to decreasing mortality from certain diseases (Schneider *et al.* 2007). Increased consumption of fruits and vegetables is therefore promoted. Not only is dietary diversification one of the strategies supported by the Integrated Nutrition Programme of the South African Department of Health (Department of Health 2002), but the South African Food-Based Dietary Guidelines also encourage South Africans to, among others, 'eat plenty of vegetables and fruits every day' (Love & Sayed 2001). An intake of five portions of fruits and vegetables is promoted through a number of initiatives such as the 5-a-Day for Better Health TRUST programme (www.5aday.co.za). The mission of the 5-a-Day for Better Health TRUST programme is to increase South Africans' consumption of vegetables and fruits, in line with the recommendation of the World Health Organization (WHO) of at least 400 g (five 80-g servings) and the Department of Health's dietary guideline 'Eat plenty of vegetables and fruits every day'.

South Africa has the double burden of under- and over-nutrition (Labadarios 2007; Schneider *et al.* 2009). Increasing the intake of β -carotene-rich fruits and vegetables could potentially reduce vitamin A deficiency (Faber *et al.* 2002a), which is one of the major nutritional deficiencies in South African children (Labadarios 2007). Increasing the intake of fruits

and vegetables could also have a large impact on reducing many non-communicable diseases (Lock *et al.* 2005; Schneider *et al.* 2007). Fruits and vegetables are also important to boost the immune system of people living with human immunodeficiency virus (HIV)/acquired immunodeficiency syndrome to help them fight infections (Department of Health 2007). However, affordability and availability may negatively impact on fruit and vegetable intake (Love *et al.* 2001).

The aim of this study was to determine the availability of, access to and consumption of fruits and vegetables for grade 6 and 7 learners, their caregivers and 2- to 5-year-old children (if any) in their household in the catchment area of four peri-urban schools in KwaZulu-Natal Province.

Materials and methods

Study population

The study was done in a peri-urban site in the Mariannhill area, Pinetown in the KwaZulu-Natal Province, South Africa. According to the 2005 National Food Consumption Survey-Fortification Baseline, KwaZulu-Natal was the province being most affected by poor vitamin A status in 1- to 9-year-old children (88.9%). The survey further showed that 21.7% of children and 37.6% of adult females were anaemic; 15.1% of children were stunted and 51.5% of adult females were either overweight or obese (Labadarios 2007). KwaZulu-Natal is the province with highest prevalence of HIV in South Africa (<http://www.avert.org/safricastats.htm>, accessed 27 August 2011).

Key messages

- Average amount of fruits and vegetables consumed was considerably less than the daily amount recommended by the WHO. Portion size seemed adequate (approximately 80 g), but variety and frequency were low.
- Consumption of fruit was highest for the 2- to 5-year-old children and lowest for caregivers, while consumption of vegetables did not differ across the three age categories.
- Cost was the major constraint prohibiting daily consumption of fruits and vegetables, although less of a constraint in the higher LSM group. Frequency of usual consumption for both fruits and vegetables increased over the LSM groups.
- Vegetable gardens were observed in 25% of households and 52% had fruit trees; the lack of fencing and animals destroying the vegetables were the major constraints for planting vegetables.

The study population resided in the catchment area of four primary schools. Twenty shops within walking distance from the four schools were identified. Each shop was visited at least once per week from February to October 2007. Fruits and vegetables available in these shops were observed and recorded. During March and April 2007, the caregivers of 400 randomly selected grade 6 and 7 learners were recruited; 100 learners per school were systematically selected using the grade 6 and 7 class lists. Only one child per household was selected. Exclusion criteria were lack of consent by the caregiver, and no adult caregiver available in the household. The caregivers were interviewed in the local language (isiZulu) by six experienced Medical Research Council (MRC)-employed fieldworkers and six local people recruited to assist with data collection. All data collectors were trained during a 5-day training workshop, which included piloting of the questionnaire and standardisation of the 24-h recall method.

Quantified dietary intake using a repeated 24-h dietary recall

To obtain the mean nutrient intakes for the different age groups, dietary intake was quantified for grade 6 and 7 learners, their caregivers and 2- to 5-year-old children (if any) in the household using a repeated 24-h dietary recall (Gibson 2005). Both the learner and the caregiver were present during the 24-h dietary recall. The two repeats were done approximately 1 week apart and on different days of the week. The fieldworkers worked Monday to Friday, and the dietary data collected therefore covered one weekend and four weekdays (Sunday through Thursday).

During the 24-h dietary recall interview, a standardised 'dietary kit' that included examples of food containers and wrappers, plastic food models, household utensils and three-dimensional sponge models was used to help the respondents and fieldworkers visualise, quantify and record food consumption for the previous day. In addition, dry oats was used to quantify portion sizes of certain food items, especially cooked food. The caregiver/learner used the dry oats to indicate the quantity resembling the amount of food that was consumed. The fieldworker quantified the dry oats

with a measuring cup. Directly after completion of each 24-h recall, quality checks were done by an experienced full-time employed fieldworker.

Information on the household collected by questionnaire

Information on socio-demographics, food sources, vegetable gardening practices at household level and constraints affecting vegetable production was collected by questionnaire that was developed using the guidelines of Gross *et al.* (1997).

To gain a better understanding of the different fruits and vegetables consumed, a set of unquantified food frequency questions was used to obtain descriptive qualitative information on the usual consumption of fruits and vegetables by children in the household during the past month. The set of questions that was used has been tested for face and content validity and has previously been used in similar studies (Faber *et al.* 1999, 2002b; Faber & Laubscher 2008). The caregiver had a choice of five options to describe the child's usual intake of listed foods. The five options were the following: (1) everyday; (2) most days (not everyday but at least 4 days per week); (3) once a week (at least once a week, but less often than 4 days a week); (4) seldom (less than once a week/infrequently); and (5) never.

The Living Standard Measure (LSM), which is based on standard of living rather than income, was used as a measure of wealth. A total of 29 variables, mainly looking at what assets (e.g. fridge and stove) and facilities (tap water and flush toilet) are available in the household, are used to create the LSM (Haupt 2006). Income is not taken into consideration when calculating the LSM. The LSMs consist of 10 groups, with LSM 1 being the most impoverished while households residing in LSM 10 tend to be better off from a household asset and socio-economic perspective. The lower LSMs are the poorer and the less serviced households, while the higher LSMs are the wealthier and more serviced households.

Processing and statistical analysis of the data

For the 24-h recall data, food intake reported in household measures was converted into weight using

the MRC Food Quantities Manual (Langenhoven *et al.* 1991). Coding of the data was done in duplicate and was checked for accuracy. The SAS software package (version 9.1; SAS Institute Inc., Cary, NC, USA) was used to convert food intake to macro- and micronutrients, using the SAFOODS2000 database (<http://safoods.mrc.ac.za>).

Summary variables were calculated for all fruits, all vegetables, and all fruits and vegetables combined for each person. Potatoes were excluded from the summary variables in order to be consistent with international recommendations (WHO 1990). Sweet potatoes are used interchangeably with potatoes in South Africa and were also excluded. The amounts of fibre and micronutrients supplied by each summary variable were calculated and expressed as a percentage of total intake for each nutrient for all the research participants. The analysis was repeated, excluding research participants who did not consume any of the foods covered by the summary variable.

Average portion size for commonly consumed fruits and vegetables was calculated as the total weight in grams of all occurrences of each food reported for the recall period, divided by the number of occurrences. Daily per capita consumption of the summary variables was calculated. The total amount (in grams) consumed over the 2-day recall period was divided by two to obtain the total amount consumed for 1 day, and this was then divided by the total study population.

Data collected by questionnaire were entered into Microsoft Excel data files and analysed using SPSS for Windows, version 15 (SPSS Inc., Chicago, IL, USA). Data are presented as descriptive statistics. The households were also grouped into three groups, namely, LSM ≤ 3 ($n = 90$), LSM 4 ($n = 183$) and LSM ≥ 5 ($n = 125$). Differences across the three LSM categories were determined using chi-squared analysis, and statistical significance was set at $P < 0.05$.

Ethical approval and permission to collect data

This study was part of a larger project 'School gardens to address vitamin A' that was approved by the Ethics Committee of the MRC.

Approval and support for the execution of the overall project were obtained from the school princi-

pals, teachers and school governing bodies of the participating schools before the onset of the study. Mothers were informed verbally and in writing regarding the aim of the study and they were asked to sign a consent form. A community liaison officer assisted with the negotiations with the schools.

Results

Fruits and vegetables available in local shops

Table 1 shows the frequency of availability of fruits and vegetables in the 20 local shops as recorded for the period February to October 2007. Fruits and vegetables that were never available are not shown in the table. Apple and banana, and cabbage, onions and tomatoes were available most often.

Household characteristics

Household characteristics were collected for 398 households. Nearly all the households had access to toilet facilities (73% pit toilet, 18% flush toilet not connected to pipe and 9% flush toilet connected to pipe), tap water (53% own tap, 43% public tap and 3% neighbour's tap) and electricity (97%). The households used mostly electricity (68%) and gas or paraffin (30%) for cooking. Seventy-seven per cent of the households received a child support grant (a social grant paid by the governmental Department of Social Development to the primary caregiver of children who live in poverty). When purchasing fruits and vegetables, this was done mostly from supermarkets in the nearby town (84% of the caregivers).

Quantified information on dietary intake was collected for 394 female caregivers (average age: 41 ± 10 years; 65% had at least 7 years of formal education), 399 learners (54.2% boys and 45.8% girls; average age: 12.7 ± 1.2 years) and 73 children aged between 2 and 5 years.

Dietary intake as determined by the repeated 24-h dietary recall

Foods reported over the repeated 24-h dietary recall period

The 10 most frequently reported food items for the 2-day dietary recall period are listed in Table 2. Oil is

Table 1. Frequency of availability of fruits and vegetables in 20 local shops, expressed as a percentage of observations

	Feb	March	May	June	July	Aug	Sep	Oct
Observations (<i>n</i>)	173	39	213	243	304	171	136	239
Fruit								
Apple	90	77	89	98	95	99	100	97
Avocado	–	–	7	6	13	8	6	8
Banana	83	87	74	64	89	87	94	88
Grapes	15	46	10	5	16	11	10	–
Grapefruit	–	–	–	–	–	2	–	–
Mango	2	5	–	–	–	–	–	–
Naartjie	1	20	19	17	10	37	41	26
Orange	52	13	54	91	99	93	100	97
Peach, white	1	–	–	–	–	–	–	–
Peach, yellow	13	5	–	–	–	–	–	2
Pear	40	74	54	54	44	34	53	46
Pineapple	7	–	4	2	10	13	16	21
Plum	17	18	5	18	5	11	21	8
Vegetable								
Beetroot	–	–	–	–	–	–	6	–
Butternut	21	62	35	34	52	37	57	59
Cabbage	88	92	80	81	82	87	92	95
Carrot	–	8	17	15	27	27	47	–
Gem squash	–	–	–	2	5	–	–	3
Green beans	–	–	–	–	6	–	6	–
Onions	92	100	83	81	94	98	98	100
Pumpkin	–	2	–	–	–	–	–	–
Spinach	–	–	7	–	4	7	–	8
Tomato	91	97	83	90	96	98	100	95

Fruits that were never available were apricot, guava, lemon, litchi, melon, papaya, watermelon and strawberry. Vegetables that were never available were broccoli, brussels sprouts, cauliflower, cucumber, lettuce, mushroom and peas.

not listed in the table as it was used mostly during food preparation and was often not coded separately. It should however be noted that oil was used during food preparation for almost all the households. Seven food items (sugar, porridge made with maize meal, bread, rice, cordial squash, hard margarine, and tea and legumes) were among the 10 most frequently consumed food items for all three groups (2- to 5-year-old children, learners and caregivers). Other food items on the top 10 lists were milk (2- to 5-year-old children and caregivers), potato (2- to 5-year-old children and learners), chicken (learners) and non-dairy creamer (caregivers).

The fruits and vegetables reported for the 2-day dietary recall period are listed in Table 3. A variety of fruits and vegetables was reported for the total group, but many of these fruits and vegetables were consumed by a small proportion of the respondents. The

only fruits and vegetables that were consumed by at least 20% of the respondents over the 2-day recall period were banana (2- to 5-year-old children only), apple, cabbage and mixed vegetables. In addition, *imifino* was consumed by 15% of learners and 17% of caregivers. *Imifino* is a collective term for various dark-green leaves that is eaten as a vegetable; the leaves either grow wild or come from vegetables such as pumpkin, beetroot and sweet potato.

The percentage of respondents who consumed fruits and vegetables over the 2-day recall period and average portion size, as well as the average per capita intake, are given in Table 4. Approximately 90% of the 2- to 5-year-old children, learners and caregivers consumed fruits and/or vegetables over the 2-day period. Approximately 80% of the research participants in the three age categories consumed vegetables over the 2-day period. Sixty-four per cent of

Table 2. Ten most frequently reported food items over the 2-day recall period for the 2- to 5-year-old children, learners and caregivers, as well the portion size consumed

Food item	Ranking	Number of times reported	Respondents		Average portion size (g)
			Number	%	
Children 2–5 years (<i>n</i> = 73)					
Sugar	1	166	70	96	10
Maizemeal porridge*	2	165	65	89	175
Bread [†]	3	147	69	94	65
Rice	4	122	68	93	85
Cordial squash	5	115	52	71	190
Hard margarine	6	80	45	62	10
Tea	7	69	43	59	175
Milk	8	67	38	52	105
Legumes	9	67	48	66	90
Potato	10	44	31	42	70
Learners (<i>n</i> = 399)					
Bread*	1	864	371	93	110
Sugar	2	745	361	90	15
Rice	3	698	358	90	150
Cordial squash	4	619	265	66	255
Maizemeal porridge [†]	5	563	323	81	300
Tea	6	496	300	75	310
Hard margarine	7	470	289	72	20
Legumes	8	397	265	66	177
Potato‡	9	267	166	42	100
Chicken	10	224	190	48	60
Caregivers (<i>n</i> = 394)					
Sugar	1	1055	372	94	15
Maizemeal porridge*	2	811	347	88	345
Bread [†]	3	697	346	88	110
Tea	4	677	323	82	348
Rice	5	629	355	90	178
Hard margarine	6	407	257	65	15
Legumes	7	377	248	63	194
Cordial squash	8	291	176	45	290
Non-dairy creamer	9	246	196	50	4
Milk	10	237	145	37	120

Oil is not listed as it was used during preparation and as such was not always coded separately. *Either as a stiff porridge (phutu) or a soft porridge. [†]Either brown or white bread. [‡]Including potato in stews.

the 2- to 5-year-old children consumed fruit, and this decreased progressively to 48% of learners and 42% of caregivers. The intake of fruit was similar for the three groups, with the range for the average per capita intake of 35–48 g per day. The average per capita intake of vegetables increased from 51 g for 2- to 5-year-old children to 91 g for the caregivers. Dietary intake of fruits and/or vegetables was low and the daily average per capita intake ranged from 99 g for 2- to 5-year-old children, 109 g for grade 6 and 7 learners and 124 g for the caregivers.

Nutrient contribution of fruits and vegetables to total nutrient intake

Total fibre and micronutrient intake are given in Table 5. The contribution of fruits and vegetables to total intake is expressed as a percentage of the total nutrient intake for, firstly, all the research participants within an age-category and, secondly, those research participants who consumed fruits and vegetables during the recall period (consumers). For those respondents who consumed fruit, 9–13% of total fibre

Table 3. Fruits and vegetables reported by the 2- to 5-year-old children, learners and caregivers during the 2-day recall period

	Frequency	Participants		Average portion (g)
		<i>n</i>	%	
2- to 5-year-old children (<i>n</i> = 73)				
Fruits				
Banana	34	27	37	75
Apple	30	25	34	75
5–10% pear, plum and orange				
<5% peach and papaya				
Vegetables				
Mixed vegetables	33	27	37	100
Cabbage	34	26	36	50
11% imifino, pumpkin				
5–10% butternut, spinach and tomato				
<5% amadumbe				
Learners (<i>n</i> = 399)				
Fruits				
Apple	133	114	29	110
Banana	66	64	16	85
5–10% avocado				
<5% grapes, guava, orange, papaya, peach, pear, plum, yellow peach and watermelon				
Vegetables				
Cabbage	205	156	39	75
Mixed vegetables	179	142	36	100
Imifino	71	59	15	130
5–10% pumpkin and tomato				
<5% amadumbe, butternut, carrot, cucumber, green beans, lettuce and spinach				
Caregivers (<i>n</i> = 394)				
Fruits				
Apple	97	88	22	120
Banana	59	57	14	90
<5% avocado, grapes, guava, mango, orange, papaya, peach, pear, plum and yellow peach				
Vegetables				
Cabbage	216	163	41	75
Mixed vegetables	170	135	34	100
Imifino	87	68	17	135
Pumpkin	63	49	12	100
5–10% butternut and tomato				
<5% amadumbe, beetroot, carrot, green beans and lettuce, spinach				

Imifino is a collective term for various dark-green leaves that is eaten as a vegetable; the leaves either grow wild or come from vegetables such as pumpkin, beetroot and sweet potato.

intake and 23–27% of total vitamin C intake were obtained from fruit. For those respondents who consumed vegetables, 13–14% of total fibre intake, 13–21% of total calcium intake, 29–32% of total vitamin A intake and 32–52% of total vitamin C intake were obtained from vegetables.

Table 4. Percentage of participants who consumed fruits and vegetables during the 2-day recall period, as well as fruit and vegetable consumption per capita per day

	2- to 5-year-old children	Learners	Caregivers
	<i>n</i> = 73	<i>n</i> = 399	<i>n</i> = 394
Percentage of participants who consumed:			
Fruits	64	48	42
Vegetables	81	82	86
Fruits and vegetables	92	91	92
Consumption per capita per day (gram)			
Fruits	48	35	33
Vegetable	51	74	91
Fruits and vegetable	99	109	124
Average portion size (gram)			
Fruits	35	100	110
Vegetables	50	90	95

Frequency of vegetable and fruit consumption during the previous month and their main sources

The frequency of consumption of individual fruits and vegetables during the past month by children in the household and the source from where it was obtained from are given in Table 6. Apple and banana were the most frequently consumed fruits and were obtained mostly from the shops and informal markets. Several of the households obtained some of the fruit consumed from their own fruit trees, particularly avocado, guava and papaya. Vegetables consumed most frequently were onion (used as a relish), followed by tomato and carrot. Cabbage was consumed at least three times per week by 63% of children. Vegetables were obtained mostly from shops and informal markets, with the exception of *imifino*, pumpkin and spinach, which were often obtained from either the household's own garden or from other community members.

Locally grown fruits and vegetables

Communal gardens were not common and only 3% of the households obtained food from a communal garden. Fifty-two per cent of the households obtained fruits from their own garden. Fruits most commonly

Table 5. Nutrient intake for 2- to 5-year-old children, learners and caregivers; nutrient contribution of fruits and vegetables for the total group and for consumers only

Nutrient	Total intake Mean (SD)	% contribution by fruits		% contribution by vegetables		% contribution by fruits and vegetables	
		Total group	Consumers only	Total group	Consumers only	Total group	Consumers only
Children 2–5 years							
<i>n</i>	73	73	47	73	59	73	67
Fibre (mg)	14 (4)	8	13	11	13	19	21
Calcium (mg)	276 (149)	1	2	10	13	12	13
Iron (mg)	8.2 (2.6)	3	4	6	7	9	9
Magnesium (mg)	151 (40)	4	6	6	7	9	10
Phosphorous (mg)	493 (139)	2	2	4	5	6	6
Zinc (mg)	6.5 (2.3)	1	2	3	4	4	5
Vitamin A (RE)	378 (212)	1	2	25	30	26	28
Thiamine (mg)	2.1 (2.1)	1	2	3	3	4	4
Riboflavin (mg)	0.82 (0.48)	2	4	3	4	6	6
Niacin (mg)	11.0 (4.0)	2	3	3	3	5	5
Vitamin B6 (mg)	2.2 (0.8)	3	5	2	2	5	6
Folic acid (µg)	243 (86)	2	4	3	3	5	6
Vitamin C (mg)	31 (29)	18	27	26	32	43	47
Learners							
<i>n</i>	399	399	190	399	328	399	362
Fibre (mg)	20 (6)	4	9	11	13	15	16
Calcium (mg)	246 (134)	<1	2	15	19	16	18
Iron (mg)	12.8 (3.6)	1	2	7	8	8	8
Magnesium (mg)	220 (60)	1	3	6	7	7	8
Phosphorous (mg)	653 (184)	<1	1	4	5	5	6
Zinc (mg)	10.0 (3.3)	<1	1	3	4	4	4
Vitamin A (RE)	511 (317)	<1	1	24	29	25	27
Thiamine (mg)	2.0 (1.9)	<1	1	2	3	3	3
Riboflavin (mg)	0.84 (0.44)	2	4	3	4	5	6
Niacin (mg)	16.8 (5.9)	1	2	3	3	4	4
Vitamin B6 (mg)	3.5 (1.3)	1	2	2	2	3	3
Folic acid (µg)	367 (126)	<1	2	3	3	4	4
Vitamin C (mg)	36 (33)	11	23	33	40	44	49
Caregivers							
<i>n</i>	394	394	167	394	342	394	361
Fibre (mg)	21 (7)	4	9	12	14	16	17
Calcium (mg)	265 (168)	<1	2	18	21	19	21
Iron (mg)	13.0 (3.9)	1	2	8	9	9	10
Magnesium (mg)	235 (64)	1	3	7	8	9	9
Phosphorous (mg)	684 (194)	<1	2	5	6	6	6
Zinc (mg)	10.1 (3.3)	<1	1	4	4	4	5
Vitamin A (RE)	532 (296)	<1	1	30	32	29	31
Thiamine (mg)	1.9 (1.7)	<1	2	3	3	4	4
Riboflavin (mg)	0.73 (0.31)	2	4	4	5	6	7
Niacin (mg)	15.2 (5.7)	1	2	4	5	5	5
Vitamin B6 (mg)	3.0 (1.3)	1	3	3	3	4	4
Folic acid (µg)	401 (146)	<1	2	3	4	4	5
Vitamin C (mg)	33 (36)	12	27	45	52	56	62

RE, retinol equivalents; SD, standard deviation.

Table 6. The frequency of fruit and vegetable consumption during the past month for children in the household and main source where the households obtained the fruits and vegetables from the previous month

	Frequency of consumption* (n = 398)				Main source – for consumers only [†]				
	≥4 times per week	One to three times per week	< once a week	Never	n [‡]	Shops	Informal market	Own garden	Friends, family and neighbours
Fruit									
Apple	4	68	20	8	368	60	40	–	–
Avocado	1	24	10	65	140	8	11	50	31
Banana	7	59	25	9	363	49	35	14	1
Grape	1	20	23	56	175	56	43	1	1
Guava	2	11	7	80	81	12	2	51	35
Mango	–	32	19	48	206	38	30	15	18
Orange	2	24	13	62	152	56	42	2	–
Papaya	8	23	13	56	174	9	8	50	33
Peach	5	26	13	56	174	40	49	10	1
Pear	7	39	26	28	288	62	37	–	1
Plum	–	25	20	55	180	58	42	–	–
Vegetable									
Beetroot	3	26	5	66	136	39	58	1	1
Butternut	3	50	19	27	289	33	63	4	1
Cabbage	5	63	24	7	371	52	47	1	–
Carrot	31	51	6	11	356	39	58	2	–
Cucumber	4	16	3	77	91	34	65	–	1
Green bean	–	–	–	–	281	48	49	2	1
Imifino	3	35	28	33	264	10	14	40 [§]	35
Lettuce	3	22	3	72	113	34	66	1	–
Onion	96	2	1	1	394	50	48	3	–
Pumpkin	3	32	17	48	209	11	19	42	27
Spinach	1	23	33	44	224	27	50	15	7
Tomato	40	39	15	6	375	64	31	4	–

*All values are given as a percentage. The options 'everyday' and 'most times' were combined and are given as 'four or more times per week'. Fruits consumed never by >80% of households were apricot, lemon, litchi, melon, naartjie, pineapple and watermelon. Vegetables consumed never by >80% of households were cauliflower, broccoli, gem squash and mushrooms. †All values are given as a percentage; expressed as a percentage of those households that consumed the fruit or vegetable the previous month. Vegetables obtained from a communal garden were beetroot (2%), carrot (1%), pumpkin (1%) and tomato (1%). ‡Number of households who consumed the fruit or vegetable the previous month. §When obtained from own garden, it was growing wild in the household's yard.

Table 7. Constraints that households experienced when growing vegetables, for those households who grow vegetables at home ($n = 100$)

Problems with gardens	%	Vegetables planted	%
Animals destroying the garden	59	Pumpkin	81
Plant diseases	49	Chilli	48
Insects	48	Spinach	40
Lack of fencing	43	Legumes	25
Lack of knowledge	35	Onions	20
Lack of money to buy supplies	29	Carrots	15
Lack of seeds	27	Butternut	11
Lack of pesticides	19	Cabbage	11
Lack of garden tools	13	Beetroot	7
Lack of fertilisers	13		
Shortage of water	10	<i>Confidence on growing vegetables</i>	
Lack of irrigation equipment	9	Confident	21
Lack of time	3	Needs a bit of advice	34
Nobody to help in the garden	1	Needs a lot of advice	45
No problems	18		

Households with a vegetables garden, $n = 100$ (25% of total sample). Values are expressed as a percentage of the number of households who grow vegetables at home.

obtained from their gardens were (expressed as a percentage of those who obtained fruit from their garden) avocado (66%), banana (61%), papaya (56%), mango (35%), guava (29%), peach (29%) and lemons (23%).

Twenty-five per cent of the households reportedly had a vegetable garden. The main function of the garden was to produce vegetables for home consumption – only 9% of those households with a vegetable garden sold some of their produce. Table 7 shows the major constraints experienced with the vegetable gardens as well as the vegetables that were usually planted. Animals destroying the crops were seen as the major constraint (59%), and this can be linked to a lack of fencing. The households further experienced problems with plant diseases (49%) and insect pests (48%); 12% of households with vegetable gardens used pesticides. Thirty-five per cent of those households growing vegetables thought that they lacked sufficient knowledge in terms of gardening practices. Lack of money (29%) and lack of seeds (27%) and other supplies/equipment were further mentioned as constraints.

Pumpkin was the most popular planted vegetable (80% of those households with vegetable gardens), followed by chilli (eaten as a relish) and spinach. Forty-five per cent of households with gardens felt

that they needed a lot of advice in terms of growing vegetables. For those households with vegetable gardens, one-third did not obtain any advice on growing vegetables, while 32% obtained information on growing vegetables from magazines.

Fruit and vegetable consumption according to the LSM

Table 8 shows the usual frequency for household consumption of fruits and vegetables and the constraints prohibiting daily intake thereof. The data in Table 8 are given for both the total group and per LSM category. Twenty-six per cent of all households reportedly consumed fruits everyday, and 56% consumed vegetables everyday. For those households not consuming fruits ($n = 297$) and vegetables ($n = 178$) daily, cost was cited as the major constraint prohibiting a daily consumption, 78% and 75%, respectively. Frequency of consumption for fruits and vegetables differed across the three LSM categories ($P = 0.002$), with daily consumption of both fruits and vegetables increasing over the LSM categories. Cost was less of a constraint for daily fruit consumption in the higher LSM group. It should be noted that in Table 8, the values for the constraints prohibiting daily consumption are expressed as a percentage of those

Table 8. Frequency of usual household consumption of fruits and vegetables, and the major constraints for not eating fruits and vegetables everyday per LSM category

	Fruits				Vegetables				
	Total group		LSM category		Total group		LSM category		
	(n = 398)		LSM 1-3 (n = 90)	LSM 4 (n = 183)	LSM ≥ 5 (n = 125)	(n = 398)	LSM 1-3 (n = 90)	LSM 4 (n = 183)	LSM ≥ 5 (n = 125)
Frequency of consumption									
Daily	26	11	25	35	56	44	54	68	
4-6 days per week	18	17	18	19	13	12	15	12	
1-3 days per week	20	24	18	21	15	16	16	11	
<1 day per week	27	34	30	17	12	18	12	7	
Never	10	14	9	8	4	10	3	2	
Biggest constraint for not eating it daily (%)*	(n = 297)	(n = 81)	(n = 134)	(n = 81)	(n = 178)	(n = 49)	(n = 88)	(n = 41)	
Cost	78	82	81	69	75	76	76	71	
Seasonality	13	10	10	20	10	6	12	10	
Health reasons†	3	5	2	5	3	6	1	5	
Personal preference	3	1	4	3	7	6	6	12	
Availability	2	2	2	1	4	6	3	2	
Unsure	1	-	1	2	1	-	2	-	

Frequency of fruit consumption: $P = 0.002$ (chi squared). Frequency of vegetable consumption: $P = 0.002$ (chi squared). *Expressed as a percentage of those who do not eat it daily. †For example flatulence, arthritis and allergies. LSM, Living Standard Measure.

households who did not eat fruits or vegetables daily. When expressed as a percentage of all households in each LSM category (irrespective of frequency of consumption), cost as a constraint for daily consumption decreased from 73% (LSM 1–3) to 45% (LSM \geq 5) for fruits and from 42% (LSM 1–3) to 23% (LSM \geq 5) for vegetables.

Caregiver and household characteristics according to the LSM

Table 9 shows caregiver and household characteristics according to the three LSM categories. The higher LSM (\geq 5) category had the highest percentage of married caregivers and caregivers who completed grade 12. Calculation of the LSM is based on, among other, services and the higher access to flush toilets and tap water on their plot in the LSM \geq 5 category was therefore expected. Most households had electricity available in their homes, yet the source of energy used for cooking differed across the LSM groups. Nearly half of the households in the LSM \leq 3 category usually used either gas or paraffin for cooking. Ownership of assets used for food preparation (electric stove and microwave) and storage (fridge and deep freezer) increased over the LSM categories. The radio and clinic were the main sources for information on healthy eating for all households; in addition, households in the LSM \geq 5 category also obtained information on healthy eating from community health workers and printed material (newspaper and magazine). Although not statistically significant, the higher LSM category tended to have the highest percentage of households that obtained fruits from their own garden (49% in the LSM \leq 3 category, 47% in the LSM 4 category and 60% in the LSM \geq 5 category). The number of households with vegetable gardens did not differ between the LSM categories.

Discussion

Dietary intake of fruits and vegetables was low for caregivers compared with the average per capita intake of approximately 200 g previously reported for South Africans (Rose *et al.* 2002) and considerably

less than the WHO recommendation of 400 g per day (WHO 1990). The per capita intake for the children was similar to the reported value of 110 g for 1- to 9-year-old South African children as determined by a single 24-h dietary recall (Naude 2007). A repeated 24-h dietary recall was used to determine average per capita intake. The limitations of the 24-h dietary recall are that it relies on the memory of the respondent; it may be difficult for the respondent to accurately estimate the portion size consumed; it is not representative of the usual diet; and it does not account for seasonal availability of fruits and vegetables.

When consumed, both fruits and vegetables did however contribute towards dietary intake of nutrients, especially fibre and vitamin C, while vegetables also contributed towards dietary intake of calcium and vitamin A. The importance of vegetables, particularly those rich in β -carotene towards dietary vitamin A intake, was reflected by data from the South African National Food Consumption survey, which showed that carrots and green leafy vegetables, respectively, were the second and third biggest contributors towards dietary vitamin A intake for 1- to 9-year-old children (Steyn *et al.* 2006). The contribution of vegetables towards dietary calcium intake can probably be ascribed to the consumption of green leafy vegetables (mostly *imifino*). A previous study in a rural village in KwaZulu-Natal showed that dark-green leafy vegetables contributed 21–39% of total dietary calcium intake for 2- to 5-year-old children over a series of seasons (Faber *et al.* 2007). Data of the National Food Consumption Survey showed that green leafy vegetables were the third biggest contributor to total dietary calcium intake for 1- to 9-year-old children (Steyn *et al.* 2006). The estimated nutrient contribution of fruits and vegetables towards total dietary intake may vary depending on the seasonal availability of fruits and vegetables.

The recommended daily intake of 400 g fruits and vegetables per day translates to five portions of 80 g each (WHO 1990). The average portion size for fruits and vegetables consumed by the learners and caregivers therefore seems to be adequate. To achieve a higher fruits and vegetables intake, a more frequent consumption of a bigger variety of fruits and vegetables should be promoted. This could be achieved

Table 9. Caregivers and household characteristics according to the Living Standard Measure (LSM)

	According to LSM			P-value
	LSM 1–3 (n = 90)	LSM 4 (n = 183)	LSM ≥ 5 (n = 125)	
Caregiver's marital status				0.049
Married	21	22	41	
Living together	11	18	9	
Single	59	51	44	
Divorced	1	2	2	
Widowed	7	7	4	
Caregivers who completed grade 12	14	12	24	0.009
Toilet facilities				0.009
Flush toilet	13	20	38	
Pit toilet	86	79	62	
None	1	1	0	
Source of drinking water				0.0001
Own tap (inside dwelling)	6	7	15	
Own tap (outside dwelling)	27	37	62	
Public tap	59	52	20	
Neighbour's tap	7	4	2	
River	1	–	1	
Electricity in dwelling	90	98	100	ns
Main energy source for cooking				0.0001
Electricity	47	77	85	
Gas/paraffin	47	22	14	
Wood	5	1	1	
Other	1	–	–	
Assets for food preparation and storage				
Fridge	67	86	96	0.0001
Deep freezer	6	12	40	0.0001
Electric stove	66	90	99	0.0001
Microwave	3	22	61	0.0001
Source for information on healthy eating				
Radio	76	77	74	ns
Clinic	74	82	80	ns
Community health workers	7	13	25	0.004
School	7	7	14	ns
Newspaper	4	5	14	0.022
Magazine	10	8	20	0.029
Family	7	3	3	ns
Friends	1	2	6	ns
Fruit trees at home	49	47	60	ns
Food from a community garden	2	3	4	ns
Collect food from the wild	77	86	78	ns
Vegetable garden at home	26	26	24	ns
Main function of home garden	(n = 23)	(n = 47)	(n = 30)	
For home consumption	100	94	97	ns
Sell some of the vegetables	4	8	13	ns

Values are expressed as a percentage. ns, not significant.

through, for example local production in home gardens, provided that the households receive support to overcome the constraints prohibiting successful home gardens.

Fencing a vegetable garden can be expensive and is often not within the financial reach of the poor. Initiatives are therefore needed to assist the poor in obtaining and maintaining well-fenced vegetable

gardens. The households also experienced problems with plant diseases and insect pests. Providing the households with information on integrated pest management, which is the sustainable control of plant diseases and insect pests, will enable them to combine alternative methods of control in a way that minimises the use of chemical pesticides [World Education (INGO) 2005, Philippines Inc; Department of Basic Education 2011]. Interestingly, unlike in other reports water for irrigation of the crops was not seen as a major problem. It should be noted that the study area is in a subtropical zone receiving 800–1000 mm of rain, which should be enough to sustain vegetable production most of the year. The exception will be the dry period from May to August when supplementary irrigation, e.g. from municipal water will be required. The finding that 45% of households with gardens felt that they needed a lot of advice in terms of growing vegetables highlights the need for good agricultural extension services in the area. Whereas vegetable gardens need active support and work, fruit trees are generally more self maintaining. Subtropical fruits such as banana, papaya and avocado can be grown in this area and should be able to supply fruit. Slightly less than half of the households consumed avocado and papaya during the month prior to the survey, and for 50% of these households the fruits were obtained from their own fruit trees.

A recent study showed that vitamin A rich fruit and vegetables, together with eggs and legumes, were the least consumed foods by South African adults (Labadarios *et al.* 2011). With the high prevalence of vitamin A deficiency in South Africa (Labadarios 2007), targeted home gardens have been recommended (Faber *et al.* 2002a). It is therefore encouraging that in households with home gardens more than half planted pumpkin and spinach, and about a quarter had butternut and carrot. We were previously able to show an improvement in the consumption of β -carotene-rich vegetables and fruit through an intervention that promoted planting of β -carotene-rich vegetables and fruit in home gardens; these fruits and vegetables contributed more than 85% of total vitamin A intake of 2- to 5-year-old children's diets (Faber *et al.* 2002b). Four years after the formal intervention, it has been

reported that β -carotene-rich vegetables and fruit contributed between 49% and 74% of total dietary vitamin A intake over a number of seasons (Faber & Laubscher 2008).

Cost was the major constraint prohibiting daily consumption of fruits and vegetables, which is in line with previously reported findings (Love *et al.* 2001; Bourne *et al.* 2007). Cost was less of a constraint for daily consumption of fruit in the higher LSM group, and the frequency of usual consumption for both fruits and vegetables increased over the LSM groups. Data from the 24-h dietary recalls did not show a difference in fruit and vegetable consumption over the LSM groups (data not shown). Owning a fridge also increased over the LSM groups; storage of perishable fruits and vegetables should thus be less of a constraint in the higher LSM category. Compared with the LSM ≤ 3 and LSM 4 categories, caregivers in the LSM ≥ 5 group were more likely to be married, have completed grade 12 and use printed material as source for information on healthy eating. Although not statistically significant, more households in the LSM ≥ 5 group had fruit trees, were confident about vegetable gardening and sold some of their produce grown in their home garden.

Previous studies have shown lower dietary diversity in the lower LSM groups in South Africa (Faber *et al.* 2009; Labadarios *et al.* 2011), reflecting poor people's ability to access a large variety of foods. With cost being the major constraint prohibiting daily consumption of fruits and vegetables, the government and business sector need to put strategies in place enabling poor households in peri-urban communities to comply with the Food-Based Dietary Guideline 'eat plenty of vegetables and fruits everyday' through access to a variety of affordable fruits and vegetables.

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Conflicts of interest

The authors declare that they have no conflicts of interest.

Contributions

Study design, data collection, data analysis, interpretation of results and the drafting of the paper was done by MF. 24-h recall dietary nutrient analysis was done by RL and SL. Agricultural questions and interpretation and editing of the paper was also done by SL. All authors read and approved the final version of the paper.

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