Nutritional status and food intake data on children and adolescents in residential care facilities in Durban

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Abstract

Objective: The aim of this study was to examine growth indicators and dietary intake patterns of children aged 4-18 years residing in residential care facilities in Durban.

Method: Thirty-three girls and 110 boys, aged 5-18 years, in three different children's homes participated in the study. Anthropometric measurements included weight and height and were analysed using the World Health Organization's AnthroPlus® version 1.0.2 statistical software. The seven-day-cycle menus were analysed for nutrient and energy intake using the FoodFinder® version 3 software programme. Daily nutrient intakes were reported as means and standard deviations, and comparisons were made with the dietary reference intakes for specific age groups. Average served portion sizes were established by plate waste studies and observation.

Results: The results showed that stunting and overweight were prevalent in this group. 4.7% of the boys aged 4-8 years and 3.3% of the boys aged 14-18 years were severely stunted. 13.3% of the girls aged 9-13 years and 20% of the girls aged 14-18 years were stunted. The body mass index for age reported that a small number (6.7% of the girls aged 9-13 years and 3.3% of the boys aged 14-18 years) were wasted. The results also showed that 33.3% of the girls aged 4-8 years and 33.4% of the girls aged 9-13 years were at risk of being overweight. 26.7% of the girls aged 14-18 years were overweight (> + 2 standard deviations). Most of the children in the 4-8 age group (83.3% of the boys and 100% of the girls) fell in the normal range for weight for age, while only one boy was underweight. One hundred per cent or more of the dietary reference intakes for energy, protein, carbohydrate and most of the micronutrients were met, except for calcium and iodine. A low intake of vitamin C among older boys and girls was reported. None of the groups met the recommended fibre intake.

Conclusion: The results indicated a need for the development and implementation of a comprehensive nutrition education programme for both child care workers and children.

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Introduction

In 2009, a total 18.6 million children under the age of 18 years lived in South Africa. This constitutes 38% of the total South African population, with an average of one million children per age category up to the age of 18. KwaZulu-Natal is home to 23% of the total number of children in South Africa.[1]

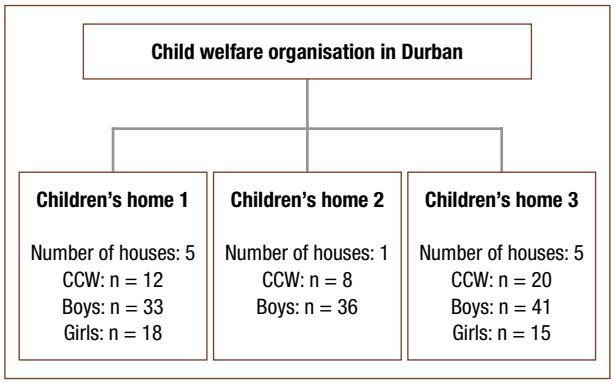
In 2010, the Department of Social Development indicated that 1.5 million children in South Africa were orphans or vulnerable children.[2] An orphan was classified as a child who had lost a mother, father or both biological parents. In KwaZulu-Natal, 6.3% of children had lost both parents, 4.3% the mother, and 16.1% the father.[3] Meintjies et al[4] refer to "children's homes" as the common name for residential care facilities. The term "residential care" can be used interchangeably with the term "children's homes". Because of a paucity of information and a lack of data in South Africa, it is still not known how many children are currently being cared for in residential care facilities or institutions. The few studies that have been conducted on residential care facilities did not state the number of children housed in these facilities.[4] No data were found that indicated the nutritional status and food consumption patterns of children in residential care.

The Children's Act of 2007[5] emphasised that these residential facilities should provide therapeutic programmes that are appropriate to the children's developmental and other needs. The legislation clearly indicates that residential care should be considered as a last resort for children's care, and also as an intervention that addresses more than the children's basic physical needs. The majority of these centres in South Africa are run by welfare organisations. Countrywide, only a handful are managed entirely by the government.[4]

The National Food Consumption Survey (NFCS) conducted in South Africa in 2005 indicated that 10% of children aged 1-9 years were classified as overweight and 4% as obese. In contrast, stunting affected 18% of children while 4.5% of children were wasted in this age category.[6] In a study by Steyn and Nel[7] in 2006 to assess the food and nutrient intake and weight status of young adult women in South Africa, Kenya and Nigeria, the mean daily energy intake of young women aged 15-29 in South Africa was 7 764 kJ, compared to the recommended intake of 9 946 kJ. This study also indicated that this group consumed 258.3 g carbohydrates compared to the dietary reference intakes (DRIs) of 100 g per day, 63.4 g protein compared to 46 g per day[8] and 53.3 g fat per day. The mean body mass index (BMI) in this group was 23.7, indicating normal weight in most of the group. However, it was reported that 20% were overweight (25-29 BMI) and 9.6% were obese (≥ 30 BMI).[7]

Adjustments in the social environment, developing independence, eating away from home, peer pressure, easy accessibility of energy-dense, nutrient-depleted snacks, as well as a concern with physical appearance, are contributing factors to the poor eating habits of children and youth. It is a common practice in this age group to skip meals and eat at irregular times.[9] Bowman[10] reported that energy-dense snack foods were very often eaten instead of fruit, vegetables, milk and other nutrient-dense foods. A study in the North West province in South Africa on 10-15-year-old school children investigated weight status and determinants of overweight and obesity. It showed that overall, the children had low intakes of fruit, vegetables and milk.[11] The diet was also associated with low intakes of iron, calcium and vitamins A and C. The NFCS indicated an overall low dietary diversity. The highest consumption frequency pertained to the cereal, roots and tuber group (99.6%) and the sugar, jam and sweets group (88%). Vegetable consumption was low, specifically vitamin A-rich vegetables, which were consumed by only 24%, while other vegetables and fruit were consumed by 32% and 22% of the children only, respectively.[12]

Countrywide, anthropometrical and dietary intake data of children in residential care facilities are limited. Therefore, this study was designed to establish whether children living in the residential facilities were reflected in the national profile and included 33 girls and 110 boys aged 5-18 years (Figure 1).



CCW: Child care workers

Figure 1: The study population that was included in the research project

Subjects and methods

Ethics

The tertiary institution's Faculty Research Committee approved the study as part of a Master's degree research project, which included ethical clearance. The proposal was submitted in accordance with the Medical Research Council's guidelines for research on human beings, as well as the Helsinki Agreement Guidelines.

Study population and sampling

The management of the residential services of a child welfare organisation in Durban approached the researchers to analyse the nutrient adequacy of the planned menus and the nutritional status of the children. Written permission was obtained for the study to be conducted. All of the children assented to being weighed and measured. A convenience sample of the children residing in the children's homes participated in this study, and thus none of the children were excluded. The facilities are located on two different premises. Each children's home comprised several houses, in which up to 15 resided. These houses are equipped with a dining room and a kitchen. Child care workers are assigned to the houses and work shifts to ensure that one is on duty at all times. The child care workers live in the houses with the children when on duty, supervising homework and social activities. They are also responsible for cooking and serving the meals as indicated on the cycle menu (Figure 1).

Data collection and analysis

Data enumerators

Six trained third-year and postgraduate Consumer Science Food and Nutrition students from the academic institution assisted in the completion of plate waste studies and the taking of anthropometric measurements. The researchers conducted the menu analysis.

Anthropometric indices

Anthropometric measurements included body weight and height, measured according to standard procedures.[13] Body weight, in light clothing with no shoes, was determined to the nearest 0.1 kg on a calibrated portable physician's scale. Height was measured to the nearest 0.5 cm with a Scales® 2000 portable stadiometer. All measurements were taken twice. The average of the two measurements was recorded.

Dietary analysis of menus

The seven-day-cycle menus were analysed for nutrient and energy intake. The average portion sizes were established by plate waste studies, as well as observation of practices as no standard existed for the portion sizes served in the children's homes. All the children consumed the same food that was planned on the cycle menus. Any food that was consumed other than the food supplied by the children's homes was not included for analysis.

Plate waste study

The purpose of the plate waste study that was conducted in these facilities was to measure all the food that was left over on the plates

and returned to the kitchen. The sample size for the plate waste study was calculated using a power calculation[14] and 100 plates were used for this measurement. Breakfasts and lunches that were served daily were very similar, whereas dinner consisted of a variety of cooked meals. A typical breakfast included porridge, milk and sugar. Lunch was always bread with a spread. Dinner consisted of a starch portion, a protein portion and a vegetable portion. Therefore, three plate waste studies were conducted for dinner, and only one lunch and one breakfast were observed. Measurements of plate waste were conducted on all the served menu items during the meal periods. A calibrated electronic food scale (Micro® CW weighing scale) was used to weigh each plate.

Statistical analyses

All the results were reported separately for girls and boys, because of different dietary requirements according to the DRIs and for the anthropometric results.

Anthropometric data for the children were analysed using the World Health Organizations' (WHO) AnthroPlus® version 1.0.2 statistical software.[15] Stunting was defined as a height-for-age z score < - 2 standard deviations (SD) (severe stunting, < 3 SD), thinness as a BMI-for-age z score < - 2 SD (severe thinness, < - 3 SD) and overweight as > + 1 SD (obesity, > + 2 SD).[16]

Dietary intake data were analysed by a nutrition expert using the FoodFinder® version 3 software programme, based on the South African food composition tables[17] developed by the Medical Research Council. The data were exported to Excel®, where mean daily nutrient intake and standard deviations were calculated. Frequencies were used to determine the percentage of subjects with nutrient intakes below 100% of the DRIs.[8] Specifically, the estimated energy requirements were used to calculate energy needs and estimated average requirement values for macronutrients and micronutrients. The adequate intake values were used when estimated average requirements were not available. Independent t-tests were used to determine the significance between the actual intake and the nutritional values of the menus and were used to compare the DRIs for different age groups.

Results

Table I indicates that 4.7% of the boys aged 4-8 years and 3.3% of the boys aged 14-18 years were severely stunted. 13.3% of the girls aged 9-13 years and 20% of the girls aged 14-18 years were stunted. The majority of the respondents were in the normal range for height for age, namely 93% of the boys aged 9-13, 86.7% of the girls aged 9-13, 86.9% of the boys aged 14-18 and 90% of the girls aged 14-18.

The BMI for age, indicating wasting, thinness, overweight and obesity, reported that a small number of children (6.7% of the girls aged 9-13 years and 3.3% of the boys aged 14-18 years) were wasted. The results also showed that 33.3% of the girls aged 4-8 years and 33.4% of the girls aged 9-13 years were at risk of being overweight. 26.7% of the girls aged 14-18 years were overweight (> + 2 SD). Weight for age, indicating underweight (< - 2 SD) and severe underweight (< - 3 SD), was calculated for the boys and girls aged 4-8 years. Most of the children in this age group (83.3% of the boys and 100% of the girls) fell in the normal range, while only one boy was underweight.

The plate waste study and observed mealtimes indicated that the average portion sizes consumed by the children were not in

Table I: Stunting and wasting indicators for children 5-18 years of age

Z-score	Classification	Boys (n = 6) 4-8 years % (n)	Girls (n = 3) 4-8 years % (n)	Boys (n = 43) 9-13 years % (n)	Girls (n = 15) 9-13 years % (n)	Boys (n = 61) 14-18 years % (n)	Girls (n = 15) 14-18 years % (n)
Stunting (height for age)							
< - 3 SD	Severely stunted	0	0	4.7 (2)	0	3.3 (2)	0
< - 2 SD	Stunted	16.7 (1)	0	2.3 (1)	13.3 (2)	9.8 (6)	20 (3)
> - 1 SD to + 3 SD	Normal	83.3 (5)	100	93 (40)	86.7 (13)	86.9 (53)	80 (12)
Wasting and thinness (BMI for age)							
< - 3 SD	Severely wasted	0	0	0	0	0	0
< - 2 SD	Wasted	0	0	0	6.7 (1)	3.3 (2)	0
> - 1 SD to < + 1 SD	Normal	66.6 (4)	66.7 (2)	81.4 (35)	46.6 (7)	85.2 (52)	60 (9)
> + 1 SD	Possible risk of overweight	16.7 (1)	33.3 (1)	16.3 (7)	33.4 (5)	11.5 (7)	13.3 (2)
> + 2 SD	Overweight	16.7 (1)	0	2.3 (1)	6.6 (1)	0	26.7 (4)
> + 3 SD	Obese	0	0	0	6.7 (1)	0	0
Underweight (weight for age)							
< - 3 SD	Severely underweight	0	0	-	-	-	-
< - 2 SD	Underweight	16.7 (1)	0	-	-	-	-
> - 1 SD to + 3 SD	Normal	83.3 (5)	100 (3)				

SD: standard deviation

accordance with the recommended serving sizes as indicated in the Department of Health ration scales.[18] The fieldworkers also noted that most children consumed all the food on their plates. The average portion size for samp and beans and stiff pap was established at 305 g and 300 g respectively, and an average portion size of 300 g was used in the analysis. The average vegetable portion was 38.7 g (butternut) and 41.5 g (coleslaw). Forty grams was used for the analysis. The average portion sizes used for rice and protein were 250 g and 135 g respectively. The recommended portion size for starch is half a cup[19] or 70 g,[18] and > 400 g per day for vegetables.[20]

The average portion sizes for other consumed food items as established by the plate waste study reflected that on a daily basis, consumed bread averaged 264 g. A high intake of sugar (60 g) per day was observed. Consumed jam (30 g) was additional to sugar. These portion sizes were similar among the various age groups and genders. The same amount and type of ingredients were issued to each house, irrespective of the age or gender of the children residing there.

The mean macronutrient analysis of the seven-day-cycle menu for the girls is reflected in Table II. It was assumed that if all the girls consumed all the food on their plates at every meal, they would meet 100% of the DRI for energy, carbohydrates and protein. The carbohydrate intake for all the groups was more than three times the recommended intake of 100 g per day. The protein intake of the 4-8-year-old girls was 346.34% of the recommended intake of 19 g per day, and the 9- to 13- and 14- to 18-year-old girls consumed 193.53% and 143.04% of the recommended intake of 34 g and 46 g, respectively. However, none of the groups met the recommended fibre intake of 25 g and 26 g for the age groups 4-8 and 9-18 respectively. The macronutrient intake was statistically significantly higher than the DRIs for the girls aged 4-13 with p-value < 0.05, except for the fibre intake that was statistically significantly lower than the DRIs. The girls aged 14-18 had a statistically significantly higher intake of all the macronutrients, except for energy intake and fibre, which was lower than the required DRIs.

In Table III, the mean macronutrient analysis of the seven-day-cycle menu for the boys is reflected. Again, if it was assumed that all the boys would consume all of the food on their plates at every meal, boys of 4-13 years of age would meet the DRI requirements for energy. However, the 14-18-year-old group would only have consumed 78.37% of its daily needs. The carbohydrate intake, similar to that of the girls, also reflected three times (334.70%) the daily requirements of 100 g. The protein intake for the boys would be sufficient for the daily needs of these age groups. The fibre intake in all three groups did not meet the minimum requirements of 25 g, 31 g and 38 g respectively, as only 19.67 g was provided by the seven-day-cycle menu. The energy, carbohydrate and protein intakes of the 4- to 13-year-old boys were statistically significantly higher than the DRIs. The fibre intake of all the groups was statistically significantly lower than the recommended intake.

Table II: Energy and macronutrient analysis of the seven-day-cycle menu for girls (5-18 years)

Nutrients	Mean intake ± SD	Girls: 4-8 years		Girls: 9-13 years		Girls: 14-18 years	
		% DRIs	DRIs p-value	% DRIs	DRIs p-value	% DRIs	DRIs p-value
Energy kilojoules (kJ)	10 374.66 ± 2 005.05	150.44	6 896.00* 0.001	119.28	8 698.00 0.047	104.31	9 946.00 0.582
Total carbohydrate g/day (EAR)	334.70 ± 77.24	334.70	100.00 0.000	334.70	100.00 0.000	334.70	100.00 0.000
Total protein g/day (RDA)	65.80 ± 12.88	346.34	19.00 0.000	193.53	34.00 0.000	143.04	46.00 0.002
Dietary fibre g/day (AI)	19.67 ± 2.99	78.69	25.00 0.000	75.65	26.00 0.000	75.65	26.00 0.001

*: Energy requirement for girls 3-8 years old
p-value < 0.05 = significance
AI: adequate intake, DRIs: dietary references intakes, EAR: estimated average requirements, RDA: recommended daily allowance, SD: standard deviation

Table III: Energy and macronutrient analysis of the seven-day-cycle menu for boys (5-18 years)

Nutrients	Mean intake ± SD	Boys: 4-8 years		Boys: 9-13 years		Boys: 14-18 years	
		% DRIs	DRIs p-value	% DRIs	DRIs p-value	% DRIs	DRIs p-value
Energy kilojoules (kJ)	10 374.66 ± 2005.05	141.81	7 316.00* 0.002	108.39	9 572.00 0.310	78.37	13 238.00 0.003
Total carbohydrate g/day (EAR)	334.70 ± 77.24	334.70	100.00 0.000	334.70	100.00 0.000	334.70	100.00 0.000
Total protein g/day (RDA)	65.80 ± 12.88	346.34	19.00 0.000	193.53	34.00 0.000	126.54	52.00 0.015
Dietary fibre g/day (AI)	19.67 ± 2.99	78.69	25.00	63.45	31.00	51.76	38.00

*: Energy requirement for boys 3-8 years old
p-value < 0.05 = significance
AI: adequate intake, DRIs: dietary references intakes, EAR: estimated average requirements, RDA: recommended daily allowance, SD: standard deviation

Table IV: Micronutrient analysis of the seven-day-cycle menu for girls (5-18 years)

Nutrients	Mean intake ± SD	Girls: 4-8 years		Girls: 9-13 years		Girls: 14-18 years	
		% DRIs	DRIs p-value	% DRIs	DRIs p-value	% DRIs	DRIs p-value
Calcium: mg/day (AI)	668.57 ± 173.08	83.57	800.00 0.068	51.43	1 300.00 0.000	51.43	1 300.00 0.000
Iron: mg/day (EAR)	9.19 ± 1.87	224.04	4.10 0.000	161.23	5.70 0.000	116.33	7.90 0.093
Zinc: mg/day (EAR)	9.17 ± 2.94	229.21	4.00 0.001	131.00	7.00 0.075	122.27	7.50 0.160
Magnesium: mg/day (EAR)	294 ± 78.34	267.48	110.00 0.000	147.12	200.00 0.008	98.98	300.00 0.849
Phosphorus: mg/day (EAR)	1 048 ± 212.73	258.89	405.00 0.000	99.38	1 055.00 0.937	99.38	1 055.00 0.937
Selenium: µg/day (EAR)	111.42 ± 26.55	484.45	23.00 0.000	318.35	35.00 0.000	247.61	45.00 0.000
Iodine: µg/day (EAR)	53.96 ± 25.30	83.02	65.00 0.271	73.92	73.00 0.070	56.80	95.00 0.001
Vitamin A: µg/day (EAR)	581.24 ± 142.83	211.36	275.00 0.000	138.39	420.00 0.011	119.84	485.00 0.100
Vitamin B_{12}: µg/day (EAR)	3.07 ± 3.05	306.71	1.00 0.098	204.67	1.50 0.199	153.50	2.00 0.373
Vitamin C: mg/day (EAR)	32.35 ± 40.95	147.03	22.00 0.516	82.95	39.00 0.675	57.77	56.00 0.152
Thiamin: mg/day (EAR)	1.03 ± 0.24	206.00	0.50 0.000	147.14	0.70 0.003	114.44	0.90 0.178
Riboflavin: mg/day (EAR)	0.97 ± 0.25	194.29	0.50 0.000	121.43	0.80 0.091	107.94	0.90 0.458
Niacin: mg/day (EAR)	11.38 ± 3.95	189.71	6.00 0.004	126.48	9.00 0.137	103.48	11.00 0.802
Vitamin B_6: mg/day (EAR)	0.82 ± 0.23	164.86	0.50 0.003	103.04	0.80 0.786	82.43	1.00 0.068
Folate: µg/day (EAR)	445.65 ± 99.16	278.53	160.00 0.000	178.26	250.00 0.000	135.04	330.00 0.004
Pantothenate: mg/day (AI)	4.31 ± 1.71	143.76	3.00 0.066	86.26	4.00 0.638	86.26	5.00 0.310
Biotin: µg/day (AI)	20.55 ± 7.61	171.25	12.00 0.012	102.75	20.00 0.832	82.20	25.00 0.148
Vitamin D: µg/day (AI)	5.71 ± 2.11	114.17	5.00 0.393	114.17	5.00 0.393	114.17	5.00 0.393
Vitamin E: mg/day (EAR)	10.04 ± 3.26	167.29	6.00 0.007	111.52	9.00 0.416	83.64	12.00 0.137
Vitamin K: µg/day (AI)	60.44 ± 32.90	109.90	55.00 0.669	100.74	60.00 0.972	80.59	75.00 0.265

p-value < 0.05 = significance
AI: adequate intake, DRIs: dietary references intakes, EAR: estimated average requirements, FE: folate equivalent, NE: niacin equivalent, SD: standard deviation

Table IV indicates that the diet of 6- to 8-year-old girls and 9- to 13-year-old girls would have met more than 100% of the DRIs for most of the micronutrients if it was assumed that all of the girls consumed all of the food on their plates at every meal, except for calcium and iodine. Calcium intake was 83.57% for girls aged 4-8 years and only 51.43% for girls aged 9-13 years and 14-18 years. Iodine intake was recorded as 83.02% (4-8 years), 73.92% (9-13 years) and 56.80% (14-18 years). Apart from accelerated growth, the 9- to 13-year-old children also participated in sport and school activities that increased energy, protein, iron, zinc and calcium requirements.[21] The 14- to 18-year-old girls reflected a lower intake of magnesium (98.98%), vitamin C (57.77%), vitamin B_6 (82.43%), pantothenate (86.26%), biotin (82.20%), vitamin E (83.64%) and vitamin K (80.59%). The 4- to 8-year-old girls had a statistically significantly higher intake of most of the micronutrients. As the girls grew older, the higher intake was closer to the recommended intake.

Similarly to the girls, the boys would have met 100% or more of the DRIs for most of the micronutrients if it was assumed that all the boys would have consumed all of the food on their plates at every meal,

Table V: Micronutrient analysis of the seven-day-cycle menu for boys (5-18 years)

Nutrients	Mean intake ± SD	Boys: 4-8 years		Boys: 9-13 years		Boys: 14-18 years	
		% DRIs	DRIs p-value	% DRIs	DRIs p-value	% DRIs	DRIs p-value
Calcium: mg/day (AI)	668.57 ± 173.08	83.57	800.00 0.068	51.43	1 300.00 0.000	51.43	1 300.00 0.000
Iron: mg/day (EAR)	9.19 ± 1.87	224.04	4.10 0.000	155.76	5.90 0.001	119.35	7.70 0.057
Zinc: mg/day (EAR)	9.17 ± 2.94	229.21	4.00 0.001	131.00	7.00 0.075	107.88	8.50 0.559
Magnesium: mg/day (EAR)	294 ± 78.34	267.48	110.00 0.000	147.12	200.00 0.008	86.54	340.00 0.148
Phosphorus: mg/day (EAR)	1 048 ± 212.73	258.89	405.00 0.000	99.38	1 055.00 0.937	99.38	1 055.00 0.937
Selenium: µg/day (EAR)	111.42 ± 26.55	484.45	23.00 0.000	278.56	40.00 0.000	247.41	45.00 0.000
Iodine: µg/day (EAR)	53.96 ± 25.30	83.02	65.00 0.271	44.97	120.00 0.070	56.80	95.00 0.001
Vitamin A: µg/day (EAR)	581.24 ± 142.83	211.36	275.00 0.000	130.62	445.00 0.027	92.26	630.00 0.384
Vitamin B_{12}: µg/day (EAR)	3.07 ± 3.05	306.71	1.00 0.098	204.67	1.50 0.199	153.50	2.00 0.373
Vitamin C: mg/day (EAR)	32.35 ± 40.95	147.03	22.00 0.516	82.95	39.00 0.675	51.35	63.00 0.071
Thiamin: mg/day (EAR)	1.03 ± 0.24	206.00	0.50 0.000	114.44	0.90 0.178	103.00	1.00 0.747
Riboflavin: mg/day (EAR)	0.97 ± 0.25	194.29	0.50 0.000	121.43	0.80 0.091	88.31	1.10 0.193
Niacin: mg/day (EAR)	11.38 ± 3.95	189.71	6.00 0.004	126.48	9.00 0.137	94.86	12.00 0.687
Vitamin B_6: mg/day (EAR)	0.82 ± 0.23	164.86	0.50 0.003	103.04	0.80 0.786	74.94	1.10 0.008
Folate: µg/day (EAR)	445.65 ± 99.16	278.53	160.00 0.000	178.26	250.00 0.000	135.04	330.00 0.009
Pantothenate: mg/day (AI)	4.31 ± 1.71	143.76	3.00 0.066	107.82	4.00 0.638	86.26	5.00 0.310
Biotin: µg/day (AI)	20.55 ± 7.61	171.25	12.00 0.012	102.75	20.00 0.832	82.20	25.00 0.148
Vitamin D: µg/day (AI)	5.71 ± 2.11	114.17	5.00 0.393	114.17	5.00 0.393	114.17	5.00 0.393
Vitamin E: mg/day (EAR)	10.04 ± 3.26	167.29	6.00 0.007	111.52	9.00 0.416	83.64	12.00 0.137
Vitamin K: µg/day (AI)	60.44 ± 32.90	109.90	55.00 0.669	100.74	60.00 0.972	80.59	75.00 0.265

p-value < 0.05 = significance
AI: adequate intake, DRIs: dietary references intakes, EAR: estimated average requirements, FE: folate equivalent, NE: niacin equivalent , SD: standard deviation

except for calcium and iodine, at 83.57%, 51.43% and 51.43% for calcium, and 83.02%, 44.97% and 56.80% for iodine respectively, for the various age groups. The 9- to 13- and 14- to 18-year-old boys also reflected a low intake of vitamin C at 83.95% and 51.35%, respectively, for the two groups. Adolescence is a period of enhanced nutrient requirements, and eating behaviour, lifestyle, human immunodeficiency virus/acquired immune deficiency syndrome and environmental influences can influence intake during this period.[21] The older boys (14-18 years) consumed less than 100% of the DRIs for riboflavin (88.31%), niacin (94.86%), vitamin B_6 (74.94%), pantothenate (86.26%), biotin (82.20%), vitamin E (83.64%) and vitamin K (80.59%) (Table V). As seen with the girls, the 4- to 8-year-old boys also had a statistically significantly higher intake of most of the micronutrients. The intake of the older boys was closer to the recommended intake.

The seven-day-cycle menu at the children's homes on average contributed 31.15% of the daily energy needs of the children from fat. This is slightly higher than the recommended amount of 15-30%. The protein and carbohydrates intake contributed 10.78% and 58.07%

Table VI: The macronutrient, dietary fibre and fruit and vegetable intake compared with the joint World Health Organization/Food and Agriculture Organization expert consultation recommendations[19]

Nutrient/food	Menu contribution	WHO/FAO goals
Total fat as a % of TE	31.15%	15-30%
Total protein as a % of TE	10.78%	10-15%
Total carbohydrate as a % of TE	58.07%	55-75%
Total dietary fibre (g/day)	19.67%	27-40 g/day
Fruit and vegetables (g/day)	68.64%	≥ 400 g/day

FAO: Food and Agriculture Organization, TE: total energy, WHO: World Health Organization

of the daily energy, which is within the WHO recommendations of 10-15% and 55-75% respectively.[20] The fruit and vegetable intake of the children was much lower (68.64%) than the recommended 400 g per day (Table VI).

Discussion

The aim of this study was to determine how the anthropometric profile and dietary intakes of children living in residential facilities in the Durban area compared to the national profile as these types of data on children in residential care facilities are limited in South Africa. The results of this study indicated that stunting was more prevalent in boys than in girls aged 4-8 years. However, in the older girls (≥ 9 years), stunting was more prevalent than that in the older boys. There is a possibility that the children may have been stunted prior to admission to the homes because of chronic malnutrition. Although catch-up growth is possible when circumstances change, malnourished children never achieve optimal growth.[22] Wasting only occurred in a small percentage of the girls aged 9-13 years and in the boys aged 14-18 years. It seems as if the children in these homes experienced a chronic, rather than acute, insufficient food and nutrient intake.[23] The findings indicated similar results to that of the NFCS (2005), with stunting of 18% in children aged 1-9 years nationally.[6] No national statistics are available for older school-aged children. However, in another study that was conducted in rural KwaZulu-Natal, 31-75% of the children (aged 8-11 years) were mildly stunted.[24] A relationship between childhood nutritional stunting and impaired fat oxidation has been observed. Thus, stunting can become a risk factor for the development of obesity later in life.[25] In this study, a possible risk of overweight was observed in more girls than in boys. However, overweight was observed more in young boys (aged 4-8 years) than in girls in the same age group. No adolescent boys were overweight or obese, compared to overweight in 26.7% of the adolescent girls (aged 14-18 years).

The possible consumption of excessive energy, as indicated in the nutrient analysis of the seven-day-cycle menus and the large portion sizes recorded in the plate waste study, could have contributed to the prevalence of overweight in these children. The dietary analysis also indicated a higher-than-recommended intake of total fat. This is likely to increase body weight by passive overconsumption of energy.[26] A limitation of this study is that food that was consumed outside the children's homes was not taken into account. Money to purchase snack items would only be obtained from family members or individuals who were external to the facility. The results of this study were consistent with the findings of the NFCS (2005), according to which 10% and 4% of the children aged 1-9 years nationally, presented with overweight and obesity, respectively. The NFCS also indicated that the prevalence of overweight and obesity increased to 16% in 13-year-olds and to 26.4% in 19-year-olds.[6] Studies in the 1990s and early 2000s showed a very low prevalence of obesity in school-aged children. However, the results of this study confirmed previous findings that overweight and obesity are an emerging problem in South African children.[21] Barker[27] noted that protective adjustment in a nutrient-poor environment can result in metabolic programming, which results in the conservation of energy. The author stated that if at a later stage in the person's life, there was an adequate or excessive energy intake, the individual would be more prone to the development of obesity. Generally, the children in the children's homes came from an environment in which food intake was inadequate. The large portion sizes that were served to the children regardless of age, as indicated in the plate waste study, resulted in an excessive energy intake, as indicated by the results of the dietary analysis, and in turn, these children may become overweight.

The portion sizes of the starch that were served to the children were large, while the fruit and vegetable portions were small. Children should consume six to eight servings of starch a day. One serving is considered to be half a cup of cooked starch (70 g) or one slice of bread (35-40 g).[18,19] However, the children consumed more than three times this at one meal, twice a day.

The average portion size for vegetables was 40 g and was only served once a day at supper. It was reported that fruit was served three times per week, but would be given more often if donations were received. The fruit and vegetable intake was well below the 400 g recommended intake per day. The actual fruit and vegetable intake was also considerably lower than the average of 219.7 g per day that was consumed by South Africans in 2001.[28] Although vegetables were planned as a menu item for dinner, the serving size was very small and only one vegetable was prepared and served. Fruit and vegetables are significant sources of a variety of micronutrients and fibre.[29] Therefore, inadequate intake will result in micronutrient deficiencies.

The DRIs for the girls and boys were met for energy and protein, except for the 14- to 18-year-old boys who did not meet the DRIs for energy. A comparison of the actual intake with the WHO guidelines indicated that protein (10.78%) and carbohydrates (58.07%) were within the recommendations of 10-15% and 55-75% respectively for a balanced diet.

The total fat intake (31.15%) was slightly above the recommended intake of 15-30%. Fibre intake was of concern. None of the groups met the DRIs of 27-40 g per day. The fibre intake was not met because of insufficient fresh fruit and vegetable intake. None of the groups met the DRIs for calcium and iodine. The lack of milk and milk products on the menu may have contributed to this.

The deficient micronutrient intakes were more prevalent in the 14- to 18-year-old groups, as enhanced nutrient requirements are evident at this age.[21] Manary and Solomon[28] explain that although the macronutrient intake is sufficient to meet or exceed the energy needs of children, micronutrient deficiencies may still be prevalent if the food that is consumed is of low nutrient density. These finding are supported by Burgess-Champoux,[30] Wenhold,[21] Story[31] and Sadik[32] in studies on children and adolescents in various parts of the world. Micronutrient deficiencies frequently arise when the usual diet of the child lacks variety and does not supply sufficient amounts of vitamins and minerals.[21]

Conclusion

The nutrient requirements of children at different ages are different.[8] Overall, the nutritional status of the children and the dietary assessment of the menus in this study indicated a need for intervention in the children's homes. The large portion sizes, low nutritional quality and inadequacy of the menus in terms of the intake of fruit, vegetables, milk and milk products need to be addressed. It should be emphasised that the management of these residential care settings is responsible for providing all the meals. Therefore, its members have an obligation to meet the nutritional needs of the children and adolescents. This study highlighted the need for the development and implementation of a comprehensive nutrition education programme for child care workers. It should focus on general healthy eating, menu planning, food preparation and the serving of nutrient-adequate, economical meals. Menu planning education should specifically address important principles such as portion or serving sizes, meal variety and nutritional considerations for various age groups. Furthermore, the study also indicated that a nutrition education programme for children is needed to improve food choices that are made as the literature indicates that poor choices in this regard are a contributing factor to the fact that often, this age group's food intake does not meet dietary recommendations. The above recommendations can be achieved through a strong link with existing national guidelines that pertain to healthy eating.

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