Nutrition knowledge and nutritional status of primary school children in QwaQwa

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Abstract

Objectives: To determine the nutrition knowledge and nutritional status of primary school children attending a purposively selected school in rural QwaQwa.

Setting: A purposively selected public school (n = 540) in QwaQwa.

Subjects: A convenience sample of all 142 school pupils, aged from nine to thirteen years.

Outcome measures: The measuring instruments included a nutrition knowledge questionnaire to determine the current nutrition knowledge, and a 24-hour recall to determine food and nutrient intakes. Anthropometric measurements included weight and height, measured using standard methodologies.

Results: The mean age of the respondents was 11.2 years, and all had deficient intakes of all the nutrients, except for protein, carbohydrates and thiamine. However, 53.1%, 17.1% and 14.3% of the respondents did not meet 100% of EAR for protein, carbohydrates and thiamine respectively. The anthropometric results indicated that 2.8% of the total group of respondents was severely stunted, and that 11.3% were stunted. The BMI-for-age indicated that 12.0% were overweight, and more so among the girls (15.7%) than the boys (8.3%). The respondents showed average nutrition knowledge in the majority of the questions.

Conclusions: This study observed malnutrition and average nutrition knowledge, with many gaps relating to aspects, such as the role of the various food groups in the diet and safe hygiene practices.

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Introduction

There is a quadruple burden of disease in South Africa (SA). This comprises a) infectious diseases linked to under-nutrition, b) chronic diseases of lifestyle (CDL) linked to over-nutrition, c) HIV/AIDS-related metabolic disorders, and d) a high prevalence of injury-related mortality.[1] Over the past 50 years, South African nutrient intakes have shown changes, such as increased total and saturated fat, decreased total carbohydrate, and an increase in refined carbohydrate-rich foods with added sugar. Other changes observed are a decreased fibre intake and increased intakes of total protein and animal protein foods. These dietary intake changes are typical of a westernised diet, which further exacerbates the globally accepted triple burden of disease, specifically over- and under-nutrition,[2] as well as HIV/AIDS-related disorders. In SA, the Department of Health (DoH) and various stakeholders have developed evidence-based, food-based dietary guidelines to promote guidance on food choices for a healthy lifestyle.[3] However, the prevalence of the triple burden of disease in SA still indicates a discrepancy between the dietary recommendations and intake behaviour. Although the DoH has implemented various national nutrition and primary health-care programmes during the past 10 years, child health has also deteriorated.[4] Malnutrition has an effect on children's wellbeing and their ability to learn and play normally; therefore healthy food choices may improve a child's wellbeing and ability to learn and play normally.[5] Furthermore, research has shown that dietary habits in childhood impact directly on growth, development and the prevalence of disease throughout the life cycle. Healthy eating habits should thus be established during childhood.[6] The quality of children's diets usually declines as they move from childhood to adolescence. Eating healthily is usually not a priority for adolescents, and poor eating patterns may thus add a risk for current and future health problems.[7] A large number of school-based nutrition programmes have been implemented globally, focusing mainly on obesity, the importance of activity and of vegetables and fruit in the diet.[8] However, very little research on basic nutrition education focusing on adolescents has been published.[9] The significance of improving nutrition knowledge through nutrition education in order to have a positive influence on healthy food choices should not be underestimated.[10]

The focus of this project was to determine the nutrition knowledge and nutritional status of primary school children attending a

purposively selected public school in rural QwaQwa, Free State, SA, in order to plan a suitable nutrition education programme for these children.

Methods

Ethics

The Medical Ethics Committee for Research on Human Beings of the University of the Witwatersrand approved the study (M080931).

Sampling and respondents

The respondents included a convenience sample of all 142 school pupils aged nine to thirteen years (representing 27% of the total number of pupils attending this school) from a purposively selected public school (n = 540) in QwaQwa. The sample comprised both genders, and was made up of 49.3% girls (n = 70) and 50.7% boys (n = 72).

Data collection and analysis

The measuring instruments included a nutrition knowledge questionnaire to determine current nutrition knowledge, and a 24-hour recall questionnaire to determine food and nutrient intakes.

A nutrition knowledge questionnaire (NKQ) was specifically developed by the researchers for the purpose of this study. The questionnaire included multiple-choice questions about the most important meal of the day, the number and functions of the various food groups in accordance with the SA food-based dietary guidelines (FBDG), and daily water consumption as suggested by the FBDG. The food groups were included to test knowledge of the functions of the nutrients in the various food items in each of the groups, and these were linked to the FBDG. For example, the FBDG "make starchy foods the basis of all meals" was extrapolated to the food items belonging to the starchy food group and to the main function of providing energy in the diet. Another example would be for the FBDG "eat plenty of vegetables and fruit every day", where examples of vegetables and fruit would be grouped together and minerals and vitamins would be stressed as forming part of certain vegetables and fruit, for example vitamin C in oranges. The food groups thus included: 1) starchy foods, 2) vegetables and fruit, 3) protein-rich foods, including meat, fish, chicken, dried beans, legumes, peas and soy, 4) the dairy group, including milk, and 5) the fat group. The equivalence reliability of the questionnaire was tested in a different public school that did not participate in the nutrition education programme. In this school, the same group of 10 randomly selected primary school children completed the same questionnaire each week for a period of four weeks. The answers were compared by means of Cronbach's alpha analyses. Based on these results, the questionnaire was accepted as reliable, as a mean α of 0.73 was found. In addition, factor analyses were carried out to unmask possible outliers in the reliability test.[11] Two trained fieldworkers assisted with the completion of the NKQ through one-on-one interviews with the respondents in the sample. The fieldworker and individual respondent read through the questions together and ticked the answer provided by the respondent. If the respondent did not understand the question, the fieldworkers could translate the question into their home language. The fieldworkers were trained not to lose the original meaning in the translation, and also not to explain the question in such a way that it would lead to the correct answer being given or to provide the correct answers to the respondents to avoid interviewer bias.

A structured, 24-hour recall questionnaire, validated previously,[12] was administered by the same two fieldworkers for three consecutive days. Food models were used for the determination of portion sizes and to explain the food items to the respondents.

Anthropometric measurements included weight and height, measured using standard methodology.[13] Weight was measured on two re-calibrated Phillips electronic bathroom scales, model HF350, and height with a Scales 2000 portable stadiometer.

Data analyses

The NKQ data were captured on an Excel spreadsheet. The Statistical Package for Social Sciences (SPSS) for Windows (version 17.0) program was used to analyse the data for the descriptive statistics, determining the percentage of respondents who answered the questions correctly for each of the knowledge questions.

The 24-hour recall questionnaires were analysed by a registered dietician for mean nutrient intakes, using the South African Medical Research Council FoodFinder® program, and compared with dietary reference intakes (DRI).[14] The means and standard deviations were calculated for daily nutrient intakes per person per day (a total of three 24-hour recall/3).

Anthropometric data were analysed using the World Health Organization's AnthroPlus version 1.0.2 statistical software.[15] Stunting was defined as a height-for-age z score < -2 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]

Results

The mean age of the sample was 11.2 years. The results of the study are summarised in Table I and show that, in the multiple-choice questions, the majority of the respondents (50.7%) considered breakfast as the most important meal of the day. Only 21.4% of the respondents were aware of the existence of the five food groups as defined in the FBDG. This was reflected in the poor responses to the functions of each of the food groups. However, the majority (59.0%) knew that starchy foods provide energy. The questions included in the 'true or false' section measured knowledge of the FBDG, as well as general nutrition knowledge, and showed that the majority of the respondents (82.3%) knew that a variety of foods should be included in the diet, which was confirmed by the 75.4% who realised that different foods perform different functions in the body. The five-a-day concept was known to 74.6% of the respondents. A majority of 51.4% of the respondents agreed that daily physical activity was important for a healthy lifestyle. Conflicting results were observed regarding the quantity of water that should be consumed daily. In the multiple-choice section, only 19.0% of the respondents answered the question correctly, compared with the answers of 73.0% in the

true or false question. The same trend was found for the functions of the different food groups when tested in the true or false section. The results showed correct answers by 66.7% and 80.1% for the protein and dairy food groups respectively. The true or false section further showed that 46.4% of the respondents did not think it was necessary to wash fruit and vegetables before consumption, and 51.1% did not think it was necessary to wash their hands before eating.

Table I: Knowledge of primary school respondents (n = 142) in QwaQwa

QUESTION	RESPONDENTS WITH CORRECT ANSWER (%)
MULTIPLE CHOICE:	
Breakfast is the most important meal of the day	50.7
Five food groups	21.4
The main function of protein-rich foods is to build muscles	33.3
The main function of starchy foods is to provide energy	59.0
The main function of dairy products is to build strong teeth and bones	26.7
One of the main functions of vegetables is protecting against infections	11.6
Six or more glasses of water should be drunk daily	19.0
Oranges help to heal sores (Vitamin C)	14.0
IDENTIFYING THE CORRECT FOODS IN A GROUP:	
Vegetables and fruit	
Dairy (including milk and eggs)	76.1
Starchy foods	37.3
Foods that should be restricted (sugary foods such as sweets, foods containing a high amount of salt, such as processed foods, and fats, such as fried foods, oils)	40.8 / 36.6
Protein-rich foods (including meat, fish, chicken, dried beans, peas, soy and legumes)	47.9
	23.4
TRUE OR FALSE:	
Include a variety of foods in the diet	82.3
5-a-day	74.6
Be active	51.4
Wash fruit before eating	53.6
Wash hands before eating	48.9
The main function of protein-rich foods is to build muscles	66.7
Different foods have different functions in the body	75.4
Fruit consumption is more beneficial than consumption of foods with high sugar content	76.4
Dairy products are needed for healthy teeth	80.1
At least six glasses of water are needed per day	73.0

Regarding the identification of the food items in each food group (Table I), correct answers for food items belonging to the various food groups ranged from 23.4 to 76.1%. A minority of 23.4%, 37.3% and 47.9% of the respondents identified the correct food items for the protein group, dairy group and foods that should be restricted respectively. Two questions were included to test the food items belonging to the starchy foods and both indicated poor knowledge, as only 36.6% and 40.8% of the respondents identified the correct food items belonging to this food group. The vegetables and fruit group was the best known, as 76.1% of the respondents correctly identified items belonging to this group.

The 24-hour recall data (Table II) indicated deficient intakes of all the nutrients, except for protein, carbohydrates and thiamine, when compared with the estimated average requirements (EAR).[14] However, 53.6%, 17.1% and 14.3% of the respondents did not meet 100% of the EAR for protein, carbohydrates and thiamine respectively. Furthermore, a large percentage (> 90%) of the respondents did not meet 100% of the EAR for energy, dietary fibre, zinc, selenium, folate, biotin and vitamins B2, C, D and E, and none of the respondents met 100% of the requirement for calcium and iodine.

Table II: Analysis of 24-hour recall: daily mean intakes of the respondents (n = 142)

Nutrient and unit of measure	24-hour recall (mean ± SD)	% of respondents < 100% of EAR	EAR*
Energy (kJ)	4309 ± 1410	99.3	9 572 (b)/8 698 (g)
Total protein (g)	37 ± 13	53.6	34
Plant protein (g)	22 ± 8		
Animal protein (g)	15 ± 11		
Total fat (g)	30 ± 19		
Cholesterol (mg)	89.0 ± 90.8		
Carbohydrates (g)	138 ± 43	17.1	100
Dietary fibre (g)	14 ± 6	97.9	31 (b)/26 (g) #
Calcium (mg)	166.9 ± 139.4	100	1 300 #
Iron (mg)	5.3 ± 1.9	65.0	5.9 (b)/5.7 (g)
Magnesium (mg)	175.5 ± 58.5	65.7	200
Zinc (mg)	3.3 ± 1.5	97.9	7
Copper (mg)	0.4 ± 0.2		
Chromium (µg)	11.7±17.7	84.3	25 (b)/21 (g) #
Selenium (µg)	15.6 ± 15.8	92.1	35
Iodine (µg)	9.3 ± 8.9	100	73
Vitamin A (RE) (µg)	220.2 ± 416.8	87.1	445 (b)/420 (g)
Thiamine (mg)	1.1 ± 0.4	14.3	0.7
Riboflavin (mg)	0.5 ± 0.3	92.1	0.8
Niacin (mg)	8.3 ± 4.7	62.9	9.0
Vitamin B6 (mg)	0.5 ± 0.6	80.7	0.8
Folate (µg)	89.2 ± 78.9	96.4	250
Vitamin B12 (µg)	1.2 ± 1.9	77.1	1.5
Pantothenate (mg)	2.3 ± 2.0	80.7	4 #
Biotin (µg)	11.0 ± 15.6	95.7	20 #
Vitamin C (mg)	14.6 ± 22.9	92.9	39
Vitamin D (µg)	1.2 ± 1.8	94.3	5 #
Vitamin E (mg)	2.6 ± 3.4	95.0	9
Vitamin K (µg)	48.0 ± 96.7	77.1	60 #

* Estimated Average Requirement for active boys and girls aged nine to thirteen years
# AI – Adequate Intake
Deficient intakes
b = boys, g = girls

The findings of the National Food Consumption Survey (NFCS) of 1999 showed that the Free State was one of the provinces worst affected by poor dietary intakes. In this province a third of all children aged one to nine had intakes of less than 50% of their daily energy needs, as measured by the Recommended Dietary Allowances (RDA). The mean energy intake for the group aged seven to nine years was 4 552 kJ.[17] These results are similar to the findings of this study, which showed a mean energy intake of 4 309 kJ. However, almost all the children in this study did not meet their energy requirements when measured by EAR. The total mean protein intakes are similar, as the NFCS showed 34 g compared to the 37 g in this study. The

mean carbohydrate intake (138 g) in this study was lower, however, and the mean fat intake (30 g) was higher when compared with the 174 g and 22 g respectively for children aged seven to nine years in the Free State, as found by the NFCS. The NFCS also showed poor micronutrient intakes for the majority of micronutrients, and 100% of the children aged seven to nine years in the Free State did not meet the RDA for vitamin D, calcium and zinc.[17] In this study, none of the respondents met 100% for calcium and iodine.

The top 20 most frequently consumed food items according to the 24-hour recall analysis of the respondents are shown in Table III. The items listed are those consumed per gram for the total group, from the highest to the lowest amount consumed by the group. However, not all the respondents consumed all the items and the information was further extrapolated to indicate the number of respondents consuming each of the top 20 most frequently consumed food items and the mean portion sizes of each. An example is for stiff maize meal porridge – the total mean consumption by the sample (n = 142) was 35 109 grams. However, only 141 respondents, thus 99.3% of the sample, consumed the item. The mean portion size consumed was thus 35109 ÷ 141 = 249 gram. The mean portion sizes for all the top 20 most commonly consumed food items were calculated in this manner.

The majority of the respondents (n = 141, 99.3%) most frequently consumed stiff maize meal porridge, with a mean daily intake of 249 grams (g). Other starchy food items (mean intake) included bread (113 g) in 4th place, soft maize meal porridge (153 g) in 7th place, scones (119.g) in 8th place, cooked potatoes (56 g) and potato crisps (47 g) in 14th and 15th place respectively, as well as vetkoek (134 g) in 16th place. Sugar also formed part of the top 20 most frequently consumed food items and was consumed by 62% of the respondents at a portion size of 10 g per day. Although the milk and maas portion sizes were good, consisting of 203 ml and 138 ml respectively, these dairy items were consumed by only 24.6 % and 7.7% of the respondents respectively. Although chicken (79 g), pork sausages (74 g), boerewors (65 g) and chicken feet (69 g) appeared on the list of the top 20 most frequently consumed food items, these were consumed by only a small percentage of the respondents. Three fruit and vegetable items appeared on the list, namely cooked spinach (56 g), fruit juice (168 ml) and cooked cabbage (54 g), but these were consumed in relatively small portion sizes and by a very small minority of the respondents. Meat and vegetable soup with maize meal porridge were served as part of the National School Nutrition Programme (NSNP). An objective of the NSNP is to contribute at least 25% of the recommended dietary allowance for various nutrients. Although the contribution of the NSNP to the total dietary intake of the group was not determined, the results show that the importance of the contribution of the NSNP to total dietary intake cannot be ignored in this community.

The anthropometric results in Table IV indicate that 4.0% of the total group of respondents were of low height-for-age, thus severely stunted (< -3 SD), and that 16% were stunted (≥ -3 < -2 SD) according to the WHO growth standards,[16] indicating chronic

Table III: Top 20 food items consumed, as measured by 24-hour recall

Food item	Total daily mean consumption (gram for the group) (n = 142)	Mean daily intake (gram per person)	Number of respondents in the sample who consumed the food item (%)
Maize meal porridge, stiff	35 109	249	141 (99.3)
Tea, brewed (Ceylon)	18 560	232	80 (56.3)
Soup (meat and vegetable)	8 050	70	115 (81.0)
Bread	7 232	113	64 (45.1)
Milk, full cream, fresh	7 105	203	35 (24.6)
Chicken, cooked	2 844	79	36 (25.4)
Maize meal porridge, soft	1 836	153	12 (8.5)
Scone	1 666	119	14 (9.9)
Maas	1 518	138	11 (7.7)
Sausage, pork, cooked	1 406	74	19 (13.4)
Spinach, cooked	1 344	56	24 (16.9)
Fruit juice	1 344	168	8 (5.6)
Potato, cooked	1 288	56	23 (16.2)
Potato crisps	1 222	47	26 (18.3)
Boerewors	1 105	65	17 (12.0)
Vetkoek	1 072	134	8 (5.6)
Sugar	880	10	88 (62.0)
Cabbage, cooked	810	54	15 (10.6)
Gravy (Oxo)	783	29	27 (19.0)
Chicken feet, cooked	759	69	11 (7.7)

insufficient food and nutrient intake and frequent infections.[18] Thus, 14.1% of the sample was stunted, including the severely stunted. The results further showed that more boys (4.2%) than girls (1.4%) were severely stunted, whereas 11.4% of the girls and 11.1% of the boys were stunted.

Table IV: Anthropometric results: stunting (height-for-age)

	Classification	Girls n = 70 (%)	Boys n = 72 (%)	Total group n = 142 (%)
< -3 SD	Severely stunted	1 (1.4)	3 (4.2)	4 (2.8)
≥ -3 < -2 SD	Stunted	8 (11.4)	8 (11.1)	16 (11.3)

It seems as if a low weight-for-age (underweight) was not observed in this sample of respondents, and only 1% of the girls were underweight (Table V). However, weight-for-age reference data cannot be calculated beyond the age of 10 years with AnthroPlus,[15] thus the whole sample was not included in this parameter. Underweight is usually the result of acutely insufficient food and nutrient intake.[18]

Table V: Anthropometric results: underweight (weight-for-age)

	Classification	Girls n = 20 (%)	Boys n = 23 (%)	Total group n = 46 (%)
< -3 SD	Severely underweight	0	0	0
≥ -3 < -2 SD	Underweight	1 (5.0)	0	1 (2.3)

The BMI-for-age (thinness/wasting) results in Table VI show that 1.0% of the respondents were severely thin and that 7.0% were thin or wasted. However, 17.0% were overweight, and more so among the

girls (15.7%) than the boys (8.3%). Four per cent of the respondents were obese, and this condition was distributed equally among the boys (2.0%) and the girls (2.0%). It is important to note that 79.6% of the children were of normal weight and, of the remaining 20.4% not of normal weight, more were overweight or at risk of overweight than wasted.

Table VI: Anthropometric results: thinness (BMI-for-age)

	Classification	Girls n = 70 (%)	Boys n = 72 (%)	Total group n = 142 (%)
< -3 SD	Severely thin/wasted	1 (1.4)	0	1 (0.7)
≥ -3 < -2 SD	Thinness/wasting	3 (4.3)	4 (5.6)	7 (4.9)
≥ -2 < +1 SD	Normal weight	53 (75.7)	60 (83.3)	113 (79.6)
≥ +1 < +2 SD	Over	11 (15.7)	6 (8.3)	17 (12.0)
≥ +2 SD	Overweight	2 (2.9)	2 (2.8)	4 (2.8)

Discussion

The aim of this study was to determine the nutrition knowledge and nutritional status of children attending a primary school in rural QwaQwa. This was done in order to gain information for planning a nutrition education programme, as poor knowledge of nutrition is seen as one of the reasons for poor food choices[19] and, consequently, as a contributing factor in the development of malnutrition.[20]

The results indicate that the respondents' knowledge was fair regarding general nutrition facts, but reflected poor knowledge of the food groups and the role of the food groups in the diet, as reflected in the FBDG, when measured by the multiple-choice questions. In the true or false section the respondents had higher scores. Similar questions were included in the multiple-choice and true or false sections and contradictory results were obtained, specifically with regard to water consumption. In the multiple-choice question, only 19.0% of the respondents indicated that at least six glasses of water per day should be consumed by children, compared with 73% who answered that it was 'true' to consume at least six glasses of water per day. Although the majority indicated the correct answer in the true or false section, this could have been a guess. In the multiple-choice questions, the respondents had to indicate the actual answer, showing that the majority did not know the correct answer.

It is clear from the results that the respondents valued the importance of the inclusion of a variety of foods in the diet, but this was not reflected in their daily food selections, based on the top 20 most commonly consumed food items, as well as on the poor nutrient intakes. These results are similar to the results of a study conducted in the Free State.[20] An area of concern was the poor knowledge of hygiene practices, as the majority of the respondents did not know that they should wash their hands before eating, and only a small majority deemed it necessary to wash fruit before eating. It is known that poor food hygiene can result in unsafe food that can cause food-borne diseases and diarrhoea when consumed.[21] Diarrhoeal diseases carried by unsafe food and water kill approximately 1.8 million people each year and are among the leading causes of illness and death in developing countries, especially among children.[22] Furthermore, according to the UNICEF conceptual framework for malnutrition, disease is an immediate cause of malnutrition.[22]

In this study, the mean age of the respondents was 11 years, thus classifying them as adolescents.[23] Adolescence is one of the most vigorous growth phases in the lifespan, and during this phase total nutrient requirements are the highest in order to meet the needs of physical growth and development. Similar findings were observed in this study compared to the findings by Burgess-Champoux and co-authors who found that adolescents seldom meet their dietary needs.[24] All the nutrients were consumed in deficient amounts when compared to the estimated average requirements (EAR),[14] except for protein, carbohydrates and thiamine in this group of adolescents. Although the mean intakes for protein, carbohydrates and thiamine were within the normal range, 53.1%, 17.1% and 14.3% of the respondents respectively did not meet 100% of the EAR for these nutrients. These results were confirmed by the top 20 most frequently consumed foods of these respondents, as a mainly carbohydrate-based diet was followed. Steyn has reported that, although cereal is consumed mainly among the rural, black community of SA, the variety within the cereal group is limited, as mainly maize, sorghum and bread are consumed.[1] This was also true for this community, as maize and bread featured among the top four food items most frequently consumed. Maize meal porridge was the most common food item eaten, with a mean portion size of 243 g, and it was consumed by 99.3% of these adolescents. Although dairy products, food items from the protein-rich food group and vegetables and fruit appeared in the top 20 list of frequently consumed items, these were consumed by only a small percentage of the respondents. The portion sizes of these items consumed by this small percentage of respondents contributed to the total grams consumed by the whole group. These findings were consistent with those of a study conducted among Taiwanese elementary school respondents.[25] Fruit and vegetable intake averaged 219.7 g/day in SA in 2001.[26] Despite the fact that the respondents knew the importance of vegetables and fruit in the diet, and that three vegetable and fruit items appeared in the top 20 list of most frequently consumed food items, the mean vegetable and fruit intake for these respondents was 22 g per person per day, which is far from reaching the recommended amount of 400 g/day.[1]

Although stunting is still the most prevalent nutritional disorder, affecting one third of the children under five years old in developing countries, overweight is increasing all over the world, with 20 developing countries already reporting rates of more than 5%.[18] This is also true for SA, where stunting and underweight remain a public health problem in children, with a prevalence of 20% stunting and almost 10% underweight in the group aged one to nine years.[27] However, overweight is also increasing in SA. Overweight and obesity are prevalent among 10% and 4% respectively of all respondents aged one to nine years,[25] increasing to a prevalence of 16% in 13-year-olds and 26.4% in 19-year-olds.[27] In this study, stunting was more prevalent than overweight, with 2.8% and 11.3% of the total group of respondents being severely stunted and stunted respectively. However, 12.0% of the children were overweight and 2.8% obese, while 15.7% of the girls and 8.3% of the boys were at risk of overweight. Overweight is thus an emerging problem in

this group of adolescents. Furthermore, the results of this study also confirm the phenomenon that both underweight and overweight may exist in the same community. This is in agreement with Wenhold and co-authors, who report that increasing numbers of young people are faced with multiple malnutrition problems,[19] such as insufficient, excessive or imbalanced nutrient intakes.[27] In this study, the deficient dietary intakes could have been more chronic than acute, as long-term insufficient nutrient intakes are associated with stunting, in contrast to acute insufficient intakes, which are associated with wasting[18] and was not observed in this adolescent group.

Conclusions and recommendations

This study found malnutrition and average knowledge of nutrition. However, there were many gaps in the nutrition knowledge. These were the roles of the various food groups in the diet, as defined by the FBDG, and safe hygiene practices. Recent research indicates that only 11 published articles on school nutrition interventions dealt with best-practice outcomes, such as knowledge and/or behaviours.[28] Research has found that nutrition knowledge is a significant predictor of dietary intakes, and that nutrition knowledge is needed for better dietary intake habits.[29] Nutrition promotion, education and advocacy are among the strategies of the existing National Integrated Nutrition Programme implemented by the South African Department of Health.[4] However, limited data on the impact of nutrition education are available in SA. Furthermore, adolescents are becoming more autonomous and behavioural patterns acquired during this phase of life, such as dietary intake behaviour, may influence long-term behaviours.[30,31,32] It is thus recommended that a nutrition education programme be developed and implemented for this group of adolescents, as nutrition education can be an accessible and effective tool for improving food choices.[33] Since most adolescents spend most of their time in school, school-based nutrition education, combined with physical activity programmes, can be employed to reinforce the message of healthy eating[34] in accordance with the FBDG.

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